ORIGINAL ARTICLE

Organoleptic parameters of meat from cows of two age categories depending on marbling

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Abstract

The aim of the experiment was to compare the sensory characteristics of meat from cows of two age categories and depending on to the degree of marbling. Slaughter cows were divided into two age categories: up to 4 years of age and over 4 years of age. Meat samples from m. longissimus dorsi for tasting were taken from the right carcass halves between rib 9 to 11. The marbling degree was evaluated according to a 10 point scale (1 – very strong marbling, 10 – virtually no marbling or only traces). A sensory evaluation of the meat was carried out on day 7 after the slaughter of the animals. Meat samples were stored for 7 days and then they were grilled to evaluate their flavour, taste, tenderness and juiciness (degree 1 – without flavour, taste, tenderness, juiciness, degree 5 – very high flavour, tenderness, taste, and juiciness). We also set a score for the *shear force* of the grilled meat in our device Texture Analyser. There are no significant differences in sensory evaluation between the categories in relation to meat marbling, which would indicate better or worse sensory evaluation of meat. With the characteristic *shear force* of the grilled meat there were more favourable results at all levels of marbling in category up to 4 years of age.

Key words: sensory evaluation; cos; marbling; meat

INTRODUCTION

In Slovakia more and more cow's meat is distributed for sale to the trade network. Such

meat is cheaper and can be compared with bull's meat as far as quality is concerned. Its quality influences the choice of consumers. However, such meat is subject to criticism – it is said that it is not of good quality, coming from old animals, being too fatty, and not suitable for sale in shops. According to Jedlicka (1988) only cow's meat from animals of less than 3 years of age should be distributed to the trade network for sale. In some countries the distribution of cow's meat for sale in the trade network is prohibited. According

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to Minchin et al. (2009) age can influence the good quality of meat at selection, mainly when comparing young and old animals.

The amount of intramuscular fat, so called marbling, is the decisive standard of beef selection. According to Zaujec et al. (2006) and Yamazaki et al. (1989) the marbling degree can influence some qualitative parameters of meat. Johnson et al. (1989) on the other hand have stated that marbling of meat has no influence on meat quality.

Recently a sensorial evaluation of meat quality, is carried out mainly after heat treatment. The sensorial evaluation of beef is important if heat treated meat is consumed. For the consumer smell is dominant out of the sensorial parameters (Rhodes et al. 1955, Van Syckle and Brough 1958, Rameny 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) have noticed differences in meat quality between males and females, mainly in the preparation of meat.

The objective of this work was to compare sensorial properties in two categories of cows depending on the marbling of the meat and to test the hypothesis that animals of a higher age have worse, better or equal sensorial evaluation of meat compared with animals of a lower age.

MATERIAL AND METHODS

Animals

Slaughter aged cows of different breeds were used in the experiment. The animals were divided into two groups.

Group I – slaughter cows up to 4 years of age (n=53)

Group II – slaughter cows over 4 years old (n=103)

Breeds composition was as follows:

Black and White Holstein:	44 heads
Red and White Holstein:	20 heads
Simmental:	35 heads
Crossbreds of Black and White	
Holstein (HxS):	30 heads
Simmental crossbreds (SxR, SxH):	27 heads

The animals came from different agricultural farms; they were killed at different slaughter houses in Slovakia. The animals were classified by the SEUROP system after they were killed

(Regulation of the MA SK No 206/2007). We replaced conformation classes by numbers: P-1, O-2, R-3, U-4, E-5, to calculate the average class of conformation. Weight of carcass and age at killing were recorded in these animals also. Basic characteristics of the set is in Table 1.

Sensory evaluation

Sensorial evaluation of meat was determined on day 7 after killing. Meat samples 2.5 cm thick were grilled at a temperature of 200 °C for 4 minutes in a contact grill and their sensorial parameters were subsequently evaluated. We evaluated smell, taste, tenderness and juiciness. We used a 5 point scale to evaluate the sensorial parameters (1 – without flavour, taste, tenderness and juiciness; 5 – very high flavour, taste, tenderness and juiciness). Besides these parameters we determined also the *shear force* of the grilled meat in the apparatus Texture Analyser (TA – XT2).

Statistics

With all results were calculated: mean ($\bar{x}$) and standard mean error ($s\bar{x}$). Differences in means among categories with individual parameters were tested by the 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 $P<0.05$; $P=0.01$ and $P=0.001$.

RESULTS AND DISCUSSION

Table 1 shows the basic composition of the set. It demonstrates that the largest differences between groups ($P=0.001$) were with the parameter age in days at all marbling degrees. The greatest difference between groups was noticed at the marbling degree 6 (1520.7 days), followed by the marbling degree 8 (1443.5 days), degree 9 (1330.0 days) and degree 7 (1309.9 days) with the lowest differences in age. We found statistically significant differences between groups at marbling degree 6 and 9 with the parameter carcass weight in kg. It is necessary to notice with this parameter that the carcass weight grew linearly in both groups from marbling degree 9 to marbling degree 6. We found higher values in group II – cows older than 4 years – at all marbling degrees of meat.

Table 1. Basic composition of the set of two age groups of cows in dependence on marbling

Marbling degree	6						7					
Group	I. (n=8)			II. (n=13)			I. (n=10)			II. (n=18)		
Parameters	$\bar{x}$	$s\bar{x}$		$\bar{x}$	$s\bar{x}$	significance	$\bar{x}$	$s\bar{x}$		$\bar{x}$	$s\bar{x}$	significance
Age in days	1124.60	149.30		2645.30	231.49	+++	1183.80	75.29		2493.70	186.50	+++
Weight of carcass in kg	256.18	17.88		331.92	12.43	++	247.74	16.90		269.87	15.79	–
Conformation score	1.37	0.18		2.08	0.14	++	1.40	0.22		1.77	0.19	–
Fatness score	2.25	0.36		2.66	0.33	–	2.20	0.20		2.38	0.21	–
Marbling degree	8						9					
Group	I. (n=10)			II. (n=27)			I. (n=25)			II. (n=45)		
Parameters	$\bar{x}$	$s\bar{x}$		$\bar{x}$	$s\bar{x}$	significance	$\bar{x}$	$s\bar{x}$		$\bar{x}$	$s\bar{x}$	significance
Age in days	1064.70	92.12		2508.20	151.97	+++	1141.20	65.49		2471.20	96.28	+++
Weight of carcass in kg	222.76	17.00		244.56	8.87	–	207.14	9.60		236.12	7.79	+
Conformation score	1.30	0.15		1.29	0.08	–	1.12	0.08		1.24	0.06	–
Fatness score	1.70	0.11		1.90	0.17	–	1.28	0.10		1.35	0.08	–

– $P \geq 0.05$; + $P \leq 0.05$; +++ $P \leq 0.001$

Conformation score: 1 – P (very poor conformation); 5 – E (very good conformation)

Fatness score: 1 – very lean; 5 – very fat

Marbling degrees: 1 – very abundant; 10 – traces or practically devoid

Table 2. Sensory evaluation and technological parameters of meat cows two age groups according to the degree of marbling meat

6		7						
Marbling degree								
Group	I. (n=8)	II. (n=13)			I. (n=10)		II. (n=18)	
Parameters	$\bar{x}$	$s\bar{x}$	$\bar{x}$	$s\bar{x}$	significance	$\bar{x}$	$s\bar{x}$	significance
Flavour	3.65	0.11	3.51	0.14	–	3.77	0.23	0.11
Taste	3.50	0.19	3.47	0.13	–	3.79	0.20	0.15
Tenderness	3.37	0.23	3.36	0.16	–	3.26	0.25	0.13
Juiciness	3.62	0.17	3.55	0.20	–	3.54	0.18	0.15
Shear force value (kg)	8.85	0.60	10.21	1.09	++	10.32	1.21	0.65
Marbling degree		9						
Group	I. (n=10)	II. (n=27)			I. (n=25)		II. (n=45)	
Parameters	$\bar{x}$	$s\bar{x}$	$\bar{x}$	$s\bar{x}$	significance	$\bar{x}$	$s\bar{x}$	significance
Flavour	3.62	0.16	3.79	0.10	–	3.46	0.11	0.09
Taste	3.52	0.12	3.72	0.11	–	3.30	0.14	0.11
Tenderness	3.17	0.31	3.32	0.17	–	3.02	0.19	0.12
Juiciness	3.41	0.16	3.50	0.13	–	3.19	0.14	0.10
Shear force value (kg)	8.45	1.03	11.36	0.86	++	9.80	0.79	0.67

– $P \geq 0.05$; + $P \leq 0.05$; ++ $P \leq 0.01$

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

Mojto et al. (2009) also noticed higher weight in the group of cows older than 4 years. Zaujec et al. (2006) noticed a linear rise of carcass weight from marbling degree 9 to marbling degree 4 as well. With the parameter conformation it is obvious that all carcasses were classified as O and P and according to the results the conformation class had no influence on incorporation of meat within marbling degrees. With the parameter *fatness* a decreasing degree of marbling was found with a lower content of surface fat. We detected higher content of surface fat in group II at all marbling degrees. With this parameter was found also a linear increase in the content of surface fat from marbling degree 9 to marbling degree 6. Zaujec et al. (2010) obtained similar results with cows at marbling degree 7.

With sensorial parameters of meat from cows of two groups it is obvious (Table 2) that between these groups there are no significant differences in individual marbling degrees that would indicate a better or worse sensorial evaluation of meat. More detailed observation shows that at marbling degrees 6 and 7 there were more favourable results in group I; mainly in cows younger than 4 years. At marbling degrees 8 and 9 there were better results in group II, namely in cows older than 4 years. It indicates that the panels gave higher points to meat from cows older than 4 years at marbling degree 8 and 9 (with very little or only traces of intramuscular fat), and at marbling degrees 6 and 7 they gave lower points to the same meat at degustation. This is a paradox, as we assumed that meat with a higher content of intramuscular fat, mainly in cows older than 4 years, would obtain a better evaluation at higher marbling degrees of meat. This hypothesis was not confirmed in our case. Individual sensorial evaluation at marbling degrees 8 and 9 are worth mentioning. In both categories of cows the evaluated flavour was the highest, followed by taste, juiciness and tenderness at these marbling degrees. Zaujec et al. (2009) Hocquette et al. (2012) and Maughan et al. (2012) detected similar results. This fact was confirmed also at marbling degree 6 in group I, and at marbling degree 7 in group II. At marbling degree 6 in group II the panels evaluated juiciness as the best parameter followed by flavour, taste and tenderness. At marbling degree 7 in group I the taste was evaluated as the best one followed by flavour, juiciness and tenderness. The panels gave the most points and evaluated as the best parameter the flavour at all marbling degrees, with the exception of group II at marbling degree

6, and group I at marbling degree 7. The worst parameter with the lowest number of points was tenderness at all marbling degrees in both groups of cows. The panels evaluated the meat of cows as more than good at all marbling degrees and in both groups – they gave more than 3 points to the individual parameters.

As far as the *shear force* is concerned we can state that we found differences between groups at all marbling degrees. These differences were significant between groups at marbling degrees 6 and 8, where they were the highest ($P=0.01$), followed by marbling degree 9 ($P=0.05$) and marbling degree 7, where we found no significant differences between the groups. More favourable results, i.e. lower *shear force*, were in group I at all marbling degrees. Similar results were reported by Gondeková et al. (2008) with slaughter cows.

In conclusion we can state that the hypothesis about more favourable results in meat with a higher content of intramuscular fat in cows older than 4 years was not confirmed. More favourable results in cows older than 4 years were detected with a low or slight marbling degree in the meat. It appears that the content of intramuscular fat has no influence on sensorial evaluation of meat.

This was the first study of sensorial meat evaluation, which considers possible improvement of sensorial evaluation in meat quality in dependence on the degree of marbling.

In the future we will study further physical and technological parameters, which could influence sensorial evaluation in beef to make its consumption more pleasant for the consumers.

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