

CARCASS QUALITY ESTIMATION BY RIB CUT

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Summary

In Croatian Simmental breeding program the great emphasis is on meat quality. So far in the aggregate breeding value (BV) there are fattening and carcass characteristics and chemical components, but no sensor characteristics. The index consists of breeding values of daily gain, carcass percentage and meat content. In this paper structure of tissue of slaughtered bulls were evaluated on the dissection samples of 7-9 rib cut. There were 326 bulls, progenies of 29 test sires. Data were analysed by least squares (Harvey, 1979), and corrected on year and season. Average cold carcass weight was 304.15 kg. The meat, fat and bone content in the rib cut were 63.91%, 13.96% and 18.93%, respectively. Meat:bone and meat:fat ratio were 3.58 and 4.78, respectively. In MLD (dry matter) there were 21.83% protein and 1.42% fat. Heritability (h^2) and correlations (r) for 10 slaughter traits were estimated. The h^2 for meat, bone and fat contents in the rib cut were .702, .421 and .489, respectively. The results in this paper were similar to those from Karadiole (1978), Car (1981) and Caput (1985), but different from results in other Simmental breeding areas in Europe (Averdunk et al. 1992; Petautschig, 1992). The differences could partly be explained by different methods and technological procedures in slaughtering and dissection. There were unusual high bone content, and low muscle:bone ratio. This is the fact which must be improved in Croatian Simmental.

Introduction

The dominant cattle breed in Croatia is the Simmental. Since 1974 a breeding programme has been carried out following the conventional scheme for dual purpose central European breeds. In estimating the breeding value of bulls the attention is given to fattening and slaughtering traits. Methods and quality criteria have gradually been adapted to the criteria of the current European market. The objectives of the present study were to examine several phenotypic and genetic parameters which may improve the progeny test on Simmental bulls for fattening and slaughtering traits in Croatia.

Rad je piropćen na 44th Annual Meeting of the European Association for animal Production (EAAP) u Aarhus-u.

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Material and methods

In the process of the progeny test on Simmental bulls for fattening and slaughtering traits the quality of carcass of 29 progeny groups of 326 sons were analyzed. The test was carried out in the period between 1984 and 1990 at one station and one slaughter house. The average age at the start of the test was 120 days, weighing 163 kg. The slaughter age was 420 days and weight was 513 kg. In the test the bulls were fed on hay and concentrate.

Cuts from the seventh to the ninth ribs were taken from the cooled halves and dissection into bones, lean, fat tissue, tendons and membranes was carried out, always in the same laboratory. A chemical analysis was performed on MLD samples.

Data were analyzed by least squares (Harvey, 1979) and corrected on year and season. The effect of year was stronger than effect of season, because it includes the differences between progeny groups.

The model used was:

$$Y_{ijk} = \mu + F_i + s_j + e_{ijk}, \text{ where:}$$

μ - overall mean
 F_i - fixed effect of the year and season
 s_j - the random effect of the bull
 e_{ijk} - error

The mean values, standard errors, heritability, phenotypic and genetic correlations were calculated, as shown in tables 1-5.

Results and discussion

The progeny test on the Simmental bulls in Croatia continues only until the slaughtering weight of about 530 kg and the age about 420 days has been achieved. These limits simulate the actual condition of fattening and possibilities of exporting baby-beef to the EC countries. As shown in table 1, the average weight of the sons before slaughtering was 513 ± 3.3 kg, which is considerably lower than in other Simmental populations. For this reason the slaughtering weight of the Croatian Simmental bulls is 84 kg lower than e.g. the slaughtering weight of the Fleckvieh in Styria (Petautschning, 1992). The differences in the conditions of beef production and the market make it difficult to compare internationally the results of research and unify the methods of evaluating meat quality.

The average daily gain in the period of testing (120-420 days) was 1205 ± 93 grams (Table 1). The percentage of lean in the carcass was 63.91%, which is considerably lower than 65.5-68.8% quoted by Schwarz and Kirchgessner (1991) for the Fleckvieh. This difference is due to dissection separation into lean, tendons and membranes. The average tendons ratio in our research was 3.31% (Table 1). Schwarz and Kirchgessner (1991) noted that the carcass of intensively fed Simmental bulls contained 12.8% of fat, while in our research 13.96% was established.

Table 1. - LEAST-SQUARES MEANS, AND STANDARD ERROR OF LS MEANS FOR SIMMENTAL BULLS
 LEAST-SQUARE SREDNJE VRIJEDNOSTI I STANDARDNE GREŠKE SREDNJIH VRIJEDNOSTI

Criteria		LS mean \bar{X}	Stand. error of LS mean $S_{\bar{X}}$
Live wight	kg	513.10	3.3244
Daily gain 120-420 days	g	1205	93
Cold carcass	kg	304.15	2.2332
Lean ratio	%	63.91	0.2431
Fat ratio	%	13.96	0.2355
Bone ratio	%	18.23	0.1538
Tendons ratio	%	3.31	0.0735

The amount of bones in the rib cut of the Simmental bulls in Croatia is relatively high (18.23%). The results of this is an unfavorably narrow ratio lean:bones (3.52) and wide between bones and the fat (1.37) (Tables 1 and 2). Our results of research differ considerably from the results of research, for example, in Bavaria (Kögel et al., 1989). The Bavarian Fleckvieh crossbred with the Bavarian Braunvieh reduced the already low percentage of Braunvieh bones (15.37) by 0.48%. A better tissue structure in halves of the Bavarian Fleckvieh bulls in comparison with our results was also established by Averdunk et al. (1992). They noted 26.6 kg of bones in the cold halves weighing 175 kg, and we found 27.7 kg in a halves weighing 152 kg.

Table 2. - TISSUE RATIO'S PARAMETERS
 PARAMETRI TKIVNIH ODNOSA

Ratio	LS mean \bar{X}	Stand. error of LS mean $S_{\bar{X}}$
Lean : bone	3.5189	0.0391
Lean : fat	4.7786	0.0885
Bone :fat	1.3670	0.0256

The high content of bones in the rib cut or the halves accounts for the smaller percentage of lean (63.91). In our analysis 5.89% lower content of lean was obtained in comparison with the Bavarian Fleckvieh. The differences can only partly be explained by different dissection methods used (dissection into lean and tendons separately). The comparison with the German and Austrian Fleckvieh has been made because the Croatian Simmental has been created in the last hundred years by constant migrations of the Simmental from Central Europe, predominantly from Bavaria.

Our earlier research (Karadjole, 1978; Caput, 1985; and others) have confirmed that by adequate feeding the process of muscle tissue growth in the Simmental bull is linear up to about 390 kg. The allometric growth of lean tissue in the rib cut (9-11) progress linear within the weight of 111-391 kg ($b=0.986$ up to 1.041 depending on feeding). In contrast the allometric growth of bones has a nonlinear shape ($b=0.716-0.918$) (Caput, 1985).

In estimating the breeding value of the Simmental bulls in Croatia the following figures of heritability have been used:

$$h^2 \text{ of daily gain in the test} = 0.34$$

$$h^2 \text{ of cold carcass} = 0.40$$

Similar estimations of heritability of meat traits can be found in literature. Most of the heritability was estimated by using test stations in Bavaria, Baden-Wurtemberg, Austria and Italy. In this work, however, the estimated h^2 for the said traits varied considerably. Thus the heritability for daily gain was 0.436, for cold carcass 0.193 and for lean percentage in the carcass 0.702.

The high heritability was also established for dry matter ($h^2=0.898$), for protein ($h^2=0.838$) and ash ($h^2=0.734$) in MLD (Table 4). The established h^2 for lean percentage in carcass is considerably higher than in Bavarian Fleckvieh as stated by Averdunk (1988, cit. Alps, 1980). Bittante (1992) also mentioned a considerably lower heritability for lean percentage ($h^2=0.53$). The estimated heritability for fat percentage was 0.489, and for bone percentage 0.421 (Table 4). Averdunk (1988, cit. Alps, 1980) quoted a similar h^2 for fat (0.41), but a considerably higher h^2 for bones in the Fleckvieh breed (0.66). Heritability for lean:bone, lean:fat and bone:fat were 0.464, 0.553 and 0.231, respectively, and differed notably from heritability in other Simmental populations (Averdunk, 1988, cit. Alps et al., 1980).

Table 3. - CHEMICAL COMPOSITION OF MLD AREA
KEMIJSKI SASTAV UZORAKA MLD

Criteria		LS mean \bar{X}	Stand. error of LS mean $S_{\bar{x}}$
Dry matter	%	24.33	0.1015
Protein ratio	%	21.38	0.0930
Fat ratio	%	1.42	0.0780
Ash ratio	%	1.08	0.0037

Table 4. - ESTIMATES OF HERITABILITIES
PROCIJENJENI HERITABILITETI

		h^2
Daily gain	(g/day)	0.436
Cold carcass	(%)	0.193
Lean ratio	(%)	0.702
Fat ratio	(%)	0.489
Bone ratio	(%)	0.421
Dry matter	(%)	0.890
Protein	(%)	0.838
Fat	(%)	0.291
Ash	(%)	0.743
Lean:bone		0.464
Lean:fat		0.553
Bone:fat		0.231

Table 5. - GENETIC (RG, UPPER TRIANGL) AND PHENOTYPIC (RP, LOVER TRIANGL) CORRELATIONS BETWEEN TRAITS
 GENETSKE (RG, IZNAD DIJAGONALE) I FENOTIPSKE (RP, ISPOD DIJAGONALE) KORELACIJE IZMEĐU SVOJSTAVA

CRITERIA	1	2	3	4	5	6	7	8	9
1 Lean ratio		-.906**	-.700**	-.104	-.159	.063	.297**	.841**	.940**
2 Fat ratio	-.743**		.435**	.420**	.515**	-.088	-.038	.608**	1.009**
3 Bone ratio	-.420**	-.210**		-.501**	-.352**	-.380**	-.451**	-.942**	-.512**
4 Dry matter (%)	-.286**	.356**	-.060		.903**	.412**	.331**	.419**	-.300**
5 Protein(%)	-.118*	.153**	.004	.686**		-.019	.571**	.186**	-.403**
6 Fat(%)	-.235**	.285**	-.084	.466**	-.323**		-.483**	.519**	.133
7 Ash (%)	.061	-.057	.031	.345**	.409**	-.087		.468**	.041
8 Lean/bone	.679**	-.100	-.923**	-.038	-.036	-.005		.687**	
9 Lean/fat	.810**	-.951**	.063	-.334**	-.141*	-.269**	.037	.236**	

* P<.05

** P<.01

Conclusion

The results of all our research so far on the beef quality of the Croatian Simmental bulls indicate unfavorably high content of bones in the halves.

The actual method of estimating the breeding value for beef takes into account the daily gain, cold carcass and lean percentage in halves. In further development of methods of estimating the breeding value more traits should be considered with actual values of genetic parameters (Tables 4 and 5) and the economic relations.

To evaluate beef quality of the Simmental breed in Croatia more completely, our further researches should be directed to analyzing sensory characteristics, their relationship with physical and chemical parameters.

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PROCJENA KAKVOĆE TRUPA PUTEM REBRANOG ISJEČKA

Sažetak

U uzgojnom programu za simentalca u Hrvatskoj naglasak je na kakvoći mesa. U agregatnom iznosu uzgojne vrijednosti (UV) sadržane su tovnost i klaoničke karakteristike, te njihove kemijske vrijednosti. Za sada senzorne karakteristike, te njihove kemijske vrijednosti. Za sada senzorne karakteristike se ne uvažavaju. Indeks je sastavljen od uzgojnih vrijednosti za dnevni prirast, hladni randman i sadržaj čistog mesa.

Struktura tkiva u ovom istraživanju procijenjena je disekcijom uzoraka 7. - 9. rebra. Analizirano je 29 progenih grupa s ukupno 326 sinova- mladih bikova. Podaci su analizirani leastsquare metodom (Harvey, 1979.) uvažavajući utjecaj godine i sezone. Prosječna težina hladnih polovica iznosila je 304.15 kg. Postoci čistog mesa (mišićnog tkiva), masnog tkiva i kosti u isječku iznosili su 63.91%, 13.96% i 18.93%. Odnos meso:kosti iznosio je 3.58, a meso:kosti:loja 4.78. U suhoj tvari MLD sadržano je 21.83% proteina i 1.42% masti. Heritabilitet za sadržaj mesa, kosti i loja u isječju iznosio je 0.702, 0.421 i 0.489.

Dobiveni rezultati podudaraju se s ranijim rezultatima u nas (Karadjole, 1978; Car, 1981; Caput, 1985), ali se razlikuju od priopćenih rezultata istraživanja u nekim drugim simentalnim uzgojima (Averdunk i sur., 1992.; Petautchnig, 1992.). Razlike se mogu djelomično objasniti različitim metodama i tehničkim postupcima pri klanju, primarnoj obradi i disekciji. Relativno visok sadržaj kosti u trupu naših simentalaca mora biti predmet pažnje u budućim selekcijskim programima.

Primljeno: 23. 9. 1993.