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FAT TISSUE DISTRIBUTION BETWEEN SUBCUTANEOUS AND INTERMUSCULAR FAT TISSUE IN SIMMENTAL AND BROWN BULLS

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SUMMARY

Simmental and Brown bulls from progeny testing station were used to evaluate the effect of breed on fat tissue partition between subcutaneous and intermuscular fat. Bulls (37 Brown and 34 Simmental breed) were slaughtered at the same degree of fatness. After slaughter carcasses were first cut into different carcass cuts and further on into lean meat, fat, bones and tendons. Fat was divided up into subcutaneous and intermuscular. Simmental bulls were heavier (average cold carcass side weight from Simmental bulls was 167 kg vs 147 kg from Brown bulls) at the same percentage of total carcass fat (10.5 %). Breed has no effect on percentage of subcutaneous and intermuscular fat tissue nor on percentage of subcutaneous fat from total carcass fat. Simmental bulls had higher (p<0.05) subcutaneous fat percentage (subcutaneous fat in the cut / total fat in the cut) in brisket and flank and lower (p<0.05) in shoulder than Brown bulls.

Key-words: cattle, distribution, fat tissue, cuts

INTRODUCTION

Carcass composition is one of the most important factors that define carcass value (Augustini et al., 1987). Fat tissue represents the most variable carcass component. With increased age and animal weight the proportion of fat tissue increases. The growth of different fat depots is not uniform; kidney and channel fat reach their maximal growth rate first, followed by intermuscular and subcutaneous fat. Therefore, during postnatal growth, the proportion of kidney and channel fat from total side fat decreases whereas the proportion of subcutaneous fat increases (Jonson et al., 1972). Cattle breed is one of the very important factors that affect fat tissue distribution (Berg and Butterfield, 1976). Beef breeds have higher percentage of fat in subcutaneous fat depot, whereas dairy breeds tend to deposit more fat as kidney and channel fat. Beef breeds also deposit more subcutaneous and less intermuscular fat than dairy breeds (Williams, 1978), which is typical for traditional (English breeds like Hereford, Angus) beef breeds. The quantity of subcutaneous fat was, therefore, one of very important selection criteria in those breeds, as only subcutaneous fat can be seen and evaluated after slaughter. Bergen et al. (2006) reported genetic correlations among subcutaneous, intermuscular, body cavity and intramuscular fat. They vary between -0.16 and 0.50, depending on slaughter end point adjustment. Brown and Simmental breeds in Slovenia are dual purpose breeds, whereas in Brown breed dairy traits are more pronounced. Thus, the aim of the present work was to compare the fat distribution between intermuscular and subcutaneous fat in Brown and Simmental bulls.

MATERIAL AND METHODS

Data from 34 Simmental and 37 Brown bulls from progeny testing stations were used in this study. Simmental bulls were fed maize silage and concentrates and Brown bulls maize and grass silage and concentrates, and slaughtered at subjectively defined optimal fatness. After slaughter the right carcass sides were cut into quarters between the 6^{th} and 7^{th} ribs and further dissected to the following cuts: chuck, shoulder, front shank, rib roast, back, loin, tenderloin, brisket, rib, flank, leg and hind shank (Figure 1).

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The cuts were dissected into muscle, subcutaneous fat, intermuscular fat, tendon and bone, and percentage of tissues were calculated. Means and standard deviation forage at slaughter, carcass side weight and carcass tissue composition are presented in Table 1. The average carcass side weight was 167 ±12 kg for Simmental and 147 ±10 kg for Brown bulls, though the Brown bulls were one month and a half older at slaughter than Simmental bulls. So if similar birth weight is assumed, Simmental bulls had higher growth rate than Brown bulls. The percentage of lean meat was slightly higher in Brown bulls (70.82 % vs. 70.33 % in Simmental bulls), whereas the percentage of total carcass fat was lower and of bone higher in Brown bulls.

Statistical analysis was performed by SAS statistical package (SAS, 1999) with GLM procedure. Breed was included as a fixed effect and the percentage of carcass fat as a covariate within breed in the model. Hence the comparison between breeds was made at the same degree of fatness (10.5 % carcass fat).

Table 1. Carcass side weight and tissue composition

	Simmental bulls		Brown bulls	
	$\bar{x}$	sd	$\bar{x}$	sd
Age at slaughter, days	490	37	546	45
Cold carcass side weight, kg	167.07	12.45	147.35	9.99
Lean meat, %	70.33	2.31	70.82	1.76
Total carcass fat, %	11.95	2.44	9.14	1.98
Subcutaneous fat, %	3.41	0.87	2.36	0.68
Intermuscular fat, %	8.54	1.66	6.78	1.38
Tendon, %	1.92	0.21	1.96	0.20
Bone, %	15.80	0.96	18.08	1.21

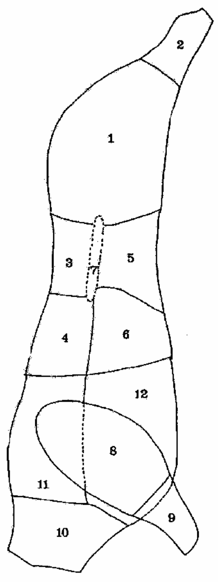

Figure 1. Dissection of right carcass side: leg (1), hind shank (2), loin (3), back (4), flank (5), rib (6), tenderloin (7), shoulder (8), front shank (9), chuck (10), rib roast (11) and brisket (12).

RESULTS AND DISCUSSION

In Table 2 the carcass composition of Simmental and Brown bulls at the same carcass fatness is presented. At the same percentage of total carcass fat the Simmental bulls had cold carcass side weight heavier by 20 kg, a higher percentage of lean meat and a lower percentage of bone ($p<0.05$). Similar results were reported also by Kögel and Alps (1978). They reported lower carcass weight and higher fat percentage in the carcasses for Brown bulls compared to Simmental bulls at the same age.

Simmental bulls had also higher ($p<0.05$) amount of subcutaneous and intermuscular fat in the carcass. The percentage of subcutaneous fat from the carcass and from the total carcass fat in Simmental bulls did not differ between breeds. The subcutaneous fat represented slightly more than one quarter of total carcass fat (26.40 % in Brown and 27.41 %Simmental bulls). Compared with the data from Berg and Butterfield (1976), who reported much higher percentage of subcutaneous fat for Angus and Hereford steers (from around 30 to more then 50 %), these values are relatively low. Nevertheless, the total amount of subcutaneous and intermuscular fat was much higher in their experiment.

We made a comparison at the same percentage of total carcass fat as an indicator of physiological age or animal maturity to eliminate these effects as far as possible. It seems that a breed has only a minor or no effect on carcass fat distribution. Also Robelin et al. (1978) paid attention to the basis of comparison; age, weight, muscle+bone weight and fat weight. Earlier matured animals had more developed subcutaneous fat at the same age or weight. Thus, at the same whole body fatty tissue weight the Friesian bulls exhibited more subcutaneous fat than Charolais and Limousin (Robelin et al., 1978). At the same time Robelin et al. (1978) could not find any differences in allometric growth coefficients for subcutaneous and intermuscular fat when compared with whole carcass fat tissue growth in the above mentioned breeds from 120 to 650 kg of body weight.

Contrary to breed, total carcass fat had significant effect on carcass fat partition. With increased total carcass fat percentage, the percentage of subcutaneous fat in the carcass as well as in the total carcass fat increased (positive regression coefficient for carcass fat percentage not shown).

Table 2. Carcass composition of Simmental and Brown bulls at the same percentage of the total carcass fat (LSMEAN±SEE)

	Simmental bulls	Brown bulls	p-value	
			Breed	Carcass fat,%
Cold carcass side weight, kg	167.55 ± 2.2	147.24 ± 2.2	< 0.001	0.291
Lean meat, %	71.57 ± 0.21	69.89 ± 0.22	< 0.001	< 0.001
Subcutaneous fat, kg	4.90 ± 0.13	4.12 ± 0.13	< 0.001	< 0.001
Subcutaneous fat, %	2.93 ± 0.06	2.79 ± 0.06	0.107	< 0.001
Intermuscular fat, kg	12.70 ± 0.18	11.37 ± 0.18	< 0.001	< 0.001
Intermuscular fat, %	7.58 ± 0.06	7.72 ± 0.06	0.107	< 0.001
Subcutaneous fat from total carcass fat, %	27.41 ±0.56	26.40 ±0.57	0.211	0.001
Bone, %	16.05 ± 0.19	17.66 ± 0.20	< 0.001	< 0.001

In Table 3 the percentage of subcutaneous fat in different carcass cuts from total fat in the cut is presented. Most of the cuts did not differ in the percentage of subcutaneous fat between breeds. Statistically significant ($p<0.05$) differences were found only in shoulder, brisket and flank. Simmental bulls had a lower percentage of subcutaneous fat in the shoulder and a higher percentage in brisket and flank. Brisket and flank are also the cuts that contained the largest percentage of total fat (intermuscular + subcutaneous), and this could be the reason for breed differences observation.

Table 3. Percentage of subcutaneous fat (subcutaneous fat in the cut / total fat in the cut) in different carcass cuts (LSMEAN±SEE)

	Simmental bulls	Brown bulls	p-value	
			Breed	Carcass fat, %
Shoulder, %	21.01 ± 1.02	23.99 ± 1.04	0.045	0.019
Front shank, %	50.86 ± 3.99	44.95 ± 4.07	0.304	0.627
Chuck, %	22.63 ± 2.06	25.29 ± 2.09	0.369	0.741
Rib roast, %	22.58 ± 1.11	21.42 ± 1.13	0.466	0.024
Brisket, %	18.45 ± 1.06	15.11 ± 1.08	0.031	0.043
Leg, %	35.51 ± 0.82	34.35 ± 0.84	0.324	0.018
Hind shank, %	53.23 ± 3.64	53.18 ± 3.69	0.993	0.004
Loin, %	75.28 ± 3.09	72.44 ± 3.15	0.522	0.701
Back, %	38.08 ± 1.94	34.84 ± 1.98	0.247	0.127
Rib, %	26.51 ± 1.81	27.45 ± 1.84	0.717	0.288

Flank, %	32.14 ± 1.26	27.14 ± 1.28	0.007	0.089

CONCLUSION

The presented results assumed that the differences in fat tissue distribution between intermuscular and subcutaneous fat depots in Simmental and Brown bulls at the same degree of fatness were relatively small and negligible. Simmental bulls had a higher percentage of subcutaneous fat in the carcass and in the total carcass fat, but the difference were not statistically ($p<0.05$) significant. Simmental bulls exhibited a lower percentage of subcutaneous fat in shoulder and a higher percentage in brisket and flank.

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