

## CARCASS AND MEAT QUALITY OF SLOVAK PIED HEIFERS AND THEIR CROSSES BY LIMOUSINE BREED

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### ABSTRACT

The aim of the present study was analysed heifer carcass and meat quality of Slovak pied breed and their crosses by limousine breed. The heifers were fattened by the same feed ration to the 450 days of age. There was a significant difference between the groups of the heifers ( $P \leq 0.01$ ) in the dressing percentage and muscle ratio ( $P \leq 0.05$ ). The *Longissimus* muscle chemical quality of fattening heifer were evaluate. Content of protein was similar in the Slovak pied heifers and in the crosses by limousine was insignificantly lower. Intramuscular fat content was significantly differed ( $P \leq 0.05$ ), in the Slovak pied heifers was 2.95 % and the crosses by Limousine 3.52 %. Water holding capacity was insignificantly higher in the Slovak pied cattle as in the crosses by Limousine breed. Shear force was significantly ( $P \leq 0.05$ ) higher in the *Longissimus* muscle of Slovak pied cattle (7.1 WB) as in the crosses by Limousine breed (6.42 WB).

**Keywords:** Beef, shear force, chemical quality, pH value

### INTRODUCTION

There are several factors that in the cattle influence carcass characteristics, chemical composition and fatty acid profile. Genetics (Rotta *et al.*, 2009), nutrition (Prado *et al.*, 2008) and finishing systems (Padre *et al.*, 2007; Aricetti *et al.*, 2008) are some factors for variations in beef quality. The influence of breed and sex on meat quality has also been analysed and compared in several studies (Filipcik *et al.*, 2009). Nade *et al.* (2007) found out in the heifers of Wagyu cross Limousin breed muscle ratio 51.23 % and fat ratio 36.77 % at the carcass weight 204.83 kg.

The chemical composition of meat considerably varies. The meat may contain 45-70% water, 15-20% protein, and fat in the range of 5-40%, depending on the cutting and trimming. Meat contains carbohydrates largely, with the exception of the liver, which is a storehouse of glycogen (Vaclavik and Christian, 2008).

The nutritional value is an important factor to the meat quality. Consumers choices of foods which are nutritious and healthier (Verbeke *et al.*, 2010; Hocquette *et al.*, 2012). Intramuscular fat content and fatty acid composition, together with the biological value of the protein, vitamins and trace elements, are key factors contributing to nutritional value (Wyness, 2013). Considerable attention has been given to essential fatty acids in meat and milk (Shingfield *et al.*, 2013; Salter, 2013; Givens, 2010).

Intramuscular fat content is a major indicator of the flavour and juiciness of beef. Fat properties are given by fatty acid forming triglycerides. Fats composed of saturated fatty acids are firmer in texture than fats composed of unsaturated fatty acids (Vaclavik and Christian, 2008).

Although the factors that regulate patterns of intramuscular fat deposition are governed by environmental factors and genetic variation in the live animal, the processes taking place during conversion of muscle to meat are known to alter the adipose tissue composition (Paredi *et al.*, 2012). Content of collagen varied in the wet tissue from 1.09 to 1.16 mg/g (Pogge *et al.*, 2014). The shear force of the beef is  $35.52 \pm 5.18$  N/cm<sup>2</sup> and WHC (water holding capacity) of beef meat is near 1% (Zhao *et al.*, 2012).

The aim of the article was to analyse chemical composition and shear force *Longissimus* muscle of heifers.

### MATERIAL AND METHODS

Heifers were fattened to the 450 days of age and slaughtered.

- S - Slovak pied cattle (n=8).
- S x Li - Slovak pied x Limousine cattle (n=8).

Heifers were fed by feed rations calculated by actual weight. Heifers were slaughtered at the 450 days and after 24 hours were carcasses deboned. Samples for analyses were from the *Longissimus muscle* at the level of 10-11 rib.

The protein, fibrous proteins, fat and water content of meat was determined by INFRATEC Meat Analyser 1265 (FOSS Tecator, Sweden), which works on the reflection near-infrared transmission (Windham *et al.*, 2003).

The samples for shear force test were obtained by cutting two parallelepipeds of 1x1 cm of cross section along muscle fibre axis. Samples were completely cut using a WB shear blade with a triangular slot cutting edge 1 mm thick. Shear force were measured in the lg.cm<sup>2</sup>(WB) and converted to kg.cm<sup>2</sup>.

Statistical analysis of the data was performed by the SAS 8.2 software. Significance of differences was evaluated by t-test.

### RESULTS AND DISCUSSION

Table 1 shows that carcass hot weight of the heifers of Slovak pied breed and crosses by Limousine breed was similar (Slovak pied breed 219.60 kg, crosses by Limousine 213.10 kg). Dressing percentage was significantly lower ( $P \leq 0.01$ ) in the heifers of Slovak pied breed was 54.42 % and in the crosses by Limousine breed was 56.73%. Dressing percentage of British cross heifers is higher varied from 61.8 to 62.9 % (Talton *et al.*, 2014). Muscle ratio was in the carcass of the heifers of Slovak pied breed 75.78 % and in the crosses by limousine significantly higher ( $P \leq 0.05$ ) 78.40 %. Opposite our results Nade *et al.* (2007) found out in the heifers Wagyu cross Limousin breed muscle ratio 51.23 (%). Fat ratio was in the carcass of Slovak pied heifers significantly higher ( $P \leq 0.05$ ) 8.32% as in the carcass of crosses by Limousine breed 7.26 %. Opposite our results Nade *et al.* (2007) found out in the heifers Wagyu cross Limousin breed fat ratio 36.77 %, but the is Wagyu bred with high fat proportion wit high content of intramuscular fat and meat with excellent sensory quality.

**Table 1** Weight and carcass composition of the left side of the carcass heifers Slovak pied and crosses by limousine

Parameters	S				S x Li				t-test
	mean	S.D.	S.E.	CV%	mean	S.D.	S.E.	CV%	
Live weight (kg)	403.55	50.90	17.99	12.58	375.30	30.22	10.15	8.02	NS
Carcass weight (kg)	219.60	29.30	10.32	13.28	213.10	14.90	5.20	7.00	++
Dressing percentage (%)	54.42	1.38	0.45	2.54	56.73	0.92	0.31	50.44	++
Muscle ratio (%)	75.78	1.42	0.47	1.85	78.40	0.83	0.30	1.06	+
Fat ratio (%)	8.32	1.56	0.55	18.88	7.26	0.78	0.28	10.95	+
Bone ratio (%)	15.87	0.95	0.33	6.11	14.12	0.55	0.20	30.83	NS

Legend: NS = (P > 0.05), + (P ≤ 0.05), ++ (P ≤ 0.01)

Table 2 shows the average moisture content of the *Longissimus* muscle of heifers Slovak pied breed and crosses by Limousine breed. Average moisture content was similar in the Slovak pied breed 73.55 g/100g and in the crosses by Limousine 73.32 g/100g. **Fiems et al. (2003)** found out similar moisture content in the Belgian blue cows (74.0 %). **Muchenje et al. (2014)** found in meat breeds Aberdeen Angus steers from 77.1 to 77.9 % moisture. Protein content was in the Slovak pied heifers 22.59 g/100g and in the crosses by limousine bred similar 22.38 g/100g. **Bartoň et al. (2007)** found out protein content from 20.7 to 21.7 g/100g. **Fiems et al. (2003)** found out similar protein content in the Belgian blue

cows 22.0 %. Intramuscular fat content significantly differed (P ≤ 0.05) in the Slovak pied heifers was 2.95 g/100g and in the crosses by limousine 3.52 g/100g. Compared to our results **Muchenje et al. (2014)** found out lower protein (20.0 g/100g) and intramuscular fat content (0.76 g/100g). Higher intramuscular fat content (4.36 g/100g) found out **Bartoň et al. (2007)**. So **Kim et al. (2008)** found out lower content of intramuscular fat in the beef of lower quality 1.80 %, but in the beef of high eating quality was fat content 25.3 %. **Fiems et al. (2003)** found out intramuscular fat content in the Belgian blue cows 2.8%.

**Table 2** Basic chemical composition of *Longissimus* muscle of heifers Slovak pied and crosses by limousine

Parameters	S				S x Li				t-test
	mean	S.D.	S.E.	CV%	mean	S.D.	S.E.	CV%	
Moisture (g/100g)	73.55	0.82	0.29	1.15	73.32	0.61	0.21	0.85	NS
Proteins (g/100g)	22.59	0.66	0.22	2.98	22.38	0.32	0.10	1.52	NS
Intramuscular fat (g/100g)	2.95	0.68	0.25	23.69	3.52	0.84	0.35	22.40	+
Ash (g/100g)	0.91	0.10	0.03	11.55	0.98	0.08	0.03	8.50	NS
Fibrous proteins (g/100g)	0.31	0.06	0.02	24.81	0.33	0.08	0.03	27.50	NS

Legend: NS = (P > 0.05), + (P ≤ 0.05)

Table 3 shows the pH<sub>48</sub> value, which were measured as the lowest value during the ripening of meat and consider it the value of *rigor mortis*. In the Slovak pied breed was 5.55 pH and in the crosses by limousine breed was similar 5.57. Higher value of pH (5.8) found out **Kim et al. (2008)**. Water holding capacity was insignificantly higher (37.80 %) in the Slovak pied cattle as in the crosses by limousine breed (32.70%). Higher water holding capacity (55.8%) found out **Kim et al. (2008)**. Shear force was significantly (P ≤ 0.05) higher in the Slovak

pied cattle (7.1 WB) in compare with the crosses by limousine breed (6.42 WB). Opposite our results found out **Kim et al. (2008)** higher shear force (8.0 WB) in the low meat quality, but significantly better results found out in the beef of high quality (3.7 WB). Cooking loss (%) in the *Longissimus* muscle of Slovak pied cattle was 41.50 and in the crosses by limousine significantly (P ≤ 0.05) lower (37.20 %). **Fiems et al. (2003)** found out cooking loss from 23.0 % to 24.2 %.

**Table 3** Physical parameters of *Longissimus* muscle of heifers Slovak pied and crosses by limousine

Parameters	S				S x Li				t-test
	mean	S.D.	S.E.	CV%	mean	S.D.	S.E.	CV%	
pH <sub>48</sub>	5.55	0.14	0.05	2.70	5.57	0.10	0.03	2.11	-
Water holding capacity (%)	34.80	1.78	0.61	5.12	32.70	4.10	1.20	12.61	-
Shear force (WB)	7.10	1.70	0.60	24.19	6.42	1.98	0.6	26.02	+
Cooking loss (%)	41.50	5.30	1.89	12.90	37.20	4.40	1.25	11.98	+

Legend: - (P > 0.05), + (P ≤ 0.05), pH<sub>48</sub>, pH 48 hours after slaughtering

**CONCLUSION**

In this work were evaluate the meat chemical quality of heifer Slovak pied and their crosses by limousine breed. There was a significant difference between the groups of the heifers (P ≤ 0.01). Dressing percentage in the heifers of Slovak pied breed was 54.42 % and in the crosses by Limousine breed 56.73 %. Muscle ratio was in the carcass of the heifers of Slovak pied breed 75.78 % and in the crosses by Limousine significantly higher (P ≤ 0.05) 78.40 %. Content of protein was in the Slovak pied heifers 22.59 g/100g and in the crosses by Limousine insignificantly lower (22.38 g/100g). Intramuscular fat content significantly differed (P ≤ 0.05) in the Slovak pied heifers was 2.95 g/100g and the crosses by Limousine 3.52 g/100g. In the Slovak pied breed *Longissimus* muscle was pH value 5.55 and in the crosses by Limousine breed was similar 5.57. Water holding capacity was insignificantly higher (37.80 %) in the Slovak pied cattle as in the crosses by limousine breed (32.70 %). Shear force was significantly higher (P ≤ 0.05) in the Slovak pied cattle (7.1 WB) as in the crosses by Limousine breed (6.42 WB).

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