

## The veal quality of Slovak Simmental breed in relation to sex

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The aim of the present study was to evaluate the influence of sex on selected fattening, carcass and qualitative veal parameters of Slovak Simmental breed. The comparison was carried out on the 8 male and the 8 female animals. The animals were reared under the same housing conditions and were fed with grass hay (*ad libitum*), feed straw and calves feed concentrate, and had a free access to the fresh water. The fattening period started from about 70 days of age to required final weight. Length of the fattening period was 180 days. The slaughter and carcass composition, carcass yield, qualitative, physical and technological characteristics of *Longissimus thoracis et lumborum* muscle were studied. We found a significantly higher proportion of bones and a significantly higher proportion of separable fat in the carcass half in males. Higher proportion of meat were found in females. At the heifers was found, although not significantly, a higher proportion of internal fat (rumen, intestinal, kidney, pelvic). Significantly different pH measured 24 hours *post mortem* was found between males and females ( $P < 0.01$ ). Parameter of meat colour – lightness was higher identified in male calves at 24 hour and 7 days *post mortem*. Higher redness value was identified in female calves at 24 hour and 7 days *post mortem*.

**Keywords:** Slovak Simmental breed, sex, carcass, veal quality

### 1 Introduction

The Slovak spotted breed is the most widespread breed on dairy farms in our latitudes. Therefore, research and evaluation of meat quality of this breed is indispensable. The quality of products that enter to the food chain is influenced by various factors such as nutrition and feeding, breed, quality of the breeding environment, age and last but not least, the sex of the fattened animals which has a significant effect on the production of the high quality meat products. When comparing the carcass indicators and the meat quality of different sex, a lot of work focuses on the evaluation of the indicators of adult animals (bulls, cows, steers), less have dealt with the differences in younger weight categories, or calf veal. Several authors evaluated the influence of sex on the quality of beef, especially on the chemical composition and physical and technological properties. Caferky et al. (2019) found an almost two times higher content of IMF in ox meat compared to bull meat (2.85 vs. 1.27% respectively). Differences in beef colour they found minimal. Previous study Daza et al. (2014) have shown similar results in the Avileña-Negra Ibérica breed. Likewise Daza et al. (2014), also Kučević et al. (2019) have indicated differences in growth intensity between males and females with higher growth rates in bulls. Čirić et al. (2017) have compared bulls (slaughter weight from 403.8 to 715.6 kg) and heifers (slaughter weight from 417.3 to 662.8 kg) of Simmental breed and they found no significant differences in the dressing percentage of males and females (56.32 vs. 56.42% respectively). However they described a higher fatness scores in females compared to males. They found also differences in the chemical composition of meat, whereas moisture percentage was higher in bulls (75.72 vs. 72.44%), the total lipids were higher in females (5.71 vs. 2.23) but the sex had no effect on the crude protein content of males and females (21.05 vs. 21.01% respectively).

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Although the authors found differences in the average weights of forequarters and hindquarters between the sex groups, the differences resulted from a larger range of slaughter weights. When they converted the weight of halves to a percentage, the differences between the sexes were minimal. In the study focused on the carcass yield of Holstein and Czech pied cattle, Bartoň et al. (2003) found a lower dressing percentage in the Holstein (54.88%) compared to the Czech pied cattle (57.29%). According to Kučević et al. (2019), the sex affected the content of fat and ash in meat. The authors states that the content of fat was the most variable parameter of the investigated groups.

## 2 Material and methods

The present study was conducted on 16 calves of Slovak Simmental breed, which were assigned to two groups according to sex: male (M) and female (F). Each group consisted of 8 animals. The animals were reared under the same housing conditions (outdoor grouping pens) in the Livestock Research Centre (LRC) of Slovak University of Agriculture (SUA). The animals were fed with grass hay (*ad libitum*), feed straw and calves feed concentrate, and had free access to the fresh water. The fattening period started from about the age of 70 days (after weaning and transport of animals to the SUA Livestock Research Centre). Length of the fattening period lasted up to 180 days of calves age.

Animals were slaughtered in the experimental slaughterhouse of LRC. Each animal was slaughtered in accordance with legislative for the protection of animals during slaughter. The carcasses were divided between the 8<sup>th</sup> and 9<sup>th</sup> rib interface into forequarters and hindquarters after slaughter. Carcass parts were chilled overnight at refrigeration temperature 4–5 °C. After 24 hours chilling, the forequarters and hindquarters from the right half of each carcass were disassembled and the separated parts were weighed, and after then the proportion of meat parts, bones and separable fat were calculated. Dissection of carcass quarters included this meat parts: top round, sirloin, tenderloin, shoulder, neck, short loin, flank, shank, brisket, boneless rib, chuck, trimmed meat. The carcass yield was calculated as the ratio of meat and kidney weight (without kidney fat) to net carcass weight.

Meat samples of each animal were taken from *M. longissimus thoracis et lumborum* (MLLT) for analysis of chemical and physical characteristics. Spectrometer Nicolet 6700 was used for determination of following chemical indicators: total water, protein and intramuscular fat. Spectrophotometric device was used for determination pH<sub>1</sub>, pH<sub>24</sub>, drip loss<sub>24</sub> and meat colour measured 24 hours and 7 days *post mortem* – at the fresh section. For pH measurement was using Titan pH meter with a glass electrode.

Results were reported as means and standard deviations. The statistical significance differences for monitored groups were tested with Students *t*-test at significance level of \*\*\**P* < 0.001; \*\**P* < 0.01; \**P* < 0.05 and ns *P* > 0.05. All results of the present study were analysed using the SPSS package program.

## 3 Results and discussion

Table 1 reports the slaughter and carcass parameters of experimental groups. The animals of female group for the period up to the finish of fattening (180 days) had, although not significant, but slightly higher growth intensity, which meant a higher weight at the finish of fattening (169.12 kg vs 166.50 kg). The females had higher weight of hindquarter, on the contrary, bull calves had higher weight of forequarter. This fact can be also seen in the share of individual meat cuts. We found a significantly higher proportion of kidney and pelvic fat in females (*P* < 0.05). A significantly higher proportion of bones in the half-carcass was found in males. Lukic et al. (2016) compared 16 month old bulls and heifers of the Simmental breed and they found minimal differences in carcass yield (56.56 vs. 56.42%, respectively) and the proportion of forequarters (54.57 vs. 54.49%, respectively) and hindquarters (45.43 vs. 45.51%, respectively). These results are similar to our findings. Comparable results in the proportion of meat from the half-carcass described Santos et al. (2013), however we found a higher proportion of bones and a lower proportion of fat in our study. Bartoň et al. (2003) stated that the lower carcass values are achieved by animals of dairy breeds compared to dual purpose breeds, which we also confirmed by evaluation of the Slovak Simmental breed. Lower proportion of bones in calves 4–6 months old compared to our results found Li et al. (2018).

The results in Table 2 show that heifers had a higher protein content (*P* < 0.01) and a lower fat content (*P* > 0.05) of *M. longissimus thoracis et lumborum* compared to the values of bulls. Li et al. (2018) found that the increasing of age positively affect the proportion of proteins in the category of 12–18 month old animals and also the proportion of IMF increased even after this period. On the contrary, the share of water decreased. The same authors found the following proportion of protein, fat and water: 19.2%, 0.9% and 77.9% in meat of 4–6 months old males. The proportion of meat in their study increased by the age of the slaughtered animals.

**Table 1** Carcass characteristics in the observed groups

	Males		Females		sign
	$\bar{x}$	s	$\bar{x}$	s	
Finish fattening weight (kg)	166.50	9.47	169.12	1.90	ns
Net slaughter weight (kg)*	159.75	9.13	162.10	1.87	ns
Hindquarter weight (kg)	22.87	1.88	23.23	0.83	ns
Forequarter weight (kg)	17.25	1.03	16.80	0.59	ns
Rumen fat (%)	0.19	0.05	0.15	0.04	ns
Intestinal fat (%)	0.15	0.07	0.12	0.03	ns
Kidney fat (%)	0.53	0.14	0.68	0.04	*
Pelvic fat (%)	0.09	0.03	0.15	0.06	*
HQ*** meat (%)	39.77	1.17	41.89	0.74	***
HQ*** bones (%)	13.83	0.60	12.75	0.21	***
HQ*** separable fat (%)	3.35	0.43	3.38	0.27	ns
FQ**** meat (%)	25.56	0.90	26.57	0.94	*
FQ**** bones (%)	13.88	0.97	12.21	0.69	***
FQ**** separable fat (%)	3.60	1.00	3.18	0.15	***
Round** (%)	22.34	0.58	23.49	0.46	***
Sirloin** (%)	3.87	0.24	4.19	0.12	**
Tenderloin (%)	1.86	0.14	2.00	0.12	***
Chuck ** (%)	6.56	2.66	7.42	0.57	ns
Rib** (%)	3.69	0.18	3.31	0.21	**
Dressing percentage (%)	53.21	4.23	50.71	1.34	ns

\* final live weight after fasting; \*\* boneless; \*\*\*HQ – hindquarter, \*\*\*\*FQ – forequarter

**Table 2** Chemical content of *M. longissimus thoracis et lumborum* in the observed groups

	Males		Females		sign
	$\bar{x}$	s	$\bar{x}$	s	
Water content (g/100 g)	75.82	1.38	72.78	2.23	**
Protein content (g/100 g)	22.63	1.49	25.33	1.67	**
IMT content (g/100 g)	1.38	0.55	0.95	0.48	ns

The evaluation of technological properties shows (Table 3). The pH values measured 1 hour after slaughter did not show differences between groups. We observed higher decline in pH 24 hours after slaughter in heifers. The higher lightness of meat was found in bulls, on the contrary, the values of redness were higher in heifers in both measured times, 24 hours and 7 days after slaughter. Węglarz (2010) compared different carcass categories and found the highest  $L^*$  values in heifers, followed bulls and the darkest meat was in cows. The pH measured 48 hours after slaughter was higher (still within the meat quality standards) in the bulls from the spring calving season. It notes that the meat of animals with higher pH values has limited use (for lower value of products). They concluded that the increasing age of heifers had effect on the increasing of pH values while in bulls, the age had no effect. Filipčík et al. (2009) did not find a significant effect of the slaughter age on the IMF content in steers and heifers of crossbreds of Czech Fleckvieh breed, on the contrary this factor was confirmed in bulls. In the authors work the factors: fattening, carcass weight and commercial type were significant in the proportion of IMF in both sexes. These indicators had also a significant effect on the  $L^*$  value. These authors described that the beef technological characteristics were significantly influenced by the age of the animals. The influence of sex on the physical and technological properties of animals of the Simmental breed was also examined by Marenčić et al. (2018). However, the effect of age has not been demonstrated.

**Table 3** Physical-technological characteristic for *M. longissimus thoracis et lumborum* in observed groups

	Males		Females		sign
	$\bar{x}$	s	$\bar{x}$	s	
pH <sub>1</sub>	6.64	0.15	6.63	0.11	ns
pH <sub>24</sub>	5.77	0.05	5.64	0.07	**
CIE L* 24 h	47.22	2.46	42.57	1.72	***
CIE a* 24 h	2.56	3.60	6.42	1.45	*
CIE b* 24 h	9.86	0.93	8.43	0.87	*
CIE L* 7 d	51.66	5.36	47.71	6.45	ns
CIE a* 7 d	2.44	3.07	2.82	3.88	ns
CIE b* 7 d	10.35	0.88	9.09	1.18	**

#### 4 Conclusion

In this work, the assessment of carcass and meat quality indicators of Slovak Simmental breed at males and females at the age of 6 months showed only slight differences. A higher proportion of internal fat (rumen, intestinal, kidney, pelvic) was found in heifers. Higher proportion of meat were found in females and a higher proportion of bones was found in the half-carcass of bulls. The higher lightness of meat was found in bulls and higher value of meat redness was identified in heifers.

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