INFLUENCE OF GROWTH INTENSITY AND CARCASS WEIGHT ON CARCASS AND MEAT CHARACTERISTICS OF BROWN BULLS

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SUMMARY

Influence of growth and carcass weight on carcass quality and physical-chemical and sensory meat characteristics has been studied in case of 64 brown bulls cross-bred with Brown Swiss (40 % of B.S. blood), fattened medium intensively to average weight 575 kg. Phenotypical correlations and regressions between certain carcass and meat characteristics have also been studied.

The results of the research show that daily gain hasn't significantly affected any of the important carcass or meat characteristics. But weight of finished animals or carcass weight has significantly affected most of the important carcass and meat characteristics. In this way, carcass weight was in significant positive correlation with subjective evaluation of carcasses (r = 0.42), with % of fat in carcasses (r = 0.47), with meat : bones ratio (r = 0.28), with flavour of meat (r = 0.34) and with % of fat in meat (r = 0.38). Carcass weight was in negative correlation with % of bones (r = -0.45), with % of more valuable carcass parts (r = -0.31), with meat : fat ratio (r = -0.44) and with % of water in meat (r = -0.27).

INTRODUCTION

Carcass and meat quality depends upon many genetic and environmental influences. It can be defined as a sum of quantitative and qualitative factors which influence on carcass and meat quality and its market value. Several quantitative and qualitative characteristics have in different countries and more in different continents different economic importance, and therefore it is impossible to define quality and its value in general. This is why it wasn't easy to nominate common European standard for valuation of carcasses on slaughter-line.

Intention of our research was to analyse the influence of growth intensity and carcass weight on carcass and meat characteristics at bulls of brown breed progeny testing.

MATERIAL AND METHODS

At progeny testing of brown bulls, cross-bred with Brown Swiss (B.S.) we sampled 64 animals with 40 % of B.S. blood. They were middle intensively fattened to average live weight 575 kg at optimal finishing. Average daily gain from 150 to 575 kg was 941 g (S=65). Immediately after slaughter the weight of warm carcasses was determined and carcasses were subjectively graded from 4-50 points (Čepin, 1980). By this system carcass fleshiness is valued at 1-5 points and at - or + signs, which sums to 15 points, but with multiplicative factor 2, fleshiness presents maximal 30 points as highest economic factor. Fattiness is valued in the same was but without multiplicative factor with maximal 15 points. Meat quality is valued with 1-5 points. Conformation index signifies relative carcass thickness and means good objective criterion of carcass quality. It is calculated by the formula:

$$C.I. = \frac{\text{weight of warm carcasses}}{\text{carcass length x chest depth}}$$

Right carcass halve was dissected after 24-hours cooling on lean, lightseparable fat, bones and tendons, using the system of rough tissue separation. Cross section area of muscle Longissimus dorsi (M.L.D.) and pH value were measured between 7th and 8th rib and samples for muscle fibers analysis were taken according to the method used by Osterc (1974). Samples of the L.D. muscle for chemical and sensorical analysis were taken between 8th and 10th rib. The results were calculated by analysis of variance.

RESULTS AND DISCUSSION

Table 1 shows mean values and analysis of variance of daily gain and carcass weight influences on some carcass and meat properties. Table 2 shows more important phenotipical correlative coefficients. In this case there is no significant correlation between daily gain and some carcass and meat properties. This is probably because all tested animals had the same daily ration (concentrate limited, mixture of corn and grass silage at libitum) and higher daily gain was dependent on bigger consumption capability of animals. Averdung et al. (1990) found various connections between daily gain and meat quality, with tendency towards predominating negative correlations. Correlation between carcass weight and carcass and meat properties is highly significant. Carcass weight is in high significant positive correlation ($P<0.01$) with subjective valuation and with conformation index. Similar results are also mentioned by other authors (Palenik et al., 1990, Grosse et al., 1991). Carcass weight is also in significant or highly significant correlation with carcass composition which is the most objective valuation of carcass quality. In this way, correlation coefficient between carcass weight and % of meat amounts to $r = -0.29^{*}$, % of fat $r = 0.47^{**}$ and % of bones $r = -0.45^{**}$.

Similar or even higher correlation coefficients are mentioned by Čepin et al. (1989, 1990), Rosenberger et al. (1985) and Sack et al. (1988).

Significant negative correlation is also shown between carcass weight and % of valuable carcass parts ($r = -0.31$). From these results it appears how important it is to determine optimal final weight of finished animals at definite breeds and at definite fattening intensivity. Percentage of meat is decreased and percentage of fat is increased with excessive increase of carcass weight, and percentage of valuable carcass parts is also decreased. Similar results are also mentioned by Cepin (1988) and Crouse et al. (1988). Carcass weight significantly affects neither the diameter of muscle fibres nor the number of muscle fibers per mm^2. Carcass weight also doesn't significantly affect the cross-section of muscle L.D. nor does the pH value of meat.

In case of sensorical characteristics there is significant positive correlation between carcass weight and flavour ($p<0.01$), while carcass weight neither significantly affects the juiceness, nor the shear value of roasted meat (Instron).

Table 1: Analysis of variance for daily gain and carcass weight influence on carcass and meat characteristics

Traits	u (n=64)	Daily gain F-value	Daily gain P	Carcass weight F-value	Carcass weight P
Carcass grading	43.5	.493	.485	12.262	.001
Conformation index	58.8	.608	.438	24.437	.000
Lean, %	71.3	.239	.627	5.318	.025
Fat, %	10.4	.028	.868	13.404	.000
Bones, %	16.7	1.532	.221	9.235	.003
Lean/live weight, %	40.5	.000	.993	.017	.896
Valuable parts, %	52.8	.378	.541	6.367	.014
Lean : bones	4.3	1.757	.190	2.083	.154
Lean : fat ratio	7.4	.018	.893	12.142	.001
M.fibres diameter, um	65.7	.014	.906	1.219	.274
M.fibres / mm^2	307.2	.565	.455	1.268	.265
MLD area, cm^2	48.7	2.616	.111	.240	.626
pH	5.6	.007	.934	.052	.820
Shear value, N	170.6	.136	.714	.994	.323
Tenderness (1-7 P)	4.4	.020	.887	1.263	.265
Juiceness (1-7 P)	5.4	.110	.741	.1839	.180
Flavour (1-7 P)	5.3	.052	.820	7.008	.010
Water, %	75.6	.035	.852	4.373	.041
Protein, %	21.5	.044	.949	1.350	.250
Fat, %	2.0	.143	.707	9.110	.004
Ash, %	0.9	.326	.570	.142	.708

Carcass weight is in significant correlation with % of water and fat ($p<0.01$) by chemical analysis. Percentage of water is decreased and percentage of fat is increased with increase of carcass weight. Carcass weight doesn't significantly affect percentage of proteins or ash. Table 3 shows linear regression coefficients of daily gain and carcass weight influence on carcass and meat characteristics.

Graphs 1-6 show linear regression lines between carcass weight and some carcass and meat characteristics.

Table 2. Phenotypic correlation coefficients between some properties

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
(1)															
(2)	.43		.11	.33	-.07	.22	-.32	-.07	.26	-.18	.25	-.10	-.06	.12	.10
(3)		.41		.60	-.29	.47	-.45	-.31	.27	-.44	.16	-.28	-.16	.38	.09
(4)				.44	-.14	.29	-.32	.25	.24	-.23	.01	.08	-.02	-.11	.17
(5)					-.14	.44	-.66	-.02	.53	-.36	.10	.44	.16	.33	.23
(6)						-.88	.04	.29	.40	.86	.23	-.37	.21	.43	.43
(7)							-.49	.23	.07	-.94	.16	-.55	-.08	.55	.45
(8)								-.4	-.90	.41	-.03	-.51	-.23	-.37	-.17
(9)									.17	.27	-.07	.08	.37	-.31	.03
(10)										.00	.11	-.30	.33	.13	-.04
(11)											.21	-.32	.08	-.45	-.40
(12)												-.02	-.15	.12	-.03
(13)													-.26	-.83	-.41
(14)														-.29	-.24
															-.38

1 - Daily gain
2 - Darcass weight
3 - Carcass grading
4 - Conformation index
5 - Meat, %
6 - Fat, %
7 - Bones, %
8 - Valuable parts, %
9 - Meat : bone
10 - Meat : fat
11 - MLD area, cm
12 - Water, %
13 - Protein, %
14 - Fat, %
15 - Ash, %

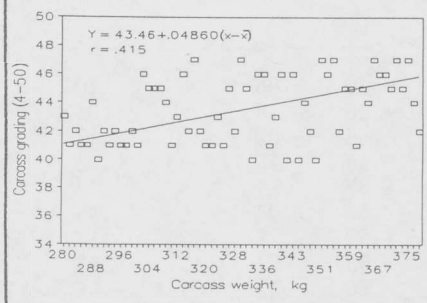
CONCLUSIONS

The results of the research of brown bulls fattening at progeny testing with middle intensive nutrition show that daily gain hasn't significantly affected the carcass and meat characteristics. Those influences would certainly be shown at various fattening intensivity and at higher variability of daily gains. But carcass weight has significantly or highly significantly affected many of quantitative and qualitative carcass and meat characteristics, which means that final weight optimization of finished animals is very important economic factor.

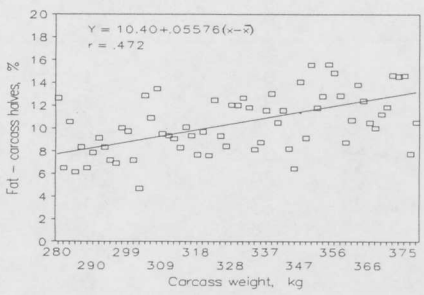
Table 3. Linear regression coefficients of daily gain and carcass weight influence on carcass and meat characteristics

Traits	Daily gain		Carcass weight	
	b_1	s.e.	b_2	s.e.
Carcass grading	-.002	.003	.049**	.014
Conformation index	.003	.004	.102**	.021
Carcass composition:				
- Lean, %	.001	.003	-.033*	.014
- Fat, %	.001	.003	.056**	.015
- Bones, %	-.002	.001	-.021**	.007
- Lean/live weight, %	.000	.003	.002	.013
- Valuable parts, %	.001	.002	-.025*	.010
Lean : bones	.001	.000	.003	.002
Lean : fat	.000	.003	-.048**	.014
M.fibres diameter, um	-.001	.007	.037	.034
M.fibres /mm2	.063	.084	-.442	.392
MLD area, cm2	.013	.008	.019	.038
pH	.000	.001	.000	.002
Sensorical properties:				
Shear value	-.020	.055	-.258	.258
- Tenderness (1-7 P)	.000	.001	.0007	.007
- Juiceness (1-7 P)	.000	.001	.004	.003
- Flavour (1-7 P)	.000	.001	.001	.003
Chemical analysis:				
- Water, %	.000	.001	-.015*	.007
- Protein, %	.000	.001	-.005	.004
- Fat, %	-.001	.001	.020*	.007
- Ash, %	.000	.000	.001	.001

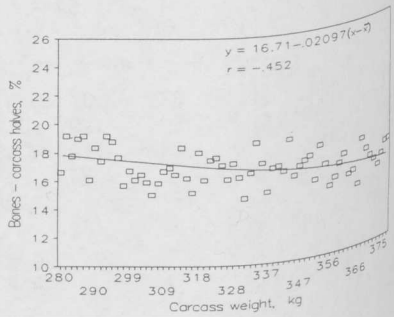
* $p < .05$
** $p < .01$



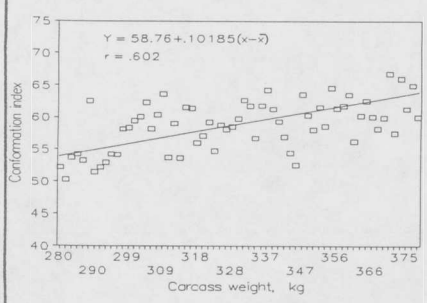
Graph 1



Graph 2



Graph 3



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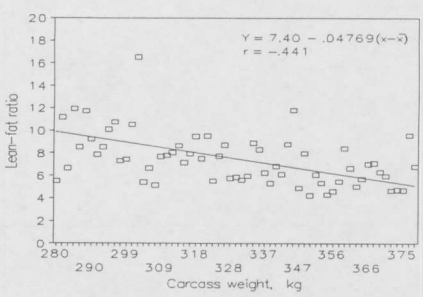

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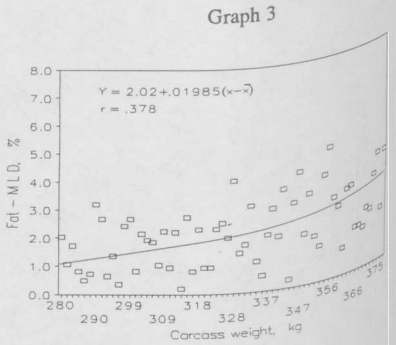

Graph 6

Graphs 1-6: Linear regressions between carcass weight and carcass and meat characteristics

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