CHARACTERISTICS OF CARCASS AND MEAT AND THEIR INTERDEPENDENCE IN THREE OF OUR MAIN BREEDS

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S U M M A R Y

At a sample of 70 bulls from the progeny test, of Brown breed, Simmental and Black and White breed, the quantitative and qualitative characteristics of carcass and meat and their interdependence were studied. The results showed that in all of the most important characteristrics, Simmental bulls were best, Brown breed stayed only little behind, while Black and White breed showed a considerable arrear. The same sequence was found in the carcass composition, as regards the rates of meat, fat, bones and tendons, being the most objective criteria. Among the various characteristics of carcass and meat there are several highly significant correlation coefficients, which could serve as a basic for indirect establishment of the characteristics of carcass and meat.

INTRODUCTION

The quality of carcass and meat has an increasing influence on the economic of the meat industry. When evaluating cattle breeds, a negative correlation between the quality of carcass and the capacity for milk production should be taken into account. In our country, three important highly productive cattle breeds are common: Brown breed, Simmental and Black and White breeds. Among these, the first two are dual purposetypes, while the last mentioned cattle are more and more improved with Holstein Friesian breed, as a results of which they are increasingly specialized as dairy cattle.

Our efforts in selecting dual purpose breeds are oriented towards an augmentation of as well meat- als milk production. However, as a results of this, the selectional progress is slower that it would be when we would be selecting for only one production characteristic. While observing the capacity for meat production, we carefully study the carcass quality, meat quality and their interdependence. Several research workers, i.e. Jenkins and Ferrel (1984), Kdgel et al. (1988), Mčller (1988), Rosenberger et al. (1987), Temisan and Augustini (1987) and others are engaged in similar research work.

This research aimed for establishing the influence which the mentioned breeds have on the quantitative and qualitative characteristics of carcass and meat and their interdependence.

MATERIALS AND METHODS

Random samples of bulls from the progeny test for fattening and carcass characteristics were included into the experiment: 24 Brown breed animals and 18 animals of each Simmental and Black and White breed. The bulls were slaughtered without previous fasting, directly after having been brought to the abattoir. The warm carcass halves were weighed immediately after slaughtering, their slaughter quality was subjectively evaluated and their length and breast dept measured. On the basis of the found measures, a conformation index as relative carcass depth, was calculated.

$$\text{Conformation Indeks (CI)} = \frac{\text{Carcass weight}}{\text{Carcass lenght x carcass depth}}$$

The subjective carcass grading inclueded fleshiness (max. 30 points, fattiness (15 points) and meat quality (5 points) which makes a total of maximal 50 points. The area of the cross-section of the M. longissimus dorsi were measured at the cut between the seventh and eighth rib at the selection of the front and hind quarters. At the same part of the muscle also a sample was taken for analysing the number and diameter of the muscle fibre, following the method, described by Hegarty and Naude (1979).

From the right halves, a dissection was made into the more important parts, which were divided following the system of rough tissue division into separate tissue (meat, fat, bones and tendons). We took a sample of the M. longissimus dorsi (MLD), between the seventh and tenth rib, for chemical and sensoric analysis. At the sample of the prepared meat, also the cutting hardnes was measured with and Instron instrument.

The results of this research were statistically processed with analysis of variance, following the method of least squares (Harvey, 1968).

RESULTS AND DISCUSSION

The results of the research are given in table 1. There was no significant difference in live weight before slaughtering between the animals of Brown breed and Simmental breed, however, the weight was significantly lower in Black and White animals ($P < 0,01$). The same goes for warm carcass weight as well.

Table 1: Qualitative and Quantitative Carcass and Meat Characteristics

Traits	1st group (Brown breed)		2nd group (Simmental breed)		3rd group Black and White breed)		Group 1-2	Group 1-3	Group 2-3
	LSQ	S.E.	LSQ	S.E..	LSQ	S.E.			
Live weight, kg	592.6	5.1	585.0	9.9	529.3	9.6	0.558	0.000**	0.000**
Warm carcass weight,kg	333.4	3.1	340.0	4.5	320.9	5.1	0.187	0.026*	0.003**
Dressing percentage, %	58.1	0.5	59.2	0.8	55.7	0.9	0.191	0.013*	0.001**
Carcas lenght, cm	132.9	0.7	132.9	1.0	135.0	1.1	0.974	0.096	0.128
Carcass depth, cm	41.7	0.4	40.6	0.6	42.2	0.7	0.109	0.493	0.058
Conformation Index	60.0	1.0	63.3	1.4	54.7	1.6	0.038*	0.003**	0.000**
Carcass Grading, p.	43.5	0.5	45.9	0.8	38.9	0.9	0.007**	0.000**	0.000**
Area of MLD, cm^2	49.6	2.3	56.5	3.3	46.5	3.8	0.064	0.441	0.030*
No.of muscle fibres in MLD,10^3	1.637.7	79,0	1.588.9	116.2	1.335.4	132.1	0.702	0.035*	0.111
No.of muscle fibres per $1mm^2$	332.9	10.0	283.4	14.7	295.0	16.7	0.003**	0.038*	0.561
Diameter of muscle fibre, µ	64.1	1.3	69.2	1.9	64.4	2.1	0.016*	0.891	0.066
Carcass composition, %									
- meat	71.0	0.2	72.6	0.4	68.5	0.4	0.004**	0.000**	0.000**
- fat	11.5	0.5	10.5	0.7	11.8	0.6	0.001	0.079	0.045*
- bones	16.0	0.2	15.5	0.3	18.0	0.4	0.022**	0.000**	0.000**
- tendons	1.5	0.0	1.4	0.0	1.7	0.0	0.261	0.889	0.300
Rate of best quality parts, %	54.4	0.3	53.5	0.5	53.4	0.5	0.104	0.105	0.891
Meat rate in best qua.parts,%	58.3	0.3	58.5	0.5	57.8	0.6	0.700	0.500	0.360
% meat per live weight	39.8	0.4	41.8	0.6	36.7	0.7	0.004**	0.000**	0.000**
Chemical composition, %									
- water	74.9	0.2	75.2	0.2	75.0	0.3	0.229	0.839	0.426
- proteins	21.9	0.2	22.6	0.2	21.6	0.3	0.014*	0.320	0.004**
- fat	2.4	0.2	1.2	0.3	2.2	0.3	0.001**	0.576	0.017*
- ash	0.0	0.0	1.0	0.1	1.0	0.1	0.349	0.106	0.485
Sensorical characteristics:									
- tenderness (1-7 points)	5.1	0.2	5.5	0.2	5.0	0.3	0.143	0.859	0.178
- juiciness, p.	5.9	0.1	5.4	0.1	5.4	0.1	0.001**	0.003**	0.865
- flavour, p.	5.9	0.1	5.5	0.1	5.8	0.1	0.003**	0.458	0.009**
- chear force values (newton)	129.9	7.9	109.6	11.6	146.8	13.1	0.114	0.232	0.020*

* $P<0.05$
** $P<0.01$

The dressing percentage without previous fasting was with Brown and Simmental breeds 58.1 and 59.2 % respectively, the differences were statistically not significant, but he much lower dressing percentage of the Black and White cattle (55.7 %) was significant, which is understandable for a specialized dairy breed. A similar results was found in earlier researches (Čepin et al., 1981, 1987).

There were no statistically significant differents in the carcass length and carcass deptht. However, highly significant ($p > 0,01$) were the differences between the three breeds in the conformation index and the subjective carcass grading. Simmental showed the best results, Black and White the worst. Our Black and White cattle strongly stay behind the other two, dual purpose breeds, because of the increasing influence of the dairy

breed Holstein Friesian eith which they are improved. Also in the area of the muscle section (M. longissimus dorsi) the lead is taken by Simmental while Black and White stays far behind.

The analysis of muscle fibre showed that the highest number of fibrils occurred in the M. longissimus dorsi of Brown breed, and the lowest number in Black and White, the differences between these two breeds are significant ($P < 0,05$). The diameter of muscle fibre was the biggest in Simmental, the smallest in Brown breed, also these differences are significant ($P < 0,05$). Similar results are mentioned by Osterc (1974).

The carcass composition, as the most objective criteria of carcass quality, appears to be the most favourable in Simmental, as this breed has the highest meat rate (72.6 %) and the lowest fat and bone rate (10.5 and 15.5 %). Black and White breed showed the worst carcass composition; it had the lowest meat percentage (68.5 %) and the highest rate of both fat and bones (11.8 and 18.0 %) The differences between all three breeds were either significant or highly significant. There were, however, no significant differences between the three breeds as for the rate of best quality parts.

There are indeed no great differences between the breeds as for their chemical composition, but because of the small variability there is in Simmental cattle a sifnificantly higher percentage of proteins and a lower percentage of fat than in the other two breeds.

Also in some sensoric characteristics, the differences between the breeds are significant. Although there are no sifnificant differences between the breeds when compared for tenderness of the prepared meat, the juiciness and flavour of the meat are the best in Brown breed.
The chear force measured with and Instron instrument, shows significant differences between the lowest hardness in Simmental and the highest hardnes in Black and White cattle.

From the shown results it becomes clear that Simmental cattle in most of the quantitative and qualitative carcass traits significantly positively deviates also from dual purpose Brown breeds, while the results in the specialized dairy Black and White cattle are even essentially worse.
In table 2, the correlation coefficients between the individual traits are given with a comment on the most significant ones.

Highly significant is the correlation coefficients between the live weight before slaughtering and the conformation index ($r = 0.64$), the subjective carcass grading ($r = 0.65$) and the bone rate in carcass halves ($r = -0.61$). Still somewhat higher are the correlation coefficients between the carcass weight and the mentioned traits.

Table 2: Correlation Coefficients between the Analysed Traits

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1. Live weight, kg	1.00	.91	.35	.64	.65	.33	.23	-.11	.16	.12	.34	-.61	-.11	-.21	.32	-.22	.17	.06	-.15	.19	.18	-.31	-.39
2. Warm carcass weight, kg		1.00	.71	.82	.66	.48	.32	-.21	.22	.16	.38	-.72	-.05	-.21	.61	-.27	.21	.07	-.15	.27	.17	-.46	-.54
3. Dressing percentage			1.00	.76	.41	.50	.32	-.27	.22	.16	.30	-.59	-.05	-.12	.82	-.20	.19	.04	-.05	.27	.10	-.50	-.56
4. Conformation Index				1.00	.65	.75	.51	-.17	.30	.31	.31	-.78	-.08	-.26	.74	-.27	.32	.03	-.10	.32	.38	-.42	-.53
5. Carcass grading (4-50 points)					1.00	.19	.12	-.08	.25	.25	.29	-.69	.03	-.02	.44	-.11	.27	-.12	-.05	.21	.11	-.22	-.35
6. Area of MLD, cm^2						1.00	.39	-.26	.02	.35	-.04	-.37	-.04	-.05	.59	-.02	-.02	.09	-.14	.20	.14	-.55	-.36
7. No. of muscle fibres in MLD, 10^3							1.00	.40	-.41	.35	-.15	-.26	-.05	-.08	.43	.06	-.10	.08	-.22	.25	.31	-.25	-.26
8. No. of muscle fibres per 1 mm^2								1.00	-.62	.02	.13	.13	.03	-.01	-.21	.12	-.07	-.04	-.17	.11	.28	.42	.09
9. Diameter of muscle fibre, µ									1.00	-.01	.24	-.29	-.01	-.08	.18	-.20	.34	-.07	-.03	.04	-.26	-.23	-.09
10 Meat rate, %										1.00	-.70	-.27	.27	.11	.61	.49	.06	-.52	-.15	-.14	-.02	-.21	-.00
11. Fat rate, %											1.00	-.52	-.36	-.31	-.08	.67	.25	.45	.10	.31	.18	-.04	-.40
12. Bone rate, %												1.00	.14	.26	-.64	.29	-.41	-.01	.07	-.25	-.27	.30	.53
13. Rate of best quality parts, %													1.00	.80	.15	.22	-.06	-.21	-.20	-.17	-.01	-.08	.07
14. Meat rate in best qua. parts, %														1.00	-.02	.18	-.18	-.05	-.03	-.20	-.17	-.07	-.08
15. % meat per live weight															1.00	.07	.23	-.25	-.17	.19	.07	-.52	-.46
16. Water content in MLD, %																1.00	-.36	-.70	.02	-.12	-.04	.12	.27
17. Protein content in MLD, %																	1.00	-.28	-.31	.14	-.01	-.13	-.37
18. Fat content in MLD, %																		1.00	.08	-.01	.08	-.08	.02
19. Ash content in MLD, %																			1.00	-.08	-.14	-.10	.33
20. Tenderness MLD, (1-7 points)																				1.00	.16	-.16	-.64
21. Juiciness MLD, (1-7 points)																					1.00	.03	-.17
22. Flavour MLD, (1-7 points)																						1.00	.30
23. Shear force values (Newton)																							1.00

$P < .05 - r \geq .25$

$P < .01 - r \geq .33$

Highly significant are also the correlation coefficients between dressing percentage and conformation index (r=0.76), bone rate in carcass halves (r=-0.59) and meat percentage obtained from liwe weight (r=0.82). Also highly significant are the correlation coefficients between the conformation index and the subjective carcass grading (r=0.65), the area of the MLS cross-section (r=0.75), the number of fibrines in the MLD (r=0.51), the percentage of meat from live weight of the animal (r=0.74) and the chear farce (r=-0.53). There exists a highly significant negative correlation (r=-0.69) between the subjective carcass grading and the bone rate, while there exists a highly positive correlation between the area of the MLD section and the meat percentage from live weight (r=0.59). The correlation coefficients between the number and the diameter of muscle fibre and the remaining traits are in most of the cases low.
The meat percentage in carcass halves stands in a significant negative correlation with the fat percentage in the carcass halves (r=-0.70) and the fat percentage in the MLD (r=0.52) and in a positive correlation with the meat percentage from the live weight of the animals. The fat percentage stands again in negative correlation with the bone percentage (r=-0.52) and the water percentage in the MLD (r=0.67).

The bone percentage stands in positive correlation with the chear force of the meat (r=0.53). The are no significant correlation coefficients between the rate of best quality parts and the remaining traits. Most of the correlation coefficients have no high values either, when compared to the chemical composition of the sensoric characteristics.

CONCLUSIONS

The results of this research show considerably better quantitative and qualitative carcass characteristics of Simmental cattle. Brown breed somewhat lags behind, while the dairy breed Black and white comes far behind.

There are several important, highly significant correlation coefficients among the indvidual carcass and meat characteristics.

The research has also proved that for objective evaluation of the carcass quality it is ever still necessary to dissect into individual tissues, as other direct methods do not offer reliable information on carcass composition in regard of the meat, fat, bones and tendons percentage.

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