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Approximately equal qualitative parameters were noticed in both categories when meat quality was studied. We noticed significant results in the parameter intramuscular fat in favour of the category of bulls, and in pH₄₈ and colour richness (a) in favour of the category of cows. The rest of results was variable, although more favourable parameters of meat quality were noticed for the category of bulls. More favourable results were also in sensorial evaluation of meat in favour of the category of bulls.

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Strictly as per the compliance and regulations of :



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I. INTRODUCTION

The Slovak Pied breed is one of the registered breeds kept in the Slovak Republic. Research in meat of the Slovak Pied breed was more focused on quantity than quality of meat (Mojto et al., 1998, 1999, 2004; Zaujec et al., 2005). The tendency is opposed at present, i.e. meat quality is in the first place (Zaujec and Mojto, 2007; Zaujec et al., 2006, 2010). Whereas till 2000 was the quality aimed at quality in bulls, at present more than a half of killed animals are slaughter cows (more than 55 %), because of lack of slaughter bulls, to meet the needs of market. Galli et al. (2008) recommend using the meat of slaughter cows purely for produces of meat or tinned food. In some countries is distribution of cows' meat for sale into trade network prohibited. According to Jedlička (1988) the cows' meat should be distributed into trade network for sale till the age of 3 years of the animal. Some experiments of authors (Kim et al., 1998) show that the main attributes of beef are meat colour, intramuscular fat – so called marbling – and shear force. Many factors such as sex, age, way of breeding, can affect these attributes (Ramsey et al., 1963; Crouse et al., 1989). Marbling of beef can at higher levels influence the tenderness of meat after heat treatment (Zaujec et al., 2006 and Yamazaki et al., 1989). According to Rhodes

et al. (1955), Van Syncler and Brough (1958) and Ramsey et al. (1963) flavour influences the consumer after heat treatment of meat. Koch et al. (1982), McKeith et al. (1985), Galli et al. (2008) and Zaujec et al. (2010) confirmed this statement in their works.

The objective of this contribution was to compare meat quality in cows and bulls of the Slovak Pied breed as well as to find out if larger amount of intramuscular fat influences sensorial parameters of meat.

II. MATERIAL AND METHOD

a) Animals

Slaughter cows (26 animals) and slaughter bulls (16 animals) of Simmental breeds were used in this experiment. Basic characteristic of this set is in table 1. The animals came from different agricultural enterprises and they were killed at the slaughter house in Dunajská Streda. The carcasses were evaluated after killing according to the regulation No. 206/2007 MA SK. We replaced classes of conformation with numbers: P-1, O-2, R-3, U-4, and E-5 to calculate the average class of conformation. The weight of warm carcass was detected after the classification. This indication served us further to calculate live weight before slaughter, which we obtained by multiplying the weight of warm carcass by the coefficient relevant for the given category.

b) Chemical Analysis

At the slaughter house were taken meat samples from the right carcass side between 9th – 10th rib 48 hours after killing. The meat samples were wrapped in microten wrapping and stored in portable refrigerator at the temperature 4^o C during the transport (approx. 1 hour). The samples were tempered to 20^o C after the transport. Then a number of parameters were studied in meat. Marbling of meat was assessed at fresh cut. Degree of marbling was determined on the basis of a 10 points American scale (USDA 1997), where 1: very abundant marbling, 10: traces or practically devoid of marbling. Percentage of proteins, fat and total water content was assessed in 100 g minced meat sample in the apparatus Infratec 1265 Meat Analyser. Combined glass electrode and portable pH meter (type 3071) were used to measure pH₄₈ value. Values of meat colour (L, a, b) were measured on cutting area of *m. longissimus dorsi* by the apparatus Mini Scan E Plus (Hunter lab., USA). The method by Grau-Hamm (modified by Palanská and Hašek 1976) was used to assess water

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holding capacity. Shear force of meat was measured in a sample of grilled meat on day 7 after killing the animals. Meat sample (thickness 2.5 cm, m. longissimus dorsi) was put into a contact grill, model PM-1015 (RM Gastro, Czech Republic) and grilled at a temperature 200° C for 4 minutes. After grilling the value of shear force was measured in grams, converted to kg, in the apparatus Texture Analyser TA.XT2i (Stable Microsystems, England).

c) *Sensorial Parameters*

Sensorial parameters of meat were assessed by 5 points scale (Jedlička 1988) valid for all kinds of meat (5 points – very high, 1 point – without). Out of meat properties were assessed the following ones: flavour, taste, juiciness and tenderness.

d) *Statistics*

With all results were calculated: mean (\bar{x}) and standard deviation (s). Differences in means between categories were tested in individual parameters by Two-Sample T-test, using the programme Statistix for Windows, version 8 (Analytical Software, Tallahassee, USA). Mean values were statistically evaluated by significance of differences to $P < 0.05$.

III. RESULTS AND DISCUSSION

Values in table 1 show statistically significant differences were found between the groups almost in all parameters. These differences were worse in the group of cows. In this group we found higher variability compared with the group of bulls, namely in all studied parameters. We found the highest variability in the parameter carcass weight, live weight before slaughter and age. These facts indicate that cows of different live weight and age are slaughtered in Slovakia. It can be caused by different reasons of culling, either efficiency or reproduction.

With the parameters conformation we noticed better results in group of bulls. However, the group of bulls was not so excellent conformation as we supposed. The value 2.37 indicates only medium muscularity, which corresponds with class O of the Europ system. The value 1.64 in the group of cows indicates below-average muscularity, which corresponds with class P of the Europ system. With the parameter fat cover showed both groups on average very slight to slight development of subcutaneous fat, which corresponds with classes 1 to 2 according to the Europ system in practice. Similar results reports Zaujec and Mojto (2007) and Zaujec et al. (2006) in bulls. Gondeková et al. (2008) reported similar results with cows. Marbling of meat is a parameter closely bound to the class of fat cover. We found no statistically significant differences between the groups; however, we found higher degree of marbling in the group of cows, which corresponds with slight degree of marbling. The

marbling degree was even lower in the group of bulls. Similar results reported Gondeková et al. (2008) and also Patten et al. (2008). On the contrary, Zaujec et al. (2006) noticed marbling degree 8 in slaughter bulls. Prado et al. (2008) reported marbling degree 6 in the crosses Aberdeen Angus.

We found no statistically significant differences between the groups in basic parameters (total water and proteins; table 2). This fact confirms that total water and proteins are constant in meat and they are influenced more by genetics than by surroundings. The intramuscular fat is the most variable parameter. We noticed larger amount of intramuscular fat in the group of cows (more than 3 g.100 g⁻¹) compared with the group of bulls (more than 1.5 g.100 g⁻¹). Differences were statistically significant on $P < 0.01$ with this parameter. These findings indicate close relation between intramuscular fat, marbling of meat and class of fat cover. The higher is the content of intramuscular fat, the higher is the class of fat cover and the higher is the marbling degree in meat. Mojto et al. (2004) found higher values of intramuscular fat in bulls. On the other hand, Zaujec et al. (2010) and Corazzin et al. (2012) found lower values of intramuscular fat in the category of bulls and higher values in the category of cows.

Value of pH is worth mentioning out of chemical and technological parameters. The average values, which we observed (over 6.3) indicate the occurrence of DFD meat in the group of bulls. We detected statistically significant differences ($P < 0.05$) in comparison with the group of cows. We assume that the occurrence of DFD meat can be connected with greater physical activity of bulls before slaughter. Kim et al. (1998) noticed lower pH values in the Hanwoo breed, when comparing bulls and cows. Similarly, Mojto et al. (2004) and Zaujec et al. (2010) noticed lower pH values in bulls.

Value of pH is closely connected with further parameters as colour of meat and water holding capacity. In our case proved the relation the higher the pH the darker the meat colour. Darker meat colour (L), although statistically non-significantly, was detected in the group of bulls with higher pH value. We found statistically significant differences ($P < 0.01$) in richness of meat colour (a): the group of bulls had darker brightness of meat compared with the group of cows. Galli et al. (2008), Kim et al. (1998), Kim et al. (2003), Chávez et al. (2012), Franco et al. (2011) found somewhat higher values in meat colour (value L) and colour richness in cows. French et al. (2001), Orellana et al. (2009) reported higher values in richness of meat colour in bulls. On the other hand, Zaujec et al. (2010) reported higher values of meat colour in meat of cows than in bulls.

In the parameter water holding capacity we found lower values by more than 3 g.100 g⁻¹ in the group of bulls compared with cows. Such low values can be

put into connection with higher pH value and darker meat colour, which manifested itself also in our case.

There were less unfavourable values in the group of bulls; however, their meat was softer than the meat in the group of cows, but statistically nonsignificant. It can be related to lower age at slaughter but also to higher content of insoluble elastin. Conclusions of Yamazaki et al. (1989) that intramuscular fat influences shear force in meat were not confirmed with this parameter. Similar results reported Gondeková et al. (2008) in slaughter cows. On the other hand, Crouse et al. (1989), Ramsey et al. (1963) found much lower values of shear force in bulls (5.88 kg or 6.35 kg).

More favourable results in all parameters, although without statistical significance, were found in sensorial parameters (tab. 3) of bulls. In both groups was taste evaluated as the most favourable, followed by juiciness and flavour; tenderness was the least favourable. Similar results reported also French et al. (2001) and Zaujec et al. (2010) for bulls. On the other hand, Cerdeño et al. (2006), Faucitano et al. (2008) noticed better results at panel evaluation than those obtained in our experiment with bulls. Kim and Lee (2003) noticed better sensorial evaluation with cows. We cannot agree with authors Koch et al. (1982), McKeith et al. (1985), Galli et al. (2008) that flavour is the dominant parameter in sensorial evaluation as in our case was taste the dominant parameter with the most points (4.08 and/or 3.75).

IV. CONCLUSION

We can say that there were found not so great differences between the animal categories, which would confirm or disprove the hypothesis that the meat of cows or bulls is better or worse in the studied Slovak Pied breed. More favourable results, mainly in sensorial evaluation, were in the group of bulls. The hypotheses that the intramuscular fat can influence the sensorial evaluation of meat were not confirmed either. Further on, we can state that if we study the categories of one breed, we obtain more compact results than in case when no breed is taken into account.

REFERENCES RÉFÉRENCES REFERENCIAS

1. Cerdeño, A., Vieira, C., Serrano, E., Mantecón, A.R., 2006. Effect of proction system on performance traits, carcass and meat quality in Brown Swiss young cattle. *J. Anim. and Feed Sci.* 15:17-24
2. Corazzin, M., Bovolenta, S., Sepulcri, A., Piasentier, E., 2012. Effect of whole linseed addition on meat production and quality of Italian Simmental and Holstein young bulls. *Meat Sci.*, 90,1: 99-105
3. Crouse, J.D., Cundiff, L.V., Koch, R.M., Koohmaraie, M., Seideman, S.C., 1989. Comparison of Bos Indicus and Bos Taurus Inheritance for Carcass Beef Characteristics and Meat Palatability. *J. Anim. Sci.*, 67: 2661-2668
4. Faucitano, L., Chouinard, P.Y., Fortin, J., Mandell, I. B., Lafreniere, C., Girard, C. L., Berthiaume, R., 2008. Comparison of alterntive beef production systems based on forage finishing or grain-forage diets with or without growth promotants: 2. Meat quality, fatty acid composition and overall palatability. *J. Anim. Sci.*, 86:1678-1689
5. Franco, D., Rodríguez, E., Purriños, L., Crecente, S., Bermúdez, R., J. M. Lorenzo, M., 2011. Meat quality of "Galician Mountain" foals breed. Effect of sex, slaughter age and livestock production system. *Meat Sci.*, 88, 2: 292-298
6. French, P., O'Riordan, E.G., Monahan, F.J., Caffrey, P.J., Mooney, M.T., Troy, D.J., Moloney, A.P., 2001. The eating quality of meat of steers fed grass and/or concentrates. *Meat.Sci.*, 57:379-386
7. Galli, I., Teuta, G., Perlo, F., Bonato, P., Tisovci, O., Monje, A., Citrone, S., 2008. Animal performance and meat quality in cull cows with early weaned calves in Argentina. *Meat. Sci.*, 79:521-528
8. Gondeková, M., Mojto, J., Zaujec, K., 2008. Carcass quality, nutritional, physical-technological and sensorial quality of musculus longissimus dorsi from slaughter cows in Slovakia. III. Scientific Conference of PhD students, SPU Nitra, p. 157-160
9. Hašek, A., Palanská, O., 1976. Determination of water in meat shelf-life instrument for constant pressure. *Hyd. Priem.* 18:228 - 233
10. Chávez, A., Pérez, E., Rubio, M.S., Méndez, R.D., Delgado, E.J., Díaz, D., 2012. Chemical composition and cooking properties of beef forequarter muscles of Mexican cattle from different genotypes. *Meat Sci.*, 91, 2: 160-164
11. Jedlička, J., 1988. Meat quality. *Príroda, Bratislava*, p.184
12. Kim, C. J., Lee, E. S., Cho, J. K., Kang, J. O., Lee, C. H., Jeong, J.Y., Song, M.S., 1998. A study on the meat quality of Hanwoo (Korean native cattle) beef in relation to sex and Koreanmeat quality grade. 44th ICoMST, Spain, p.272-273
13. Kim, C.J., Lee, E.S., 2003. Effects of quality grade on the chemical, physical and sensory characteristics of Hanwoo (Korean native cattle) beef. *Meat Sci*, 63:397-405
14. Koch, R.M., Dikeman, M.E., Crouse, J.D., 1982. Characterization of biological type soft cattle (Cycle III). III. Carcass composition, duality and palatability. *J. Anim. Sci.*, 54:35-40
15. McKeith, F.K., Savell, J.W., Smith, G.C., Dutson, T.R., Carpenter, Z.L., 1985. Physical, chemical, histological and palatability characteristics of muscles from three bred-types of cattle at different times-on-feed. *Meat Sci.*, 15:37-42
16. Mojto, J., Chrenek, J., Palanská, O., Kmet', J., Zaujec, K., Pavlíč, M.: 1998. Nutritive and physical and technological quality of meat and fat in slaughter bulls of Holstein breed and in crosses with

- Belgian White-Blue breed (in Slovak). Czech Journal of Anim. Sci., 43, 10: 483- 488
17. Mojto, J., Chrenek, J., Palanská, O., Zaujec, K., Pavlič, M., 1999. Characteristics of nutritional and physical-technological meat quality in slaughter bulls of Braunvieh, Piemont and Slovak Pied breeds. Journa of Farm Anim. Sci., XXXII:127-132
 18. Mojto, J., Zaujec, K., Novotná, K., Pavlič, M., 2004. Chemical and physical-technological properties of three different muscles in carcass of slaughter bulls. Journal of Farm Anim. Sci., XXXVII:237-244
 19. Orellana, C., Pena, F., García, A., Perea, J., Martos, J., Domenech, V., Acero, R., 2009. Carcass characteristics, fatty acid composition, and meat quality of Criollo Argentino and Braford steers raised on forage in a semi-tropical region of Argentina. Meat. Sci., 81:57-64
 20. Patten, L.E., Hodgen, J.M., Stelzleni, A.M. Calkins, C.R., Johnson, D.D., Gwartney, B.L., 2008. Chemical properties of cow and beef muscles: Benchmarking the differences and similarities. J. Anim. Sci., 86: 1904-1916
 21. Prado, I. N., Prado, R. M., Visantainer, J. V., Moletta, J. L., Perotto, D., 2008. Carcass cahracteristics and chemical composition of the Longissimus muscle of crosbred bulls (Bos taurus indicus vs Bos taurus taurus) finished in feedlot. J. Anim. and Feed Sci. 17: 295-306
 22. Rameny, C.B., Cole, J.W., Meyer, B.H., Temple, R.S., 1963. Effects of type and breeds of British zebu and dairy cattle on production. Palatability and composition. II. Palatability differences and cooking losses as determined by laboratory and family panels. J. Anim. Sci., 22:1001-1008
 23. Regulation of Ministry of Agriculture SK No 206/2007 Law Digest on classification of cattle carcasses, dressed carcasses of sheep, specialist education and specialist competency certificate.
 24. Rhodes, V.J., Kiehl, E.R., Brady, D.E., 1955. Visual preferences for grade of retail beef cuts. Missouri, Agric. Exp. Sta. Res. Bull. p. 583, Columbia
 25. USDA. United State Department of Agriculture 1997. Agricultural marketing Service. Livestock and Seed Division (S1), 17 p.
 26. Van Syckle, C., Brough, O.L., 1958 Customer acceptance of fat characteristics of beef. Washington Agric. Exp. Sta. Tech. Bull., p.27, Pulman
 27. Yamazaki, T., Nakanishi, N., Ozusumi, K., 1989. Effect of age and fatness on the meat quality of beef animal. VIII: Comparison of meat quality between Japanese black and Holstein streers. Bulletin of Bational the Grassland Institute, 42:83-94
 28. Zaujec, K., Mojto, J., 2007. Difference quality of carcass bulls by application SEUROP system. Slovak J. Anim. Sci., 40, 3:126-131
 29. Zaujec, K., Mojto, J., Gondeková, M., 2010. Comparison of meat quality in bulls and cows. Slovak J. Anim. Sci., 43, 3:160-165
 30. Zaujec, K., Mojto, j., Greguška, D., Novotná K., 2006. Quality m. longissimus dorsi of carcass bulls by different degree of marbling meat. Slovak J. Anim. Sci., 39, 4:209-213
 31. Zaujec, K., Mojto, J., Novotná, K., Pavlič, M., Greguška, D., 2005. Study of relations between quality of carcass (EUROP) and quality of musculus longissimus dorsi in bulls of Slovak spotted and Holstein breeds. Journal of Farm Anim. Sci., XXXVIII.:225-232.

Table 1 : Basic characteristics of animals and carcass

Parameter	cows			bulls			t- test
	n	\bar{x}	s	n	\bar{x}	s	
age (months)	26	85.80	11.42	16	21.06	4.65	+++
final live weight (kg)	26	508.90	42.11	16	540.06	39.23	+++
carcass weight (kg)	26	262.32	53.36	16	297.06	43.38	+++
conformation score	26	1.64	0.56	16	2.37	0.50	++
fatness score	26	1.92	0.84	16	1.18	0.40	++
marbling score	26	7.46	1.60	16	8.12	0.88	

+++ P < 0.001, ++ P < 0.01

conformation score: 1- P(very poor conformation)... 5 – E (very good conformation)

fatness score: 1 – very lean ... 5 very fat

marbling score: 1 – very abundant ... 10 - traces or practically devoid

Table 2 : Qualitative parameters of meat

Parameter	cows			bulls			t- test
	n	\bar{x}	s	n	\bar{x}	s	
total water (g.100g ⁻¹)	26	75.52	2.05	16	76.18	1.04	
proteins (g.100g ⁻¹)	26	20.39	0.99	16	21.00	0.49	
intramuscular fat (g.100g ⁻¹)	26	3.06	1.96	16	1.81	0.82	++
pH ₄₈	26	5.86	0.42	16	6.50	0.57	+
meat colour lightness L	26	30.17	3.84	16	29.09	4.06	
redness a	26	10.77	2.29	16	7.93	2.98	++
yellowness b	26	7.30	1.51	16	6.06	2.09	
water holding capacitance (g.100g ⁻¹)	26	27.67	5.11	16	24.72	4.19	
shear force (kg)	26	10.66	4.18	16	9.20	3.48	

++P < 0.01, +P < 0.05

Table 3 : Sensory evaluation of meat quality

Traits	cows			bulls			t- test
	n	\bar{x}	s	n	\bar{x}	s	
flavour	26	3.75	0.50	16	4.08	0.58	
taste	26	3.55	0.56	16	3.92	0.62	
tenderness	26	3.41	0.86	16	3.77	0.88	
juiciness	26	3.69	0.71	16	3.95	0.66	

Scale: 1 – without flavour. taste. tenderness. juiciness. 5 – very high flavour. taste. tenderness. juiciness