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REGULAR ARTILCE

COMPARISON OF MEAT QUALITY IN BULLS AND COWS

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ABSTRACT

Comparison of quality and sensorial evaluation of meat was performed in two categories of animals: cows (n=69) and bulls (n=52). We found highly significant differences between the categories in basic characteristics of animals. The greatest differences were found in age, weight of carcass, conformation, fatness and marbling of meat. Observation of meat quality in these categories showed approximately the same qualitative parameters in both categories. Significant results were noticed in the parameters total content water and content of intramuscular fat in favour of the bulls. The other results varied, though the more favourable parameters of meat quality were in the category of bulls. More favourable results were observed in sensorial evaluation of meat in the category of bulls also.

Key words: cows, bulls, meat quality, sensory panel

INTRODUCTION

Carcass and technological values of animals were taken into consideration mostly when evaluating the slaughter cattle in our country. Meat quality was underestimated. Quality beef was usually studied in the slaughter of bulls (**Mojto et al. 1998, 1999, 2004; Šubrt and Schmidt 1994; Zaujec et al. 2005; Fiems et al. 2000; Yamada et al. 2009**). According to many authors (**Cranweel et al. 1996; Haberman et al. 2002; Sawyer et al. 2004; Patten et**

al. 2008) live weight before slaughter influences the quality of meat. **Orellana et al. (2008)** affirmed the influence of live weight before slaughter in bulls coming from Argentina. **Mojto et al. (1998)** indicates the tendency to paler meat and low content of intramuscular fat in slaughter bulls with dressing percentage of about 70 %. **Hodgson et al. (1992) and Johnson and Rogers (1997)** recommend to introduce subclasses to improve quality of meat in bulls and cows. Because of lack of slaughter bulls are slaughtered slaughter cows to a higher degree in order to meet the demand for beef on the market at present. Cows' meat is considered to be of lower quality than the meat of bulls more for empiric reason. Higher age at slaughter is reported as the reason for worse quality of cows' meat. Similarly **Galli et al. (2008)** give age at slaughter as the main reason for 80 % culling of cows. **Minchin et al. (2008)** mentioned that age can influence the quality of beef, mainly in young and old animals. Some experiments of authors prove that higher live weight influences colour of meat, intramuscular fat, and shear force of meat. According to **Pritchard and Burg (1993)** the influence of live weight on quality of cows' meat became evident mainly in slaughter calves, which were classed within P and O classes.

Sensorial evaluation of meat becomes important also, mainly if it is thermally processed. Sensorial parameters of beef are important at consumption of thermally processed meat. For the consumer flavour is dominant out of sensorial parameters (**Rhodes et al., 1955; Van Syckle and Brough, 1958; Ramsey et al., 1963). Koch et al. (1982), McKeith et al. (1985), Galli et al. (2008)** confirmed this statement in their works. **Aumaitre (1999), Harrington (1994) and Goodson et al. (2002)** reported difference in the quality of meat between male and female sex mainly in its preparation.

Objective of this work was to compare meat quality between slaughter bulls and slaughter cows with regard to sensorial parameters of meat.

MATERIAL AND METHOD

Animals

Slaughter cows (69 animals) and slaughter bulls (52 animals) of different 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 slaughterhouse 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.

Chemical analyses

At the slaughter house were taken meat samples from the right carcass side between 9^{th} – 10^{th} rib 48 hours after killing. The meat samples were packed in microten wrapping and stored in portable refrigerator at the temperature 4^0 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 pH_{48} 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 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^o 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).

Sensorial parameters

Sensorial parameters of meat were assessed by 5 points scale **(Jedlička 1988)** valid for all kinds of meat (5 points – very distinctive property, 1 point – inexpressive property of meat). Out of meat properties were assessed the following ones: flavour, taste, juiciness and tenderness.

Statistics

With all results were calculated: mean (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 $P< 0.05$.

RESULTS AND DISCUSSION

Significant differences were found in all studied parameters of basic characteristics in animals (Tab. 1).

Table 1 Basic characteristics of animals and carcass

Parameter	cows			bulls			t-test
	n	$\bar{x}$	s	n	$\bar{x}$	s	
age (days)	69	2220.00	862.39	52	662.31	103.73	+++
final live weight (kg)	69	539.56	113.02	52	565.96	80.61	+
carcass weight (kg)	69	278.12	58.25	52	310.97	44.29	+++
conformation score	69	1.71	0.64	52	2.30	0.50	+++
fatness score	69	2.07	0.95	52	1.46	0.64	+++
marbling score	69	7.63	1.52	52	8.57	0.72	+++

+ P < 0,05, +++ P < 0,001

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

The lowest significance ($P<0.05$) was found in the parameter live weight before slaughter. It can be caused by the calculation of carcass weight as there are used different calculation coefficients in both categories. Lower carcass weight was found in cows compared with bulls. Difference between categories was highly significant ($P<0.001$) with this parameter. Carcass weight influenced the incorporation of carcasses into classes of conformation. The average value of conformation in cows was 1.71, which corresponds with classes P and O. In bulls was the average value 2.30, which corresponds with classes O and R.

In classes of fatness we noticed more surface fat in cows than in bulls. In both parameters were highly significant differences between the categories (P<0.001). Similar results noticed **Zaujec and Mojto (2007)** and **Zaujec et al. (2006**) in bulls**. Gondeková et al. (2008)** found out similar results in cows. In general high level of surface fat correspond to high content of intramuscular fat.

This fact was affirmed in our research work. Almost degree 8 of marbling was detected in cows, which is slight marbling, in bulls it was almost degree 9, which are only traces of marbling in meat. Similar results reported **Gondeková et al. (2008)** and also **Patten et al. (2008)** in slaughter cows. On the contrary **Zaujec et al. (2006)** found out marbling degree 8 in bulls. **Prado et al. (2008)** noticed marbling degree 6 in crosses Aberdeen Angus. It appears from the obtained results that animals with markedly lower content of intramuscular fat are killed in the Slovakia than e.g. in the USA. It can be related to the fact that inhabitants in Slovakia prefer meat with lower content of intramuscular fat.

Variable results were noticed in chemical parameters of meat (Tab. 2).

Table 2 Qualitative parameters of meat

Parameter	cows			bulls			t-test
	n	$\bar{x}$	s	n	$\bar{x}$	s	
total water (g.100g^{-1})	69	74.95	2.36	52	76.36	0.98	+++
proteins (g.100g^{-1})	69	20.52	0.65	52	20.85	0.48	
intramuscular fat (g.100g^{-1})	69	3.52	2.52	52	1.78	0.80	+++
pH_{48}	69	5.92	0.41	52	6.11	0.46	
meat colour lightness L	69	29.70	2.82	52	30.63	3.32	
redness a	69	10.62	2.47	52	9.42	2.41	
yellowness b	69	7.03	1.29	52	6.86	1.67	
water holding capacitance (g.100g^{-1})	69	25.95	5.52	52	26.74	3.72	
shear force (kg)	69	11.19	4.30	52	9.91	3.46	

+++P < 0.001

In the parameter total water were found statistically significant results between the categories (P<0.001). Lower values were found out in cows than in bulls. It stands to reason as the older animals have lower capability to bind water than the young animals. We did not found out statistically significant differences between categories in content of total proteins. The value of protein was almost the same in both categories (20.52 g.100 g^{-1} or 20.85 g.100 g^{-1}). **Faucitano et al. (2008)** found higher content of proteins (over 22 g.100 g^{-1}). Similarly

Mojto et al. (2004) noticed higher content of proteins than were measured by us. Highly significant differences ($P<0.001$) were found in content of intramuscular fat. Higher content of intramuscular fat was noticed in cows (over 3.5 g.100 g^{-1}) compared with bulls (over 1.5 g.100 g^{-1}). In this case was affirmed the fact that fatness, marbling and intramuscular fat influence each other. **Mojto et al. (2004)** found higher values of intramuscular fat in bulls. The value of pH_{48} was in both categories almost the same. Increased pH_{48} value was noticed in bulls (over 6) compared with cows. There occurred no deviations in meat quality in form of DFD in spite of quite high pH values in both categories**. Kim et al. (1998)** reported lower pH values in the Hanwoo breed when comparing bulls and cows. Similarly **Mojto et al. (2004**) noticed lower pH values in bulls. The parameter colour of meat is closely connected to pH value. Our experiment did not affirm the fact that meats with higher pH value are of darker colour. We found out that lower value of colour (L value) and therefore meat of darker colour was in cows. Meat of cows showed also higher saturation of colour (a value) than meat of bulls. **Galli et al. (2008), Kim et al. (1998), Kim et al. (2003)** detected some what higher values in meat colour (L value) and saturation of colour in cows. **French et al. (2001), Orellana et al. (2009)** noticed higher values in colour and saturation in meat of bulls. Generally the opinion prevails that the higher pH value and darker meat the lower value water holding capacity should occur. Our study did not affirm lower value of water holding capacity in the category of bulls. The bulls meat was higher in value of water holding capacity (26.74 g.100 g^{-1}) and higher pH value (6.11) compared with cows (25.95 g.100 g^{-1} or 5.92). Difference in average values between both categories was statistically non-significant. Shear force in grilled meat was higher in cows (over 10 kg) than in bulls (nearly 10 kg). In this parameter were not affirmed the conclusions of **Yamazaki et al. (1989)** that the intramuscular fat influences shear force in meat. Higher shear force in grilled meat of cows can be caused by less tender muscle fibres as well as by higher content of insoluble elastin. **Gondeková et al. (2008)** detected similar results in slaughter cows. On the contrary **Crouse et al. (1989), Ramsey et al. (1963**) found much lower values of shear force in bulls (5.88 kg or 6.35 kg).

In the category of bulls more favourable results were unambiguously detected in sensorial parameters (table 3) though the results were statistically non-significant almost in all parameters.

Table 3 Sensory evaluation of meat quality

Traits	cows			bulls			t-test
	n	$\bar{x}$	s	n	$\bar{x}$	s	
flavour	69	3.53	0.49	52	3.80	0.62	+
taste	69	3.37	0.61	52	3.71	0.61	
tenderness	69	3.25	0.83	52	3.58	0.82	
juiciness	69	3.27	0.69	52	3.57	0.74	

+ $P < 0.05$

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

French et al. (2001) noticed similar results in bulls also. On the contrary **Cerdeño et al. (2006), Faucitano et al. (2008)** recorded better results in panel evaluation than those noticed in our experiment with bulls. Similarly **Kim and Lee (2003)** noticed better sensorial evaluation with cows. Significance ($P<0.05$) was manifested in the parameter flavour in favour of the category of bulls. We can agree with the authors **Koch et al. (1982), McKeith et al. (1985), Galli et al. (2008)** that flavour is the dominant parameter of sensorial evaluation as we noticed the highest number of points (3.53 or 3.80) in both categories.

CONCLUSION

Comparison of meat in categories of bulls and cows showed that the meat quality in cows is approximately the same as in bulls. In some parameters cows had even better results than bulls (water holding capacity, pH value). Similar results were obtained in panel evaluation; better results were noticed in bulls. Worse results in the category of cows can be caused by higher age at slaughter.

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