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COMPOSITION OF CARCASS CUTS IN YOUNG SIMMENTAL BULLS AND HEIFERS

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ABSTRACT

The proportions of main cuts (tender loin, leg, back, shoulder, upper and lower sub-shoulder, ribs, breast, neck, belly, front and hind shank) and tissues (muscle, fat, bones and connective tissue) in the carcasses of young Simmental bulls (n = 13) and heifers (n = 13) were determined by carcass dissection and compared. Bulls had higher proportion of shoulder, neck and front shank while the share of back, ribs and breasts were higher in heifers. The share of carcass cuts of category II was higher in bulls. They also had higher proportion of muscle in most of the main cuts (leg, back, shoulder, upper and lower sub-shoulder, breast, neck and belly). In contrast, the proportion of fat tissue was generally higher in heifers' cuts (leg, shoulder, upper and lower sub-shoulder, ribs, breast, neck and belly). Consequently, the proportion of muscle tissue was higher in all carcass cuts categories in bulls while share of fat tissue was higher in heifers. Proportions of bones and connective tissue in the main cuts and carcass cuts categories were similar between bulls and heifers. Overall, the average share of muscle, fat, bones and connective tissue in the carcass halves was 70.45, 7.46, 16.33 and 5.76% in bulls, and 67.09, 10.72, 16.25 and 5.94% in heifers, respectively.

Key words: cattle / breeds / Simmental breed / carcass / composition

SESTAVA POSAMEZNIH KOSOV KLAVNIH POLOVIC MLADIH LISASTIH BIKOV IN TELIC

IZVLEČEK

Delež posameznih kosov (pljučne pečenke, stegna, hrbta, plečeta, zaplečja, reber, prsi, vratu, potrebušine in sprednje in zadnje goleni) in delež posameznih tkiv (mišično, maščobno tkivo, kosti in kot) v posameznih kosih smo ugotavljali s pomočjo razreza klavnih polovic mladih lisastih bikov (n = 13) in telic (n = 13). Biki so imeli večji delež plečeta, vratu in prednje goleni, medtem ko je bil delež hrbta, reber in prsi večji pri telicah. Delež drugorazrednih kosov je bil večji pri bikih, ki so imeli tudi večji delež mišičnega tkiva v večini glavnih kosov klavnih polovic (stegno, hrbet, pleče, prsi, vrat in potrebušina). Nasprotno pa je bil delež maščobnega tkiva večji v klavnih kosih telic (stegno, pleče, zaplečje, rebra, prsi vrat in potrebušina). Delež mišičnega tkiva je bil v vseh kategorijah klavnih kosov večji pri bikih, delež maščobnega tkiva pa pri telicah. Delež kosti in kit je bil v glavnih kosih klavnih polovic podoben pri bikih in telicah. Tako je znašal delež mišičnega tkiva, maščobnega tkiva, kosti in kit pri bikih 70,45, 7,46, 16,33 in 5,76 % ter pri telicah 67,09, 10,72, 16,25 in 5,94 %.

Ključne besede: govedo / pasme / lisasta pasma / klavne polovice / sestava

INTRODUCTION

In 2007, the annual production of all categories of beef in Croatia ranged between 70 and 75 thousand tons, as estimated by the meat producers' association ¨Croatiastočar¨ (Babić, 2008).

Within the total quantity, the meat of bulls and beef heifers accounted for about 45 thousand tons, cow meat about 20 thousand tons and veal about 10 thousand tons. In comparison with 2006, beef production was increased by 20% and it was for the first time after 2000, that Croatia has once again reached the self-sufficiency level of beef production. The average annual consumption of beef in Croatia amounts to 9.2 kg of beef and 2.2 kg of veal per capita (Statistical Yearbook, 2007). The export of beef has also increased, so that in 2007 it amounted to about 3.5 thousand tons. Meeting of the home market demand and the increase of both the export and number of domestic beef cattle (37 291 of 86 331 heads fattened during 10 months of 2007), shows an upward trend of recovery for this, once very important, branch of Croatian livestock production. For example, in the period between 1981 and 1998, the annual export to foreign markets was on average 19 thousand tons of live beef cattle and 12.8 thousand tons of beef and beef products (Pankretić, 1998). Traditionally, the most important export markets are Italy, about 90% of total sales, and Greece with about 5% (Kolega *et al*., 2003). In Italy, the average annual consumption of beef per capita is high, about 24.5 kg, (FAOSTAT, 2004) and domestic beef production does not cover the needs of local market. For example, in 2005, it covered only 68% of beef needs (Cozzi, 2007), and consequently, the import of live cattle and beef from other countries is significant. Beef production in the European Union (EU-27) is in general insufficient and import from the third countries is a necessity. According to estimations of the European Commission, the import of beef in EU-27 in the period 2007–2014 will increase further and it is expected to reach the level of 741 thousand tons in 2014 (EC Directorate-General for Agriculture and Rural Development, 2007). Preferential quota for export of the Croatian beef in the EU countries amounting to 9.4 thousand tons has not yet been reached, and the national beef producers will have good opportunities for market expansion in the coming years, especially regarding export to traditional markets, such as Italy.

The trend of recovery of the Croatian beef production in recent years and the potential to renew the export of beef to some traditional European markets (Kolega *et al*., 2003) have actualised research of the locally produced baby beef. Distribution within the EUROP classes and traits of carcasses and meat of young Simmental bulls and heifers for the Italian market have been presented in some of earlier published works (Karolyi *et al*., 2006a, b; Karolyi *et al*., 2006b). In this work, the shares of main cuts and tissues (muscle, fat, bones and connective tissue) in the carcasses of young Simmental bulls and heifers were analysed.

MATERIAL AND METHODS

The investigation was carried out on twenty six young Simmental cattle (a total of 13 bulls and 13 heifers) calved and reared in Croatia. Fattening and slaughtering procedure were as it was described previously by Karolyi *et al*. (2006a). The average weight of bulls before slaughter was 510 kg and of heifers was 455 kg. At the time of slaughter the animals were at the age of about 12 months. Carcass tissue composition was determined by dissection of right side of each carcass. The average weight of right carcass side of bulls was 138 ± 8 kg and of heifers was 121 ± 12 kg. The sides were divided into the quarters by cut between eighth and ninth rib and then into the cuts according to DLG method (Scheper and Scholz, 1985). Carcass cuts: tender loin, leg, back, shoulder, upper sub-shoulder, lower sub-shoulder, ribs, breast, neck, belly, front and hind shank were weighed and dissected into the muscle, bone, fat and connective tissue. The total weight of separated tissues was used as the denominator for calculating proportions of particular tissue in the cuts. The proportion (%) of cuts in the carcass and its tissue composition (means ± standard deviation) of bulls and heifers were compared by Student t-test using PROC TTEST Statement (SAS, 1999). The pooled test for equal variances was used for group

comparison, except for the proportion of shoulder and connective tissue in the neck where Satterthwaite method for unequal variances were used.

RESULTS AND DISCUSSION

Proportion of main carcass cuts and tissue composition of young Simmental bulls and heifers are presented in Table 1. Bulls had a higher proportion of shoulder (15.23 vs. 13.84%, $P < 0.01$), neck (7.50 vs. 6.65%, $P < 0.01$) and front shank (3.29 vs. 3.10%, $P < 0.01$) in the carcass while the share of back, ribs and breasts were higher in heifers (8.81 vs. 8.31%, $P < 0.01$; 4.80 vs. 4.27%, $P < 0.05$; 6.68 vs. 6.24%, $P < 0.05$, respectively). Proportions of other cuts were similar ($P > 0.05$) between sexes. The most prominent difference in carcass cuts proportion between bulls and heifers was for the share of shoulder and neck, regions with normally greater muscle deposition in bulls (Purchas, 2003). The average share of most valuable category of carcass cut (tender loin) and carcass cut of category I (leg) were similar ($P > 0.05$) in both, bulls (2.02 and 30.33%, respectively) and heifers (2.05 and 30.62%, respectively). The average share of carcass cuts of category II (back and shoulder) was higher ($P < 0.05$) in bulls (23.54%) than in heifers (22.66%) while the shares of carcass cuts of category III (upper sub-shoulder, lower sub-shoulder, ribs, breast, neck, belly, front and hind shank) did not differ ($P > 0.05$) between bulls (44.12%) and heifers (4.68%).

When a somewhat different method of dissection into main cuts was applied in beef cattle carcass halves of 169 kg average weight, Aleksić *et al*. (2007) found the average shares of 29.2%, 23.5% and 47% of carcass cuts of category I, II, and III respectively. In Simmental bulls of Slovenian progeny testing stations, with average carcass half weight of 165 kg the average shares of category I, II, and III were 28.6%, 24.2% and 44.9% respectively (Žgur *et al*., 2006).

The proportion of muscle tissue (Table 1) in bulls was higher than in heifers in leg (76.97 vs. 75.31, $P < 0.05$), back (69.88 vs. 67.07%, $P < 0.01$), shoulder (15.23 vs. 13.84%, $P < 0.01$), upper sub-shoulder (67.02 vs. 62.97, $P < 0.01$), lower sub-shoulder (61.32 vs. 55.16, $P < 0.01$), breast (59.99 vs. 55.29, $P < 0.01$), neck (77.46 vs. 73.15, $P < 0.01$) and belly (74.40 vs. 67.89%, $P < 0.01$). In front and hind shank the proportions of muscle tissue were similar ($P > 0.05$) between sexes. In ribs the means of dissected tissue were apparently different but proportions were highly variable within the groups, as the degree of infiltration of thoracic fat on muscle between the ribs may greatly vary between animals of different fatness level. The deposition of muscle tissue was highest in bull's neck, leg, belly and shoulder. As regards carcass cuts categories, besides in category I (leg), bulls also had higher ($P < 0.01$) share of muscle tissue than heifers in the cuts of category II (71.80 vs. 68.64%) and III (61.14 vs. 57.31%).

Heifers had higher deposition of fat tissue (Table 1) than bulls in leg (6.03 vs. 4.41%, $P < 0.01$), shoulder (10.84 vs. 7.24%, $P < 0.01$), upper sub-shoulder (8.16 vs. 5.98%, $P < 0.05$), lower sub-shoulder (23.26 vs. 14.97, $P < 0.01$), ribs (24.07 vs. 17.97%, $P < 0.05$), breast (22.14 vs. 17.31%, $P < 0.01$), neck (7.75 vs. 4.42%, $P < 0.01$) and belly (22.89 vs. 15.73%, $P < 0.01$). Proportions of fat tissue in front and hind shank were similar ($P > 0.05$) between sexes, while in back, the proportions of dissected fat tissue were quite variable. Proportion of fat tissue in the carcass cuts of category II and III was higher ($P < 0.01$) in heifers (8.55 and 14.51%, respectively) than in bulls (5.90 and 10.50%, respectively). In both heifers and bulls, the highest deposition of fat tissue existed in lower sub-shoulders, belly, ribs and breast. Žgur and Čepon (2000) found preferential fat deposition on these cuts in Simmental and Brown bulls with increased carcass fatness.

Table 1. Proportion (%) of main carcass cuts and tissue composition of young Simmental bulls and heifers

Carcass parts	Bulls	Heifers	T-test
Tender loin	2.02 ± 0.14	2.05 ± 0.21	NS
Leg	30.33 ± 0.68	30.62 ± 1.03	NS
Muscle	76.97 ± 1.75	75.31 ± 1.42	*
Fat	4.41 ± 1.35	6.03 ± 1.37	**
Bones	13.34 ± 0.77	13.24 ± 0.84	NS
Connective tissue	5.27 ± 1.01	5.42 ± 1.59	NS
Back	8.31 ± 0.43	8.81 ± 0.43	**
Muscle	69.88 ± 2.37	67.07 ± 2.59	**
Fat	4.56 ± 1.75	6.27 ± 2.76	NS
Bones	20.48 ± 1.74	20.22 ± 1.98	NS
Connective tissue	5.10 ± 1.89	6.45 ± 2.47	NS
Shoulder	15.23 ± 0.66	13.84 ± 1.27	**
Muscle	73.72 ± 2.55	70.21 ± 2.37	**
Fat	7.24 ± 2.29	10.84 ± 2.02	**
Bones	14.61 ± 0.72	14.34 ± 0.93	NS
Connective tissue	4.43 ± 1.30	4.60 ± 2.14	NS
Upper sub shoulder	7.93 ± 0.40	7.68 ± 0.31	NS
Muscle	67.02 ± 3.06	62.97 ± 3.11	**
Fat	5.98 ± 1.49	8.16 ± 2.39	*
Bones	19.58 ± 2.05	20.71 ± 1.70	NS
Connective tissue	7.42 ± 1.55	8.16 ± 2.68	NS
Lower sub shoulder	5.03 ± 0.59	5.42 ± 0.45	NS
Muscle	61.32 ± 3.89	55.16 ± 4.17	**
Fat	14.97 ± 3.99	23.26 ± 4.29	**
Bones	18.98 ± 1.53	17.38 ± 1.87	*
Connective tissue	4.73 ± 1.58	4.21 ± 2.08	NS
Ribs	4.27 ± 0.46	4.80 ± 0.50	*
Muscle	57.21 ± 8.12	53.25 ± 8.17	NS
Fat	17.97 ± 6.27	24.07 ± 5.93	*
Bones	16.91 ± 2.11	15.36 ± 2.17	NS
Connective tissue	7.90 ± 4.99	7.33 ± 5.01	NS
Breast	6.24 ± 0.36	6.68 ± 0.54	*
Muscle	59.99 ± 2.94	55.29 ± 2.50	**
Fat	17.31 ± 4.05	22.14 ± 1.92	**
Bones	18.10 ± 1.81	17.45 ± 2.45	NS
Connective tissue	4.61 ± 2.09	5.12 ± 2.50	NS

Table 1. (Continued)

Carcass parts	Bulls	Heifers	T-test
Neck	7.50 ± 0.59	6.65 ± 0.34	**
Muscle	77.46 ± 3.26	73.15 ± 3.85	**
Fat	4.42 ± 1.46	7.75 ± 2.53	**
Bones	15.35 ± 2.91	15.94 ± 2.01	NS
Connective tissue	2.77 ± 0.69	3.16 ± 2.02	NS
Belly	6.19 ± 0.50	6.64 ± 0.73	NS
Muscle	74.40 ± 5.30	67.89 ± 5.64	**
Fat	15.73 ± 4.99	22.89 ± 5.85	**
Connective tissue	9.87 ± 4.48	9.22 ± 4.69	NS
Front shank	3.29 ± 0.16	3.10 ± 0.10	**
Muscle	49.34 ± 1.63	48.96 ± 2.00	NS
Fat	1.48 ± 0.42	1.56 ± 0.42	NS
Bones	41.50 ± 1.76	42.33 ± 2.17	NS
Connective tissue	7.69 ± 2.05	7.16 ± 2.10	NS
Hind shank	3.67 ± 0.22	3.72 ± 0.21	NS
Muscle	42.41 ± 1.92	41.82 ± 1.74	NS
Fat	6.14 ± 1.45	6.21 ± 1.69	NS
Bones	44.03 ± 1.82	44.78 ± 2.48	NS
Connective tissue	7.43 ± 1.62	7.19 ± 1.48	NS
Carcass side			
Muscle	70.45 ± 1.89	67.09 ± 1.75	**
Fat	7.46 ± 1.78	10.72 ± 2.01	**
Bones	16.33 ± 0.79	16.25 ± 0.89	NS
Connective tissue	5.76 ± 0.90	5.94 ± 1.29	NS

NS = $P > 0.05$, * = $P \leq 0.05$, ** = $P \leq 0.01$

Proportion of bones in individual carcass cuts was similar ($P > 0.05$) between bulls and heifers, except for lower sub-shoulder cut where it was higher in bulls (18.98 vs. 17.38%, $P < 0.05$). The average shares of bones in the carcass cuts of category I, II and III were 13.34, 17.54 and 24.92% in bulls and 13.23, 17.28 and 24.85% in heifers, respectively.

Proportion of connective tissue in carcass cuts did not differ ($P > 0.05$) between sexes with average values of cuts in category I, II and III of 5.27, 4.76 and 6.55% for bulls and of 5.27, 5.53 and 6.44% for heifers, respectively.

Considering the whole carcass halve composition, dissection showed higher ($P < 0.01$) proportion of muscle tissue in bulls and fat tissue in heifers. In the carcass halves the average share of muscle, fat, bones and connective tissue was 70.45, 7.46, 16.33 and 5.76% in bulls, and 67.09, 10.72, 16.25 and 5.94% in heifers, respectively.

CONCLUSIONS

Dissection of carcass cuts of young Simmental bulls and heifers showed the rather marked difference between males and females in the proportion of muscle and fat tissue. Bulls were more developed in front shank, shoulder and neck region due to higher deposition of muscle in these cuts. They also had higher share of muscle tissue in leg, back, upper and lower sub-shoulder, breast and belly. In contrast, heifers had higher share of back, ribs and breasts with higher proportion of fat tissue in leg, shoulder, upper and lower sub-shoulder, ribs, breast, neck and belly. Consequently, the share of muscle tissue was higher in bulls in all carcass cuts categories while share of fat tissue was higher in heifers. In both, heifers and bulls the highest deposition of fat tissue was found in lower sub-shoulder, belly, ribs and breast. Proportions of bones and connective tissue in the main cuts and carcass cuts categories were similar both in bulls and heifers.

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