THE EFFECT OF GENDER ON COMPOSITION OF THREE-RIB CUT AND MEAT QUALITY OF DOMESTIC SPOTTED BREED

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In Serbia, production of beef since the year 2001 has been in slight increase, but it is still unsatisfactory in regard to number of heads, as well as productivity (**Aleksić et al.,** 2007). Production of beef is based on Domestic Spotted breed, which is breed with combined production traits. Simmental cattle is participating with about 70% in total number of cattle, crossbreds of Domestic Spotted, Simmental and Busha cattle with about 25%, and about 5%goes to Black and Red-White cattle of European White-Black and Holstein breeds (**Aleksić et al.,** 2011).

Weight gains, feed efficiency and carcass quality are of great economic importance to cattle producers. Variations in these production traits can be attributed to differences in genetic composition, nutrition, slaughter characteristics and gender. Factors affecting the quality of meat can be divided into *ante mortem* (genetic background, housing, starving before slaughtering, etc.) and *post mortem* (slaughtering procedure, storage and cooling of meat) (**Aleksić et al.,** 2011). Gender has beenrecognized as one of the *ante mortem* factors contributing to variation in beef muscle characteristics becauseit affects muscle and fat depositions in the carcass (**Choat et al.,** 2006). Female cattle produce more tender meat, more intramuscular fat, higher marbling score and quality grade of carcass (**Choat et al.,** 2006; **Zhang et al.,** 2010). Studies have also shown that the beef physicochemical properties, especially water holding capacity (WHC), were affected bygender and meat from female animals had significantly more dry matter andfat than meat from male-animals irrespective of breed (**Litwinczuk et al.,** 2006).

The objective of the present study was to evaluate the effect of gender on properties of three-rib cut and meat quality of Domestic Spotted breed, which is the most common cattle breed in Serbia.

MATERIAL AND METHODS

Trial was carried out on experimental farm, slaughterhouse and laboratory of the Institute for Animal Husbandry, Belgrade-Zemun (Serbia), on 18 young cattle of Domestic Spotted breed. First group of 9 male cattle was slaughtered after reaching an average weight of 650 kg, and the second group (female cattle) after reaching an average weight of 600 kg.

During the fattening period the rearing system was free, and food consisted of concentrated feeds, hay and corn grain silage. One day prior to slaughtering animals were deprived food, but had free access to water. Slaughtering was carried out according to standard commercial procedures. After removing the skin and head, front and rear rounds and eviseration, carcasses were placed in cold storage at temperature of 4°C for next 24 hours.

After cooling (+4°C/24 hours), dissection of all three-rib cut was carried out into muscle tissue, fat tissue, connective tissue and bones. Cut of the 9-10-11 ribs was separated from the left cooled carcass sides cutting along the cranial line of the 9^{th} and 11^{th} rib, and with cut parallel to the spine (vertical to the ribs), where 1/3 of the upper rib remained on the cut.

Examination of meat quality was performed on all samples of *M. longissimus dorsi* (*MLD*), from the region of the 9^{th} and 11^{th} vertebrae.All muscle samples were analysed for basic chemical composition: quantity of water, quantity of intramuscular fat, amount of protein and amount of mineral substances (ash) (**AOAC,** 1990). pH value of meat was measured using pH-meter Hanna, HI 83141 (Hanna Instruments, USA). Water holding capacity (WHC) was done according to method by **Grau et al.** (1953). Cooking loss (CL) was determined in the following way: sample of size of 3x4x1.5 cm is weighed and put into glass with boiling water and cooked for 10 minutes; difference in mass of sample before and after cooking represents loss of mass during heat treatment and it is expressed in percentages. Tenderness of meat, expressed as shear force, was measured on the Volodkevich apparatus (**Volodkevich,** 1938), where higher values read out on the apparatus marked higher values of shear force, i.e. firmer meat.

The colour of fresh cut meat surface following 30 min blooming time (samples were stored in contact with air at 4°C) was measured using Minolta CR-410 portable chromameter (illumination D65, geometry 0 projection angle and 50 mm measure area). Values were given in the colour

Acknowledgement Research was financed by the Ministry of Education and Science, Republic of Serbia, project TR 31053.

space CIE (**CIE,** 1976), where L* – metrical lightness; a* – redness; b* – yellowness. Three readings were made on non-overlapping areas of the muscles and the average value was used for data analysis. Hue angle (H^o – true redness) was calculated as [arctangent (b*/a*) × 180/3.142] and chroma (C*– color intensity; also known as saturation index) was calculated as $[(a^{*2} + b^{*2})^{0.5}]$ (**King et al.,** 2010).

In order to determine the effect of gender on three-rib cut composition and meat quality, a single-factor analysis of variance was performed using Statistica7 software (StatSoft, USA), at $P \leq 0.05$. All results are presented as mean value ± standard deviation.

RESULTS AND DISCUSSION

Share of muscle tissue, fat tissue, connective tissue and bones in three-rib cut is presented in Table 1. Male cattle had significantly higher share of muscle tissue (for approx. 5%) and significantly lower share of fat tissue (for approx. 7%) compared with female cattle ($P \leq 0.05$).Share of connective tissue and bones did not differ significantly between groups. According to **Bureš and Bartoň** (2012), bulls produced leaner carcasses with a lower proportion of separable fat ($P<0.001$) and lower subcutaneous fat thickness ($P<0.001$) compared to heifers, which is in accordance with results obtained in this trial.

Waritthitham et al. (2010) state that share of muscle tissue decrease and share of fat tissue increases in young cattle of pre-slaughter weight of 600 kg compared to those slaughtered at weight of 500kg. Similar results were obtained by **Sañudo et al.** (2004).

Table 2 shows the proximate composition and technological characteristcofmeat samples. According to **Bureš and Bartoň** (2012), bulls have lower contents of dry matter, protein and intramuscular fat compared with heifers. In this trial, statisticaly signifacnt difference was found only for the content of intramuscular fat, which was higher in meat from female cattle ($P \leq 0.05$), as expected, because the female animals had a higher proportion of body fat (Table 1).

Higher share of intramuscular fat and hydrogen ions (lower pH value) can influence the decrease of the water holding capacity of meat (**Oprzadek and Oprzadek,** 2000). However, in this trial, pH value of meat after 24 hours of chilling, did not differ and despite the fact that female animals had higher intramuscular fat content, the WHC of meat was approximately the same between groups (Table 2). **Mach et al.** (2008) noted that the incidence of meat $pH_{24} \geq 5.8$ tended to be more frequent in males than in females and that females

Table 1. **Effect of gender on tissue distribution in three-rib cut of Domestic Spotted breed**

Tissue , %	Male cattle	Female cattle	Effect of gender
Muscle	64.72 ± 2.89	59.35 ± 5.62	*
Fat	13.25 ± 0.87	20.98 ± 1.44	*
Connective	0.98 ± 0.26	0.96 ± 0.11	ns
Bones	20.51 ± 2.03	18.37 ± 3.15	ns

ns – non significant ($P>0.05$); * $P \leq 0.05$.

Table 2. **Effect of gender on proximate composition and technological characteristics of *M. Longissimus dorsi* of Domestic Spotted breed**

	Male cattle	Female cattle	Effect of gender
Chemical content , %			
Water	75.03± 3.88	74.99± 2.12	ns
Fat	1.45± 0.05	2.85± 0.07	*
Ash	1.11± 0.03	1.10± 0.02	ns
Protein	22.38± 1.99	21.02± 1.08	ns
Technological quality			
pH_{24}	5.53 ± 0.05	5.54± 0.03	ns
WHC, cm^2 [1]	13.17 ± 2.78	12.68± 1.27	ns
CL , % [2]	42.92 ± 3.48	41.13± 3.04	ns
Sheare force, kg	13.09 ± 1.01	10.61± 0.89	*

ns – non significant ($P>0.05$); * $P \leq 0.05$.

[1] WHC – Water holding capacity;

[2] CL – Cooking loss.

Table 3. **Effect of gender on CIE L*a*b*, hue angle and chroma values of *M. Longissimus dorsi* from Domestic Spotted breed**

	Male cattle	Female cattle	Effect of gender
L*	38.79 ± 1.06	41.46 ± 0.86	*
a*	19.96 ± 0.87	21.07 ± 1.17	ns
b*	9.73 ± 1.30	11.49 ± 1.00	*
H°	26.63 ± 2.90	28.60± 3.57	ns
C*	21.66± 1.18	24.00± 2.24	*

ns – non significant (P>0.05); * P≤0.05.

with lean carcasses tended to be more susceptible to having meat pH_{24}≥ 5.8 than males.

Cooking led to a systematic and significant loss of matter and the cooking yields differed depending on the muscle and cooking process (**Gerber et al.,** 2009). In this trial, gender had no statisticaly significant effect on cooking loss of meat (Table 2).

According to **Ouali** (1990) meat tenderness is affected by the origin and age of animals, their gender, breed, environmental conditions associated with the pre-slaughter stress, the slaughter itself as well as the time of meat ageing.Research results reported by **Sazili et al.** (2003) and **Purchas et al.** (2002) indicate that female animals have more tender meat compared to male animals.Values of tenderness of meat (expressed in sheare force) were lower in male compared to femalecattle(P≤0.05), which agrees with the data cited by **Bureš and Bartoň** (2012). However, there are many conflicting reports concerning differences in tenderness of meat from carcasses of bulls, steers and heifers, probably because tenderness is a very complex and multifactorial sensory meat quality trait that is very variable (**Zhang et al.,** 2010).

The colour of meat is primarily dependant on the concentration and chemical state of the pigment myoglobin, which is responsible for moving oxygen through the muscle (**Stanišić et al.,** 2012). Although meat colour is a poor guide to eating quality, most consumers make purchase decisions based on display colour. Consumers discriminate against meat that is not red and bright, considering it is old or of poor quality (**Young et al.,** 1999). The effect of gender on CIE L*a*b*, hue angle and chroma values of *M. Longissimus dorsi* from Domestic Spotted breed is presented in Table 3. More content of intramuscular fat is probably the reason for higher L* values of meatof female catlle. Proportion of yellow colour of meat (b*) was higher in *M. Longissimus dorsi* of female cattle (P≤0.05), while proportion of red colour (a*) did not differ significantly between groups.

Hue angle (H°) is the development of color from red to yellow and larger angles indicate a less red product and Chroma (C*) is used to indicate the saturation of color, sometimes termed vividness (**Tapp et al.,** 2011). In this trial, colour saturation was more intensive (higher C*) in meat from female compared with male cattle (Table 3).

CONCLUSION

Based on results presented in this paper it can be concluded that gender of Domestic Spotted cattle had some effects onproperties of three-rib cut and meat qualityattributes. Compared to female, male cattle had higher share of muscle and lower share of fat tissue in three-rib cut (P≤0.05). Statistically significant difference (P≤0.05) was established in intramuscular fat content, which was higher in meat from female animals. Technological quality of meat did not differ significantly, except shear force values that was higher in male animals (P≤0.05). Meat form female cattle was lighter, it had higher proportion of yellow colour and more intensive colour saturation (chroma values), compared to meat from male cattle.

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SUMMARY

The objective of the present study was to evaluate the effect of gender on properties of three-rib cut and meat quality of Domestic Spotted breed, which is the most common cattle breed in Serbia.Male cattle had significantly higher share of muscle tissue (approx. by 5%) and significantly lower share of fat tissue (approx. by 7%) in three-rib cut compared with female cattle ($P \leq 0.05$). Regarding proximate composition of *M. Longissimus dorsi*, statisticaly signifacnt difference was found only for the content of intramuscular fat, which was higher in meat from female cattle ($P \leq 0.05$). Technological quality of meat did not differ significantly, except shear force values that were higher in male animals ($P \leq 0.05$). Meat form female cattle was lighter, it had higher proportion of yellow colour and more intensive colour saturation (chroma values), compared to meat from male cattle.

Key words: *Domestic Spotted breed, gender, three-rib cut, meat quality*

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