ANALYSIS OF MARBLING IN MEAT OF SLAUGHTER BULLS FOR THE PURPOSE OF CLASSIFICATION AND REALIZATION

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Background

Today the marbling in meat appears to be in many states an important criterion in evaluation of quality in meat as raw material.

Though the results of many studies of the effect of marbling on meat utility value differ, its positive effect is generally accepted. Numerous American studies conclude that 3 % intramuscular fat in a sample from central part of m.long.dorsi are sufficient for good sensorial quality of beef (Dikeman, 1987). Kempster (1987) says that the optimum content are 3 - 7 %, and another Danish study (Libouriussen, 1977) states that in young bulls can be accepted good consume quality of meat with 1.6 % intramuscular fat already.

In some states (USA, Canada, Japan), in which the consumer asks beef of very high quality, with adequate marbling and high utility value, is the estimation of marbling degree in meat a part of the classification process with the carcass at purchase, and it is reflected in the final quality class, and in the purchasing price as well.

Objective

The objective of this experiment was to analyse and estimate the degree of marbling in meat, and the content of intramuscular fat in slaughter bulls of the most spread breeds reared in the Slovak Republic, with the prospect to use this qualitative criterion in the classification of carcass at purchase and realization.

Methods

We used for our observations adult slaughter bulls of the Slovak Pied breed(S), represented by 109 animals (weight before slaughter 520.24 kg), Holstein breed (H) with 91 animals (485.40 kg), and Slovak Pinzgau breed (P) with 32 animals (479.06 kg).From each right carcass side a sample of m.long.thoracis et lumborum was taken between 9th and 12th rib 24 hours after slaughter at the experimental slaughter house of RIAP Nitra. The degree of marbling in meat and content of intramuscular fat was estimated in a meat sample from the region of 10th to 11th rib. We used a 10 points scale to evaluate the degree of marbling. Degree 1 represents very intensive marbling and degree 10 no marbling. The content of intramuscular fat was determined by the apparatus Infratec 1265 (near infrared analysis).The basic mathematical and statistic parameters were calculated by the programme STATGRAFIC.

Results and discussion

The results according to individual breeds are given in table 1.

The less marbled meat was in carcasses of S breed, up to 42.21 % carcasses were classified as marbling degree 9, only with traits of visible intramuscular fat. There were 31.24 % in P, and only 23.08 % in H breed. We noticed an explicit trend to include the carcasses into classes with more intensive marbling (degrees 6 - 3) in P and H breeds. Mainly in H breed this can be connected with higher content of total fat in the carcass, although the relation between the degree of marbling in beef and total content of fat in the carcass was not unambiguously confirmed by the researchers.

The given results are the first larger analysis in the conditions of Slovakia. Similar analyses are already common in countries in which is the marbled beef known to a broad range of consumers and brings profit also to producers of beef. Wheeler et al. (1994) found out in various breeds that with more intensive degree of marbling in meat decreased proportionally the shear force in cooked meat, the differences between the averages of extreme degrees of marbling being 2 - 3 kg shear force. It was interesting in the experiment of Stephens et al. (1999) that out of the whole scale of studied breeds the consumers estimated most the meat from steers of Jersey breed, with the average content of intramuscular fat 6.8 %, although it is known that this breed is of weak carcass conformation and it has less muscular substance. Cameron et al. (1994) evaluated the marbling in meat of steers of the Japanese black cattle using a 12 degree scale which is used in Japan to classify the slaughter cattle at purchase and realization. Up to 78 % animals were classified with degree 1 – 4 which represent slight to moderate marbling, and 22 % with degree 5 - 12 which represent medium to intensive marbling. The Danish are convinced that the extremely marbled beef which is popular in Japan has a future in European restaurants also. The measurements of shear force showed that the extremely marbled meat of steers was of excelent consume quality. The pure Jersey breed had more intensive marbling and better consume quality than the crosses with Angus breed (Bang et al., 1998). In order to evaluate how much percent of our bulls meet the standard of marbling expressed in content of intramuscular fat recommended in Europe we divided the whole studied set according to this criterion as well as according to breeds into the chosen classes (table 2). As far as the whole set is concerned 45.98 % animals settled the span 2.0 - 5.0 %. The least favourable results were found in S breed, in which only 33.84 animals fell to the mentioned span. With P breed fell 62.56 % and with H breed 59. 34 % animals to this span, more than in the most spread breed (S) in Slovakia.

Conclusions

The expected differences between breeds were confirmed. The least marbling was found in meat from animals of the Slovak Pied breed. Explicit trend to classify the carcasses with more intensive marbling was found in the Slovak Pinzgau and Holstein breeds (degrees 6 - 3).

The changes of intramuscular fat with respect to the degrees of marbling in beef were linear, this confirms the suitability of the used scale, its good ability to show the real state, and its sensitiveness. As far as the whole set is concerned, 45.98 % animals met the recommended span 2.0 - 5.0 g.100 g^{-1} of intramuscular fat. The least favourable results were found in the Slovak Pied breed, in which only 33.84 % animals fell to the mentioned span.
This first broader research in the area of Slovakia showed that the degree of marbling in meat of bulls of the native population meets the needs of consumers only partly.

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Tab.1 Representation of carcasses and content of intramuscular fat in individual degrees of marbling

Degree of marbling	S				P				H			
			intramusc.fat g.100g^{-1}				intramusc.fat g.100g^{-1}				intramusc.fat g.100g^{-1}	
	n	%	$\bar{x}$	$s_{\bar{x}}$	n	%	$\bar{x}$	$s_{\bar{x}}$	n	%	$\bar{x}$	$s_{\bar{x}}$
10-Practically devoid	-	-	-	-	-	-	-	-	-	-	-	-
9-Traces	46	42,21	1,42	0,04	10	31,24	1,55	0,09	21	22,08	1,48	0,07
8-Slight	35	32,11	1,88	0,05	11	34,38	2,25	0,12	30	32,97	1,97	0,07
7-Small	19	17,43	2,30	0,12	5	15,63	2,78	0,12	21	23,08	2,52	0,07
6-Modest	5	4,59	3,18	0,13	2	6,25	3,41	0,06	10	10,99	3,21	0,15
5-Moderate	2	1,83	3,20	0,93	2	6,25	4,38	0,19	6	6,59	3,82	0,73
4-Slightly abudant	2	1,83	4,32	0,34	2	6,25	4,72	0,40	2	2,19	3,88	0,28
3-Moderately abudant	-	-	-	-	-	-	-	-	1	1,10	5,52	-
2-Abudant	-	-	-	-	-	-	-	-	-	-		-
1-Very abudant	-	-	-	-	-	-	-	-	-	-		-

S – Slovak Pied; P – Slovak Pinzgau; H - Holstein

Tab.2 Percentual representation of bull carcasses of the studied breeds considering various limits of intramuscular fat content

Intramusc.fat g.100 g^{-1}	Total		S		P		H	
	n	%	n	%	n	%	n	%
0 - 0,99	23	7,39	12	11,01	1	3,12	3	3,30
1 - 1,99	143	45,98	60	55,05	10	31,25	33	36,26
2 - 2,99	102	32,79	27	24,77	12	37,50	37	40,66
3 - 3,99	31	9,97	8	7,34	5	15,63	13	14,29
4 - 4,99	10	3,22	2	1,83	3	9,38	4	4,39
5 →	2	0,65	-	-	1	3,12	1	1,10
Total	311	100,00	109	100,00	32	100,00	91	100,00