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QUALITY OF BEEF FROM YOUNG BULLS IN EXTENDED FATTENING

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Abstract

This paper presents the results from a study on the quality of beef obtained by slaughtering of young bulls with final mass of over 650 kg. In particular, bearing in mind the diminishing number of breeding animals in Serbia, it is essential that future fattening technology is based on the increase in pre slaughter body mass, in order to compensate the reduced number of cows and heifers and thus the production of beef. One of the ways for a fast and efficient increase of beef production per head is the increase in pre-slaughter body mass in order to provide greater quantity of beef per head. The current production practices are mainly finishing cattle fattening with about 450 kg to 500 kg. Based on the study results, it can be concluded that the group A (weight group of 650 kg) achieved a higher dressing percentage of warm, and cold carcass. The study of technological and sensory properties indicates that the group B (weight group of 500 kg) showed less cooking loss, while for other traits no difference was recorded. Overall it can be concluded that the increase in pre slaughter body mass can provide more than 30% of the amount of meat without diminishing the quality of beef.

Key words: cattle production, breeds, pre-slaughter mass, male cattle, carcass quality, meat quality

Introduction

Cattle production is an important branch of livestock production in Republic of Serbia. Situation in cattle production is unsatisfactory both in terms of production per head and per number of animals, which in recent years has been decreasing steadily (Aleksić et al., 2007). Our country has been a traditional exporter of beef, processed meat products and fattened cattle to many countries, among them the most developed, especially Italy and Greece. Export of beef was particularly booming right prior to the entrance of Italy (1974) and Greece (1980) into the European Economic Community. Thus, for example, in 1974, we exported 50 500 t/year to the Italian market, and in 1980 - 51 310 t (Aleksić et al., 2005) and 25 registered slaughterhouses had EU certificates.

Situation in cattle production in the Republic of Serbia

Beef production is largely based on domestic spotted cattle of Simmental type, Simmental and to a lesser extent Holstein-Friesian breed and crossbreeds.

According to official statistical data, the state of the cattle production is assessed as not favorable (Republic Statistical Office of Serbia). The number of heads is in constant decline and thus the production of beef as well.

The data in Table 1 indicate that the number of cattle in this period decreased by 27%. Due to the decrease the number of calves for fattening was also reduced. The Republic of Serbia in 1996 had a license to export beef to the EU - quota for export of "baby beef" to that market of 10

Table 1
Number of cattle and beef meat production in R Serbia

Year	Nu.of cattle	Beef meat (t)
2000	1 246.00	104.000
2005	1 079.00	90.000
2011	938.000	81.000
2013	921.000	70.000

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000 t, and the quota is now reduced because the limit has not been achieved. Today, only 650 t - 700 t are exported of the total permissible export preferential quotas in the EU of 8870 tones.

The Republic of Serbia in the near future will become member of European Union (EU) and the World Trade Organization (WTO), which means that livestock production should prepare for competition on unique developed market, without any state trade barriers. Serbia has been preparing for this since 2006 with the signing of bilateral free trade agreements with neighboring countries (Central European Free Trade Agreement, CEFTA) and thus has become part of the market and accepted the competition rules of the free market. Accession to the EU and WTO includes liberalization of trade in livestock products, low possibility for import protection, implementation of quality standards (HACCP, ISO, Global GAP), reduction of domestic support, elimination of export subsidies, increase of profitability and ability to withstand competition in the international market.

All this trends point the need of using the already existing cattle population in order to get more quality beef meat per head. The increase in beef production can be carried out in several ways, such as:

1. Increase in the number of cows and heifers for reproduction (long process);
2. Insemination of the existing population with semen from bulls progeny tested on fattening performance of Simmental breed (long and demanding process) (Pantelić et al., 2011; Kunzi et al., 1978);
3. Crossing the existing population with beef cattle breeds (male and female cattle for slaughter - the population for reproduction is reduced) (Ostojić et al., 2011; Petrović et al., 2011; Augustini et al., 1989);
4. Increase in pre slaughter body mass (Aleksić et al., 2001).

One of the ways for a fast and efficient increase of beef production per head is the increase in pre slaughter body mass in order to provide greater quantities of beef per head. The current production practices are mainly finishing cattle fattening with about 450 kg to 500 kg (Petričević et al., 2015). This paper presents the results obtained in the study of the quality of beef from young bulls slaughtered with the final mass of over 650 kg. In this way more than 30% more meat per head can be provided and it does not diminish the quality of beef. In particular, taking into account the reduction of breeding animals in Serbia, it is necessary that future fattening technology is based on the increase in pre slaughter body mass in order to compensate the reduced number of cows and heifers and therefore production of beef.

Materials and Methods

The study was conducted on male fattening young cattle. Fattening was carried out on the experimental cattle farm of the Institute for Animal Husbandry, Belgrade-Zemun. The cattle were kept in free system of housing and fed diet with whole plant silage, hay and concentrate. Young cattle were slaughtered in the experimental slaughterhouse of the Institute. A total of 73 male beef cattle were slaughtered, of which 41 with average mass of 667 kg (group A) and 32 average pre slaughter body mass 512 kg (group B). After a 24-hour cooling of the carcasses at +4°C, cutting and separating of the major anatomical parts of the carcasses were performed. Three cut rib, cutted at 9-10-11 rib were separated from the left chilled carcass side, cut at the cranial edge of the 9th and 11th rib and cut parallel to the spinal column.

Technological properties of the sample M. longissimus dorsi, namely: cooking loss was determined on the basis of the mass difference of the piece of meat (size: 3 x 4 x 1.5 cm and a mass of about 70 grams) before and after cooking in distilled water (where the ratio of meat and water was 1:2) in a closed glass vessel (at 100°C for 10 minutes) and expressed as the percentage relative to the mass of the sample prior to cooking (Official Gazette of SFRY no. 2/85, 12/85 and 24 / 86); roasting loss was determined on the basis of the difference in mass of the pieces of meat before and after cooking; the cut of M. longissimus dorsi muscle, which was transversely cut to provide the direction of muscle fibers, weighing 150 ± 1 g was wrapped in aluminum foil and baked for 25 minutes at 250°C. Subsequently, it was extracted from the foil and immediately measured. The softness (tenderness) of meat was determined using consistency meter by Volodkevich (1938) by cutting pieces of meat transversely to the direction of the muscle fibers. Determination of total pigments according to Horsney (Bunning and Hamm, 1970) and instrumental color measurement was done using Chroma Meter CR-400 (Minolta, Japan), which had been previously calibrated in relation to a standard white surface (illumination D65, viewing angle 20°C and the opening of the probe 8 mm) on fresh meat samples (24 hours post-mortem). Samples of meat were cut off and left 30 min in air to stabilize colour. Colour values are represented in the CIE L*a*b* system (CIE, 1976), where L* is a measure indicating lightness of meat, a* the relative proportion of red and b* relative share of yellow colour. Three readings for each sample of meat were carried out and their average value were used for statistical data processing. The cross-sectional area of M. *longissimus dorsi* was determined on cross section of M. *longissimus dorsi* in the region of 11th

rib by tracing on the tracing paper, and then measuring using the planimeter. The scores of taste, aroma, juiciness/succulence and tenderness of the meat were determined after cooking and after roasting. The quantitative descriptive scale of 5 points was used for each evaluated parameter: marbling: 1-very bad marbling, 2- bad marbling, 3-neither good nor bad marbling, 4-good marbling, 5-very good marbling; taste and odor: 1-very bad, 2-bad, 3-neither good nor bad, 4-good, 5-very good; softness/tenderness: 1-very firm, 2-firm, 3-neither firm nor soft, 4 soft, 5-very soft; juiciness/succulence: 1-very dry, 2-dry, 3-neither dry nor succulent, 4-succulent, 5-very succulent.

Results and Discussion

Table 2 shows the slaughter results for examined cattle. It should be noted that the yield of warm and cold carcass is slightly higher in group A.

Cattle from prolonged fattening had good covering of the carcass which contributed significantly to lower cooling loss during ripening of meat in cold storage.

Table 3 shows the results of basic anatomical parts of the carcass. Based on these results we can see that the only difference was observed in the rib eye mass in favor of B group of cattle.

Table 2
Average values of slaughter traits of beef cattle

Indicator	A	B	t-test
Pre-slaughter mass, kg	667.48± 30.15	512.67 ± 32.75	***
Warm carcass mass, kg	392.45± 20.66	295.67 ± 25.59	***
Warm carcass dressing percentage, %	58.80 ± 1.81	57.49 ± 2.19	**
Warm carcass mass without fat (tallow), kg	386.31 ± 20.03	279.98 ± 22.49	***
Warm carcass dressing percentage without fat (tallow), %	57.88 ± 1.75	55.66 ± 1.75	***
Kidney fat (tallow), %	0.90 ± 0.41	0.98 ± 0.69	ns

ns – not significant; *** $p<0.001$; ** $p<0.01$

Table 3
The share of main beef carcass side parts

Carcass side parts, %	A	B	t-test
Round	28.33 ± 1.51	28.77 ± 2.11	ns
Shoulder	12.50 ± 1.12	12.66 ± 1.60	ns
Back loin part	9.99 ± 1.38	10.27 ± 0.88	ns
Rib eye	1.13 ± 0.24	1.49 ± 0.34	***

ns – not significant; *** $p<0.001$

Table 4
Share of muscle, fat tissue and bone in the main parts of beef carcass sides

Carcass part/tissue, %	A	B	t-test
Round			
Meat	83.84 ± 3.13	82.83 ± 2.76	ns
Fat	2.75 ± 1.59	3.40 ± 2.54	ns
Bone	13.08 ± 2.21	13.54 ± 1.69	ns
Sholder			
Meat	81.48 ± 2.88	80.75 ± 2.62	ns
Fat	1.78 ± 0.77	1.83 ± 1.61	ns
Bone	16.48 ± 2.69	17.16 ± 1.91	ns

ns – not significant

Also, in both groups of studied beef cattle there was no difference in terms of the meat, fat and bones ratio which can be seen in Table 4.

Table 5 confirms that in three rib cut there were no differences in terms of the meat, fat and bones ratio.

Table 6 and Table 7 show that meat cooking loss was higher in group A and in terms of sensory tenderness/softness was better in group B.

Conclusion

Based on the study results, it can be concluded that the group A (weight group of 650 kg) achieved higher dressing percentage of warm and cold carcass. Testing of technological and sensory traits indicate that the group B (weight group of 500kg) had less cooking loss, while for other traits there was no difference. Overall it can be concluded that the in-

Table 5
Share of tissues in three rib cut

Item	A	B	t-test
Three rib cut, %			
M. longissimus dorsi	35.89 ± 3.37	37.44 ± 5.02	ns
Remaining muscle tissue	30.67 ± 3.90	29.20 ± 4.13	ns
Fat tissue	14.11 ± 4.03	13.92 ± 5.96	ns
Binding tissue	0.97 ± 0.45	1.19 ± 0.43	ns
Bones	18.08 ± 3.46	17.71 ± 3.82	ns

ns – not significant

Table 6
Technological characteristics/properties of *M. longissimus dorsi*

Item	A	B	t-test
Total pigments, mg/kg	162.82 ± 41.67	127.20±42.31	*
Cooking loss, %	42.75±1.47	34.88±6.07	***
Roasting loss, %	40.30±2.31	40.04±2.14	ns
Colour	37.56±1.77	36.91±1.10	ns
Tenderness	11.86±2.80	9.39±3.45	**
Cross section surface, cm^2	104.83±13.37	92.68±15.68	**

ns – not significant; *** $p<0.001$; ** $p<0.01$; * $p<0.05$

Table 7
Sensory characteristics/properties of *M. longissimus dorsi*

Item	A	B	t-test
Cooked meat			
Aroma	4.81±0.32	4.79±0.37	ns
Taste	4.67±0.46	4.64±0.53	ns
Tenderness	3.62±0.71	4.29±0.70	**
Succulence	3.71±0.46	4.09±0.75	*
Roasted meat			
Aroma	4.32±0.37	4.89±0.21	***
Taste	4.25±0.32	4.44±0.38	ns
Tenderness	3.31±1.14	3.54±1.05	ns
Succulence	3.32±0.93	3.56±0.98	ns

ns – not significant; *** $p<0.001$; ** $p<0.01$; * $p<0.05$

crease in pre slaughter body mass can provide over 30% more meat per head and without diminishing the quality of beef.

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