ACTA UNIVERSITATIS AGRICULTURAE ET SILVICULTURAE MENDELIANAE BRUNENSIS
SBORNÍK MENDELOVY ZEMĚDĚLSKÉ A LESNICKÉ UNIVERZITY V BRNĚ

Volume LVI 30 Number 2, 2008

THE QUALITY OF *MUSCULUS LONGISSIMUS PARS THORACIS* IN HEAVIER CATEGORY OF CZECH FLECKVIEH AND MONTBELIARD BULLS

J. Šubrt, G. Chládek, R. Filipčík

Received: November 15, 2007

Abstract

ŠUBRT, J., CHLÁDEK, G., FILIPČÍK, R.: *The quality of Musculus longissimus pars thoracis in heavier category of Czech Fleckvieh and Montbeliard bulls*. Acta univ. agric. et silvic. Mendel. Brun., 2008, LVI, No. 2, pp. 235–244

Non-significant differences were established when the nutritional and technological beef quality of Czech Fleckvieh and Montbeliard and their reaction to the end of feeding at the different age and different carcass growth intensity were studied.
Bulls were fattened until average weight of 656 kg. Montbeliard beef quality evaluation shown non-significant difference of higher intramuscular fat proportions and energy value compared to Czech Fleckvieh. Technological quality evaluation only indicated the tendency to lighter meat, lower water retention and lower level of hydroxyproline. Slaughter age rising in both breeds (the boundary vas 570 days) resulted in non-significant increasing of intramuscular fat together with significant ($P < 0.05$) increasing of muscle pigmentation content and non-significant shortening and water retention reduction.
Longer fattened bulls at both breeds shown non-significant *m.l.th.* area reduction at higher difference at Montbeliard. Net gain level as a carcass growth intensity, showed non-significant intramuscular fat production. Higher level of net daily gain produces, particularly at Montbeliards, lead to increasing of hydroxyproline. Higher growth intensity of Czech Fleckvieh influenced pigmentation content increase. Higher growth intensity in both breeds leads to enlarging the *m.l.th.*

beef quality, nutrition value beef, technological value beef, Montbeliard breed, Czech Fleckvieh breed

The importance of Montbeliard in the Czech Republic production field is partly as a pure breed and partly as a developer of Czech Fleckvieh production abilities by the cross-breeding between fylogenetically equal breeds.

At first the imported insemination doses were used for the need of imported pure herd and later to cross-breed with Czech Fleckvieh. Due to a little experience of Czech breeders with Montbeliard was very important to indicate the aim related to its import. Considering the production and improvement in its homeland is possible to assume, that progeny will tend to dairy aptitude which means will impair beef aptitude. This hypothesis does not correspond with the breed target of our combine aptitude home breed. Therefore the hypothesis was verified by comparison testing of young Montbeliard bulls at the progeny testing program. According to our tests can be said that pure breeds as well as bulls with Montbeliard proportion show excellent growth intensity compare to Czech Fleckvieh (HORA, 1997).

There are not much information about detailed beef production and beef quality of Montbeliard in the literature. In Italy PIASENTIER et al. (2002, 2003) evaluated level of beef production at Simmental bull fattening according to proportion of Montbeliard breed. After slaughtering at the same weight the authors found out that together with increasing Montbeliard proportion, its linear meatiness decrease and rise the carcass length while the fat covering showed stabilization. The colour of meat (L*, b* parameters) was slightly influenced by bull breed, showing gradual trend to darker red and yellow spectre with the increasing of Montbeliarde. Intramuscular fat

content was 0.5% lower in Simmental. Collagen content increased together with Montbeliard breed as well as insoluble collagen. The authors determined as a characteristic that influence highly the quality of the meat is the insoluble collagen content. This consistency is objectively established with a special machine, and increase along with the increase in Montbeliard proportion.

Bavarian Simmental vs. Montbeliard was less pushed to dairy production compare to animal breeding pressure to conformation (BONSEMBIANTE et al., 1988; GIGLI and ROMITI, 1989 and WYSS, 1988). Beside dairy production Montbeliard undoubtedly modify some of the beef production characteristics and its quality. The difference between combine aptitude breeds in the same breeding conditions are frequently manifested by higher growth intensity in fattened Montbeliard bulls, carcass gain and carcass meat proportion (GOLDA et al. 1988; GOLDA et al. 1989; HAUREZ et al., 1990; BESOZZI, 1996, MIKŠÍK et al., 1996 and VERBIC et al.,1988).

Montbeliard usage in breeding with phylogenetically related breeds has a moderate influence at same quality parameters such as carcass and meat quality (ŠUBRT et al., 1997; ŠUBRT and MIKŠÍK, 2002; CHLÁDEK and ŽIŽLAVSKÝ, 2004; CASSAR – MALEK et al., 2004; CHLÁDEK et al., 2005). The Montbeliard impact in quality characteristic, manifested in cross-breeding with combine aptitudes, should be considered in breeding programs for double – aptitude cattle.

MATERIAL AND METHODS

Bulls of Czech Fleckvieh and Montbeliard breed /46; 23 + 23/ were used in the experiment, monitoring beef nutritional and technological changes. The fattening was done in the same breeding conditions described in the work (CHLÁDEK et al., 2005). Technological dissection of the carcasses' dorsal sides after the end of the fattening stage was preformed, so the sirloin (*musculus longissimus dorsi)* meat samples were taken at the 9th–11th pectoral vertebra back quarter).

Chemical and physical meat analyses were done according to standard methods. The area of *m.l.th.* was established planimetrically at the cut between 10th and 11th pectoral vertebras. The average muscle fibre strength was set by a lanameter without differencing muscle fibre types and after their maceration in HNO_3. Great numbers of measurements (n = 150) minimize the variable from proportions of a particular muscle fibre type as well as rising the accuracy of the average fibre diameter value was done in one sample.

The completed database was put through a statistical procedure GLM in program package SAS 8.1, aimed to determine difference and expansion of the fixed effect influence (breed, slaughter age and net daily gain) on total variable of monitored quality beef characteristics. The method of polyfactorial variance analyses was used:

$$Y_{ijkl} = \mu + B_i + A_j + N_k + e_{ijkl},$$

where: Y_{ijkl} = resultant value
μ = average value
B_i = breed (l – Czech Pied, 2 – Montbeliard)
A_j = slaughter age (1 – < 570 days, 2 – > 571 days)
N_k = net daily gain (1 – <636 g, 2 – > 637g)
e_{ijkl} = residuum.

RESULTS AND DISCUSSION

The bulls were fatten up till slaughter age 656 kg with non-important differences between the group (+ 27 kg). This was due to diverse growth intensity of the groups which lead to unequal slaughter age (table I). The average slaughter age was 599 days with 10.12% variability (s = 60.5 days) and with significant difference between the breeds ($P < 0.01$). The carcasses slaughter weight difference increased to 21 kg recounted to the same beef production (55.56%), which lead to lowering of the characteristic variety in all set of animals. The carcass weight was an average of 378 ± 30.98 kg without statistically important difference. Almost similar are the results of meat production (+0.14%),while net daily gain evaluation, cumulate gross gain and beef yield shown highly important differences between breed groups, in Montbeliard benefit.

The main aim of the work was to contribute to expand information about possible differences in the beef quality characteristics of (*m.l.th.)* Czech Fleckvieh and Montbeliard, at high slaughter weight. Dry matter content at *m.l.th.* taken from the sirloin at the level 9th–11th vertebra was substantially similar in both breeds. It reached 25.1 ± 0.2 (table II). Distinct results (+1.7% of dry matter) are specified in a work published by WARZECHA et al. (1995) during the fattening of Montbeliard cattle with high growth intensity (net daily gain 1400 g). Total protein and intramuscular fat content evaluation did not prove any significant differences. Only the tendency to higher intramuscular fat production in Montbeliard (+0.12) is indicated at the table II. The said tendency to higher intramuscular fat content was the centre of attention of the results of WARZECHA et al. (1995). Comparing with Czech Fleckvieh Montbeliard shown 1.35% higher intramuscular fat content (4.35, resp. 3%) during high growth intensity. In the other hand CAASAR-MALEK et al. (2004) did not virtually find any differences at lipids content and proteosomal muscle activity in Montbeliard oxen, fattened till the age of 21 months. However particular muscles react differently to the nutritional level. The protein analyses in muscle were in our experiment very similar in both breeds which correspond to ours and previous authors (21.22, resp. 21.87%).

Technological parameters only indicate to lower content of connective proteins at Montbeliard, ex-

pressed by hydroxyproline content and smaller average diameter of muscle fibres which means finer muscle. Contradictious conclusions present amounts of total and non-soluble collagen PIASENTIER et al. (2003). The authors published, compare to Italien Pied bulls, a difference of total collagen content in Montbeliard 0.41g/100 g of meat higher, that is higher number than our experiment results. Bulls were fed to slightly higher weight (676 kg) than at our experiment, but they reached significantly higher growth intensity. According to CASSAR-MALEK et al. (2004) the nutritional intensity has lower influence on the muscle fibre size and in compliance with SCORJANCE et al. (1992) is in Simmental and Montbeliard bulls, significant effect between the muscle fibres numbers depends on the specific muscle. We specified only non-important difference at *musculus longissimus pars thoracis* evaluation area for the Montbeliard benefit (93.12 cm^2, resp. 93.48 cm^2). The colour assessment by the pigment content showed no prestigiously darker meat in Czech Fleckvieh, which was certified by colour meat assessment by spectrophotometer with waves of 522 nm, which is different from the results by PIASENTIER et al. (2003). Montbeliard compared to Czech Fleckvieh indicated non-significantly lower water absorption capacity (±1.2%), it could be an influence of the slaughter age.

The influence of age at slaughtering and the net daily gain on the nutritional and technological meat characteristics was studied too. The slaughter age, as a factor influencing meat quality, was 570 days, based on many references on slaughter maturity. Increasing the animal age above 571 days was accompanied by non-important changes of most of the parameters studied (table III). Non-significant increasing of dry matter content depends till certain degree on higher intramuscular fat content (0.788 resp. 0.893%) and marginal protein content increasing. Fattening to higher slaughter age arises intramuscular fat content, that outlines also PIASENTIER et al. (2003). This fact corresponds very closely with energy meat value changes. Higher slaughter age only outlines the tendency to total hydroxyproline decrease. The orientation said will be more influenced by grow intensity during fattening that is showed by CAASAR – MALEK et al. (2004).

The technological characteristic changes (table IV) show significant difference only in pigment content. The significant difference ($P < 0.05$) was established just among Czech Fleckvieh, age groups (+0.637 mg/g), while the same one was non –significant in Montbeliard (+ 0.288 mg/g). Meat colour changes in the studied bulls do not correspond with colour spectrum measurement that was published by PIASENTIER et al. (2003). Higher slaughter age resulted to non-significant water absorption capacity reduction (–3.007 and –0.991%) with more difference in Czech Fleckvieh. The average age group differences in the rest of the technological meat characteristics were not significant. Also SANUDO et al. (2004) did not recognize any significant weight or aptitude influence on total and soluble collagen content. DIKEMAN et al. (1986) presents in agreement to our results, that the collagen content is not greatly influenced by the animal slaughter age. The area of *m.l.th.* in breed and age group scope was 89.79–97.1 cm^2 and the muscle fibre thickness 36.3 to 39.1 μm, without uncompromising value trend.

Another part of the work was to set the growth grade influence, expressed by net daily gain, on beef nutritional and technological characteristics in the compared breeds with combined aptitude (table V and VI). The mean value of the net daily gain was fixed at 635 g/day. Increasing carcass growth intensity in Montbeliard lead to dry matter increasing of 0.5% together with intramuscular fat content rising from 1.9 to 2.4% (the difference of the average value is of an importance level ($P < 0.05$). Czech Fleckvieh shown lower non – important differences at dry matter and intramuscular fat content. Higher carcasses growth intensity in Montbeliard prove tendency to increasing hydroxyproline, while Czech Fleckvieh shown no influence on hydroxyproline content. Hydroxyproline content develops according to CAASAR-MALEK et al. (2004), who put as the most important the influence of collagen content, feeding level and growth intensity. Table VI outline, that higher net daily gain has an influence on changes of percentage values of free water retention. Pigment content is on the edge on significance among Czech Fleckvieh groups (0.373), where groups with higher grow intensity have lighter coloured beef. This corresponds with evaluated assessment. Different growth intensity positively manifested *m.l.th.* growing and muscle fibre diameters. Also the area of *musculus longissimus dorsi* increased, when Montbeliard shown double difference compare to Czech Fleckvieh (+7.69, reps. +14.18 cm^2).

Nutritional and technological results of beef value, fed at the middle level, show low influence on the breeds compared, slaughter age and net daily gain as possibilities of beef quality characteristics of combine aptitude cattle to be changed. Montbeliard compared to Czech Fleckvieh, incline to higher intramuscular fat content and changes mainly at m.l.th. area, connective proteins content and meat colour.

I: *Descriptions of beef bulls by breeds*

Characteristic/ breed	n	CS (a)	MO (b)	File total
		23	23	46
Slaughter age (days)	Mean	633[b]	564[a]	599
	s_x	68.10	18.755	60.539
	s	14.285	3.911	8.926
	$V_{\%}$	10.825	3.343	10.123
Slaughter weight (kg)	Mean	670	643	656
	s_x	41.272	64.418	55.229
	s	8.606	13.432	8.143
	$V_{\%}$	6.234	10.000	0.084
Converted weight (kg) /Carcass weight x 1.8/	Mean	691	672	681
	s_x	41.896	56.914	50.363
	s	8.736	11.867	7.426
	$V_{\%}$	6.125	8.546	7.447
Carcass weight (kg)	Mean	384	374	379
	s_x	31.646	30.182	31.028
	s	6.599	6.293	4.575
	$V_{\%}$	8.232	8.101	8.234
Dressing percentage (%)	Mean	55.54	55.69	55.62
	s_x	2.322	2.601	2.439
	s	0.484	0.542	0.360
	$V_{\%}$	4.231	4.725	4.446
Carcass daily gain (g)	Mean	610[b]	662[a]	636
	s_x	51.334	52.877	57.907
	s	10.704	11.026	8.538
	$V_{\%}$	8.412	8.000	9.112

a,b = $P < 0.05$; a,b = $P < 0.01$

II: *The influence of breed on nutritional and technological beef quality characteristics*

Characteristic	Breed	LS mean ± Se
Dry matter (%)	CS	25.125 ± 0.232
	MO	25.140 ± 0.226
Fat (%)	CS	2.099 ± 0.244
	MO	2.221 ± 0.238
Total protein (%)	CS	21.703 ± 0.117
	MO	21.752 ± 0.114
Ash (%)	CS	1.076 ± 0.009
	MO	1.051 ± 0.009
Hydroxyproline (mg/100 g)	CS	0.236 ± 0.018
	MO	0.201 ± 0.018
Energy value (MJ/kg)	CS	5.705 ± 0.141
	MO	5.789 ± 0.138

Characteristic	Breed	LS mean ± Se
Binding capacity (%)	CS	88.986 ± 1.544
	MO	86.965 ± 1.508
pH_{48}	CS	6.406 ± 0.115
	MO	6.314 ± 0.113
Muscle pigments (mg/g)	CS	3.039 ± 0.167
	MO	2.842 ± 0.164
Remission (%)	CS	4.244 ± 0.431
	MO	4.490 ± 0.421
Area of m.l.th. (cm^2)	CS	93.481 ± 4.743
	MO	93.205 ± 4.700
Average diameter of muscle fibres (μm)	CS	38.592 ± 1.279
	MO	37.715 ± 1.093

III: *The influence of age on nutritional beef quality characteristics*

Characteristic	Breed	Slaughter age	LS mean ± Se
Dry matter (%)	CS	< 570	24.583 ± 0.177
		>571	25.412 ± 0.251
	MO	< 570	24.950 ± 0.205
		>571	25.878 ± 0.427
Fat (%)	CS	< 570	1.578 ± 0.244
		>571	2.366 ± 0.237
	MO	< 570	2.046 ± 0.186
		>571	2.939 ± 0.472
Total protein (%)	CS	< 570	21.690 ± 0.187
		>571	21.733 ± 0.103
	MO	< 570	21.728 ± 0.125
		>571	21.771 ± 0.187
Ash (%)	CS	< 570	1.073 ± 0.018
		>571	1.069 ± 0.009
	MO	< 570	1.064 ± 0.009
		>571	1.043 ± 0.012
Hydroxyproline (mg/100 g)	CS	< 570	0.233 ± 0.039
		>571	0.228 ± 0.018
	MO	< 570	0.213 ± 0.019
		>571	0.199 ± 0.024
Energy value (MJ/kg)	CS	< 570	5.470 ± 0.153
		>571	5.885 ± 0.122
	MO	< 570	5.636 ± 0. 162
		>571	6.220 ± 0.225

IV: *The influence of age of bulls on technological beef quality characteristics*

Characteristic	Breed	Slaughter age (days)/*	LS mean ± Se/**
Binding capacity (%)	CS	< 570	91.005 ± 2.185
		>571	87.998 ± 1.422
	MO	< 570	87.027 ± 1.552
		>571	86.036 ± 2.354
pH_{48}	CS	< 570	6.640 ± 0.164
		>571	6.325 ± 0.103
	MO	< 570	6.270 ± 0.116
		>571	6.289 ± 0.178
Muscle pigments (mg/g)	CS	< 570	2.672 ± 0.226^{b}
		>571	3.309 ± 0.208^{ac}
	MO	< 570	2.704 ± 0.143^{b}
		>571	2.992 ± 0.060
Remission (%)	CS	< 570	4.975 ± 0.486
		>571	3.905 ± 0.393
	MO	< 570	4.686 ± 0.423
		>571	5.125 ± 0.714
Area of m.l.th. (cm^2)	CS	< 570	91.750 ± 10.250
		>571	90.211 ± 4.240
	MO	< 570	97.143 ± 5.925
		>571	89.735 ± 6.106
Average diameter of muscle fibres (µm)	CS	< 570	36.347 ± 2.824
		>571	39.068 ± 1.440
	MO	< 570	38.176 ± 1.206
		>571	36.909 ± 2.233

*/ CS : a = < 570; b = > 571; MO: c = < 570; d = > 571
**/ a,b,c,d = $P<0.05$

SUMMARY

The aim of the work has been to set the difference at beef quality parameters at the Czech Fleckvieh and the Montbeliard bulls fed to higher slaughter weigh.

The condition for the assessment of the beef quality differences at both breeds was to reach an average slaughter weight at 650 kg for all the bulls.

The Montbeliard are used at rotation crossbreeding of the combine Czech Fleckvieh population; therefore the intention of an experimental fattening was to find more significant beef quality differences between both breeds not just at the effect of slaughter weight but also at the effect of slaughter age and net yield.

Laboratory analysis of the nutritional value come from the standard methods to determine dry matter, total protein, fat and mineral content. Technological beef value consist of water retention (pressing method – Hamm), muscle pigment content (Hornsey) and meat remission (Specol 11), collagen content (recounted from hydroxyproline content) and energy value (calorimetric method). A planimetrically evaluation of *m.l.th.* at the tenth thoracic vertebra and an average muscle fibre thickness (microscopically) like two more morphological parameters were used as an addition to determine beef quality. Statistical analysis of the nutritional and technological parameters was done after slaughtering and laboratory analysis. The variance multiple analyses with fixed effect (SAS 8.0) was used to evaluate the results.

V: *The influence of net gain of bulls on nutritional and technological quality parameters*

Characteristic	Breed	Net gain (g)	LS mean ± Se
Dry matter (%)	CS	< 635	25.291 ± 0.268
		> 636	25.202 ± 0.391
	MO	< 635	24.898 ± 0.412
		> 636	25.433 ± 0.257
Fat (%)	CS	< 635	2.282 ± 0.270
		> 636	2.078 ± 0.249
	MO	< 635	1.918 ± 0.349
		> 636	2.540 ± 0.270
Total protein (%)	CS	< 635	21.736 ± 0.113
		> 636	21.693 ± 0.134
	MO	< 635	21.753 ± 0.117
		> 636	21.740 ± 0.136
Ash (%)	CS	< 635	1.061 ± 0.008
		> 636	1.095 ± 0.018
	MO	< 635	1.057 ± 0.022
		> 636	1.056 ± 0.006
Hydroxyproline (mg/100 g)	CS	< 635	0.228 ± 0.020
		> 636	0.230 ± 0.030
	MO	< 635	0.175 ± 0.022
		> 636	0.220 ± 0.018
Energy value (MJ/kg)	CS	< 635	5.777 ± 0.137
		> 636	5.912 ± 0.162
	MO	< 635	5.862 ± 0.270
		> 636	5.843 ± 0.173

Beef of the Montbeliard bulls compared to the Czech Fleckvieh demonstrated no significant rising of intramuscular fat content and energy meat value. The set technological quality parameters of the Montbeliard breed only inclined to lighter meat colour, lower water retention and lower fibrous – protein level. The increasing slaughter age (the limit was 570 days) lead to non-significant increase in intramuscular fat content together with significant (P < 0, 05) increase in muscle pigments and non-significant water retention reduction. The fattening extension showed non-significant reduction of the area of m.l.th. at both breeds, although the difference was higher at the Montbeliard breed. The level of the net yield as a growth intensity parameter indicated at the Montbeliard non-significantly higher intramuscular fat production. The Montbeliard showed rise in the hydroxyproline content together with the higher net yield. Higher growth intensity at the Czech Fleckvieh influenced negatively pigments content and both breeds increased growth intensity together with increasing area of m.l.th.

The research of the elementary nutritional and technological beef quality parameters of the Montbeliard and the Czech Fleckvieh breeds and their reaction to the different age and growth intensity of slaughter body pointed out mainly non-significant differences. The result of the statistical evaluation can be valued positively from the breeding point. It means that both evaluated combine breeds showed no important differences at the beef quality. The research results are clear to not connect the beef production degradation of the Czech Fleckvieh when the Montbeliard is used at the rotation crossbreeding.

VI: *The influence of net gain of bulls on technological beef quality parameters*

Characteristic	Breed	Net gain (g)/*	LS mean ± Se
Binding capacity (%)	CS	< 635	88.050 ± 1.496
		> 636	89.855 ± 2.274
	MO	< 635	87.188 ± 2.284
		> 636	86.471 ± 1.575
pH_{48}	CS	< 635	6.351 ± 0.114
		> 636	6.460 ± 0.156
	MO	< 635	6.290 ± 0.178
		> 636	6.272 ± 0.117
Muscle pigments (mg/g)	CS	< 635	3.296 ± 0.239
		> 636	2.923 ± 0.153
	MO	< 635	2.824 ± 0.283
		> 636	2.796 ± 0.090
Remission (%)	CS	< 635	3.965 ± 0.442
		> 636	4.450 ± 0.468
	MO	< 635	4.933 ± 0.856
		> 636	4.813 ± 0.409
Area of m.l.th. (cm^2)	CS	< 635	88.471 ± 4.821
		> 636	96.167 ± 5.269
	MO	< 635	84.000 ± 6.245
		> 636	98.188 ± 5.298
Average diameter of muscle fibres (µm)	CS	< 635	39.421 ± 1.603^{c}
		> 636	36.255 ± 1.686
	MO	< 635	32.733 ± 1.899^{ad}
		> 636	29.583 ± 1.999^{c}

*/ CS : a = < 635; b = > 636; MO: c = < 635; d = > 636

SOUHRN

Kvalita *musculus longissimus pars thoracis* v těžších kategoriích býků českého strakatého a montbeliárdského plemene

Cílem práce bylo stanovit diference v hodnocených parametrech kvality masa býků českého strakatého a montbeliárdského skotu při jejich výkrmu do vyšší porážkové hmotnosti. Předpokladem pro hodnocení diferencí v kvalitě hovězího masa obou plemen bylo dosažení průměrné hmotnosti celé skupiny jatečných býků na úrovni 650 kg. Vzhledem k tomu, že je plemeno montbeliárde v ČR využíváno i k zušlechťovacímu křížení domácí kombinované populace českého strakatého plemene, bylo podstatou pokusného výkrmu stanovit, zda jsou významnější diference v jakosti masa mezi oběma sledovanými plemeny nejen při hodnocení efektu porážkové hmotnosti, ale i věku v době porážky a netto přírůstku.

Laboratorní analýzy výživné hodnoty masa vycházejí z klasických metodik pro stanovení sušiny, celkového proteinu, tuku a popelovin. Při analýzách technologické hodnoty hovězího masa byla stanovena vaznost vody (lisovací metoda-Hamm), obsah svalových pigmentů /Hornsey/ a remise masa (Specol 11), obsah kolagenu (přepočet z obsahu hydroxyprolinu) a energetická hodnota masa (kalorimetrická metoda). Jako doplněk kvality masa jsou použity i další dva morfologické parametry, jako je planimetrické stanovení plochy *m.l.th.* na úrovni 10. hrudního obratle a průměrná síla svalových vláken (lanametr). Po porážce jatečných býků a laboratorních analýzách *m.l.th.* byla provedena matematicko-statistická analýza jakostních ukazatelů nutriční a technologické hodnoty masa. K vyhodnocení výsledků analýz byla využita vícenásobná analýza variance s pevnými efekty (SAS 8.0).

Při hodnocení nutriční jakosti masa montbeliárdských býků bylo v porovnání s českým strakatým skotem zjištěno nesignifikantní zvýšení tvorby vnitrosvalového tuku a energetické hodnoty masa.

Při hodnocení parametrů technologické kvality byla u montbeliárdského plemene pouze naznačena tendence ke světlejšímu masu, nižší vaznosti volné vody a ke snížené hladině obsahu nebílkovinného /vazivového/ proteinu. Zvýšení věku býků před porážkou (hraniční hodnota 570 dnů) mělo u obou sledovaných plemen za následek nevýznamné zvýšení vnitrosvalového tuku při významném ($P < 0,05$) zvýšení obsahu svalových pigmentů a nevýznamném snížení hodnot vaznosti volné vody. U déle vykrmovaných býků jsme u obou plemen stanovili nesignifikantní snížení plochy *m.l.th.,* při vyšším rozdílu u montbeliárdského plemene. Úroveň netto přírůstku jako ukazatele růstové intenzity jatečného těla se u montbeliárdských býků projevila nevýznamně zvýšenou tvorbou vnitrosvalového tuku. Při vyšší hladině netto přírůstku bylo při výkrmu montbeliárdských býků naznačeno zvýšení obsahu hydroxyprolinu v mase. U českého strakatého plemene byl vyšší intenzitou růstu více negativně ovlivněn obsah pigmentů a obě sledovaná plemena reagovala na vyšší růstovou intenzitu jatečného těla zvýšením plochy *m.l.th.*
Při studiu změn v základních ukazatelích nutriční a technologické kvality masa montbeliárdského a českého strakatého plemene a jejich reakce na ukončení výkrmu v rozdílném věku a při odlišné intenzitě růstu jatečného těla jsme v převážné míře stanovili nesignifikantní diference. Uváděný výsledek statistického šetření lze z hlediska šlechtitelského hodnotit pozitivně, to znamená, že mezi oběma hodnocenými plemeny kombinovaného užitkového typu nebyl významnější rozdíl v kvalitě masa. Z výsledků pokusu vyplývá, že využití plemene montbeliárde při zušlechťovacím křížení s českým strakatým plemenem nelze spojovat se zhoršováním masné užitkovosti domácího kombinovaného typu skotu.

Supported by the Ministry of Agriculture of the Czech Republic Project No. QF 4005.
This study was supported by the Research plan No. MSM6215648905 "Biological and technological aspects of sustainability of controlled ecosystems and their adaptability to climate change", which is financed by the Ministry of Education, Youth and Sports of the Czech Republic.

REFERENCES

BESOZZI, M., 1996: The Montbeliard breed for quality Milk and Meat. Informatore-Agrario, 52: 39, 43–45.

BONSEMBIANTE, M., ANDRIGHETTO, I., BITTANTE, G., SPANGHERO, M., COZZI, G., 1988: Attitudine alla produzione della carne di vitelloni di due razze da latte e quattro a duplice attitudine. Zootecnica e Nutrizione Animale, 14, 325–340.

CASSAR-MALEK, I., HOCQUETTE, J. F., JURIE, C., LISTRAT, A., JAILER, R., BAUCHART, D., BRIAND, Y., PICARD, B., 2004: Muscle-specific metabolic, histochemical and biochemical response to a nutritionally induces discontinuous growth path. Animal Science, 79: 49–59.

DIKEMAN, M. E., REDDY, G. B., ARTHAUD, V. H., TUMA, R. M., KOCH, R. M., MANDIGO, R. W. and AWE, J. B., 1986: Longissimus muscle quality, palatability and connective tissue histological characteristics of bulls and steers fed different energy levels and slaughtered at four ages. Journal of Animal Science, 63, 92–101.

GIGLI, S. E. and ROMITI, A., 1989: Prove sui capi pezzati rossi da carne. Pezzata Rossa, 2:1, 2526e 2:2, 3: 44–46.

GOLDA, J., VRCHLABSKÝ, J., PONÍŽIL, A., 1988: Masná užitkovost býků po otcích plemen německé strakaté a Montbeliardské. Živočišná výroba, 2: 133–41.

GOLDA, J., PONÍŽIL, A., VRCHLABSKÝ, J., 1989: Jatečná hodnota býků po otcích plemen německé strakaté a Montbeliardské. Živočišná výroba, 7: 577–586.

HAUREZ, P., MOURIER, C., 1990: Charolais x French Friesian bulls have the best carcass yield. Cultivar-Paris, 28: Supplement 2: 22–24.

HORA, J., 1997: Montbeliarde – jistota pro chovatele. Svaz chovatelů plemena Montbeliarde a kombinovaných plemen, 51 p.

CHLÁDEK, G., ŽIŽLAVSKÝ, J., 2004: Comparison of meat performance of Montbeliard and Czech Fleckviehbulls fattened to live weight of 680 kg. Acta Univertátis Agriculturae et Silviculturae Mendelianae Brunensis, LII, 5: 107–114.

CHLÁDEK, G., ŽIŽLAVSKÝ, J., ŠUBRT, J., 2005: Porovnání masné užitkovosti českého strakatého a montbeliárdského plemena. Czech Journal of Animal Science, 50, 3: 109–116.

MIKŠÍK, J., ŠUBRT, J., ŽIŽLAVSKÝ, J., GOTTHARDOVÁ J., 1996: Meat production of young fattened Montbeliard bulls. Živočišná výroba, 41, 9: 381–385.

PIASENTIER, E., VALUSSO, R., VOLPELLI, L. A., 2002: Meat quality of Italian Simmental young bulls as affected by the proportion of Montbeliarde crossing. Relazione presentata al "14th World Simmental-Fleckvieh Congress", South Africa and Namibia, August.

PIASENTIER, E., VALUSSO, R., VOLPELLI, L. A., SEPULCRI, A., PITTIA, P., FAILLA, S., 2003: Meat quality of Italian Simmental young bulls as affected by the genes frequency of Montbeliarde origin. Italian journal of Animal Science, suppl. 1: 328–330.

SAÑUDO, C. MACIE, E. S., OLLETA, J. L., VILLARROEL, M., PANEA, B., ALBERTI, P., 2004: The effects of slaughter weight, breed type and ageing time on beef meat quality using two different texture devices. Meat Abstract, 66, 925–932.

SCORJANC, D., CEPON, M., ERJAVEC, M., 1992: Characteristic of Musle fibers in bulls regarding growth intensity and fat rate in carcasses. Proceedings: 38th International Congress of Meat Science and technology, Clermont-Ferrand, France, August 23–28, 2: 141–143.

ŠUBRT, J., MIKŠÍK, J., ŽIŽLAVSKÝ, J., POLÁCH, P., 1997: Základní jatečný rozbor býků montbélliardského plemene. Acta Univertatis Agriculturae et Silviculturae Mendelianae Brunensis, XLV, 1: 91–98.

ŠUBRT, J., MIKŠÍK, J., 2002: Comparison of selected quality parameters of the meat of Bohemian spotted and Montbeliarde bulls. Czech Journal Animal Science, 47, 2: 57–63.

VERBIC, J., 1998: Effects of crossbreeding Simmental with Red and White Holstein and Montbeliard breed on milk yield. Agriculture and environment. Proceedings Bled, Slovenia, 12–13 March, 537–543.

WARZECHA, H., HANSCHMANN, G., REICHARDT, W., TREFFLICH, R., 1995: Das Fleckvieh aus dem Jura. Neue Landwirtschaft, 10, 70–72.

WYSS, U., 1988: Breed comparison of fattening trials of intact and castrated cattle. Fattening performance, carcass composition and evaluation. Mitteilungen des Schweizerischen Verbandes für Künstliche Besamung und der Interessengemeinschaft Schweizerischer Besamungszüchter, 26, 3: 8–11.

Address

Prof. Ing. Jan Šubrt, CSc., Prof. Ing. Gustav Chládek, CSc., Ing. Radek Filipčík, PhD., Ústav chovu a šlechtění zvířat, Mendelova zemědělská a lesnická univerzita v Brně, Zemědělská 1, 613 00 Brno, Česká republika, e-mail: subrt@mendelu.cz