

STUDY OF FATTENING AND SLAUGHTER TRAITS OF CATTLE UNDER THE INFLUENCE OF FLAX SEED BASED NUTRITION

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Abstract: The trial was designed in order to examine the impact of flax seed in the nutrition of young cattle/bulls, in the final stage of the fattening. In the trial, 30 bulls of Simmental breed of uniform initial weight were selected, divided into 2 groups (control and experimental). The control animal group did not consume flax seed as a food supplement. Cattle of the experimental group consumed flax seed in an amount of 3.75% (300 g per day) of concentrated meal in the last 90 days of fattening, i.e. 300 g per day. The study included the examination of the fattening performance, slaughter traits and the composition of the bovine carcass. After slaughtering, warm carcass sides, with and without kidneys, were measured individually. Subsequent to period of cooling, the left carcass side it was cut into the main carcass parts according to the Rulebook. The results of the study showed that the addition of flax seed in the diet did not have a statistically significant effect on the body weight of bulls at the end of the trial. It was found that the addition of flax seed in the feed during the final stage of fattening did not have an impact on the differences in the average overall gain of bulls and the feed conversion ratio. Based on the data obtained by cutting of carcass sides to main parts, it was established that feeding with flax seeds had no significant effect on the share of carcass parts.

Key words: flaxseed diet, young bulls, Simmental breed

Introduction

Beef is considered to be "meat of the highest quality" in most countries because of its biological value and sensory properties. The economic effect, which is reflected in achieving the best possible results with minimal costs of production,

is important to the cattle producers. The economy of slaughtering and processing and technological quality is an important aspect for the slaughter industry, and for the consumer sensory, and increasingly nutritious quality of meat. *Pavlovski et al. (2003)* state that European consumers prefer less fatty, less caloric beef, while English consumers prefer fatty, succulent meat.

For producers, the quality of cattle depends on the properties (body weight) which have the greatest impact on the price when sold. The most important factor responsible for changes in carcass properties are the genetic traits that influence the fat deposition and structure and properties that can alter the meat quality (*Prado et al., 2008b; Prado et al., 2009; Rotta et al., 2009a*). Depending on the requirements of the final consumer, meat quality can be defined in several ways: carcass quality, nutritive, sensory and technological quality.

The amount of fatty tissue and its distribution has a significant role in the carcass value, as an excessive amount of fatty tissue can have a negative economic effect. An excess of intermuscular or subcutaneous fat tissue is eliminated in the treatment/processing of the carcass or main carcass parts and represents an economic loss for producers and processors (*Harper et al., 2001*).

The quality of carcasses of slaughtered animals is a matter of interest both in primary production and in the meat industry (*Petrović et al., 2016*). Based on the estimated value of carcasses of slaughtered animals and classification in classes, it is possible to make appropriate financial compensation to producers and in this way stimulate them to produce slaughter animals of the highest quality. The criterion for evaluating the beef carcass is mostly its weight, conformation, carcass covering with fatty tissue and the ratio of muscle and fat tissue.

The body weight of the cattle before slaughter has a significant effect on the carcass yield, the meat yield and the quality of the meat. In Serbia, Domestic Spotted beef is the most prevalent breed, with 45% in 2000 (*Petrović et al., 2001*). *Aleksić et al. (2001)* state that the quantity and quality of meat is a phenotypic characteristic in the function of genotype and nutrition. With the increase in weight and age of the animal, the yield and the lean meat content of the carcass also increase (*Pečiulaitienė et al., 2015*). *Petrović et al. (2016)* state that the heifers of the body weight of 450–500 kg show slaughter yields of 42–56%, and the heifers of the body weight of 550–600 kg 49–57%. The male cattle of the Domestic Simmental breed of average weight of about 554 kg achieve higher slaughter yields compared to those of the same breed of average body weight of 509 kg (*Aleksić et al., 2009*).

One of the most important factors that significantly affects the quality of beef carcass and meat is nutrition (*Abrahão et al., 2005; Prado et al., 2008a*). A diet for fattening beef cattle must be balanced in terms of the contents of dry matter, energy, protein, mineral matter and vitamins. Cereals are the main source of energy in the final fattening phase, but oils and fats can also be used as alternative components (*Rotta et al., 2009b*). It is very important that the meal also tastes

good, so that the animals consume it better. If more concentrates are present in the meal, the gain will be higher, the duration of fattening will be shorter, but also more expensive, so the diet should include roughage. Nutrition is an important factor that affects the production of meat.

Flaxseed is used in animal nutrition because of the specific and, from the nutritional aspect, preferred fatty acid composition. This property makes flaxseed an extremely interesting raw material for the production of functional feeds that can increase the intake of essential fatty acids in the organism of animals and, consequently, change the fatty acid composition of fat and meat through which the intake of essential fatty acids can be increased in the human organism (*Larsen et al., 2012*). Given the high content of oil, flaxseed is used in the diet of cattle as a source of fat. Flaxseed can also be used as an alternative source of protein in ruminant nutrition, but in limited quantities due to high oil content (*Lardy and Anderson, 1999*). Heat treated flaxseed (by toasting, extruding) has a greater influence on the meat yield than the untreated seed (*Maddock et al., 2004*). In recent years, the functional feeds are being used in livestock production intensively, with the goal of improving the health and general condition of the organism of animals, improving the growth and better conversion of food.

Materials and methods

The research was carried out on the experimental farm and in the experimental slaughterhouse of the Institute for Animal Husbandry in Zemun (Serbia). In the study, male cattle of Domestic Simmental breed were used. In the trial, 30 Simmental young bulls of uniform weights were selected (431 kg), which consumed the food of the same composition until reaching the age of 390 days. The feeding of cattle prior to trial was carried out according to existing diet composition norms for these cattle used on the farm of the Institute for Animal Husbandry (whole maize silage and concentrate mixture with 12% of the total protein). The fattening of young bulls was in the free system. In order to fulfil the trial objective, it was necessary to prevent the movement of the animals when consuming a concentrated portion of the meal, so that we can reliably claim that each animal consumed the predetermined amount of concentrate. At the age of 390, two groups of 15 cattle were formed: the control group (CON) in which the cattle did not consume heat-treated flax seed and the experimental group (FXS) in which the part of the concentrate was replaced by heat-treated flax seeds, so that each animal consumed 300 g of flax seeds per day. The final pre-slaughter weights were about 570 kg. One day before slaughter, the bulls did not receive food, but they had free access to water. Slaughtering and primary processing were performed in the experimental slaughterhouse of the Institute for Animal Husbandry. Animals were measured immediately before slaughter and then slaughtered according to standard

commercial procedures. After primary processing, the carcasses were chilled at 4°C for the next 24 hours. The weight of the warm carcass, the weight of the intestines (heart, lungs, liver, kidneys, spleen and tongue), head, tail and kidney fat was measured one hour post- slaughter and chilling. After chilling, the carcasses were measured and split along the vertebral column in two halves, and the left side was used for all measurements. The left side of each carcass was divided into twelve anatomical regions: round, beefsteak, loin, shoulder, back, neck, chest, short ribs, ribs, flank, fore shank and leg, using a standard technique.

The obtained data were processed by analysis of variance in one-way ANOVA program SPSS Statistics 20, and all results are displayed as the mean value \pm standard deviation. The statistical significance of the difference between mean values was determined by t-test.

Results and discussion

The results for fattening and slaughter traits of the young bulls are shown in Table 1. CON had better gain and feed conversion ratio, but there was no statistical significance between the established differences ($p > 0.05$). The addition of flax seed in the cattle feed did not have a significant effect ($p > 0.05$) on the pre- and post-slaughter weight of the carcass, as well as the yield of warm and cooled carcass. The determined values were similar among groups of cows. The larger pre- slaughter weight was recorded in CON. The weight of warm carcasses with and without fat tissue and weight of cold carcasses without fat tissue were higher in CON. The yield of warm carcasses with and without fat tissue, as well as of the cooled carcass without fat tissue were higher in FXS.

Table 1. Average values of fattening and slaughter traits of cattle/young bulls

	CON	FXS	p
ADG ¹ (kg)	1.59 \pm 0.43	1.48 \pm 0.29	ns
Feed conversion (kg)	7.23 \pm 0.73	7.74 \pm 0.89	ns
Weight PS ² (kg)	576.25 \pm 25.36	561.67 \pm 11.93	ns
Weight WC ³ with fat (kg)	337.52 \pm 19.83	332.50 \pm 9.32	ns
Yield WC ³ with fat (%)	58.56 \pm 1.53	59.23 \pm 2.59	ns
Weight WC ³ without fat (kg)	333.50 \pm 19.33	328.33 \pm 9.07	ns
Yield WC ³ without fat (%)	57.85 \pm 1.32	58.49 \pm 2.53	ns
Weight CC ⁴ without fat (kg)	326.82 \pm 18.96	321.63 \pm 9.17	ns
Yield CC ⁴ without fat (%)	56.70 \pm 1.27	57.30 \pm 2.53	ns
MLD ⁵ Cross section surface (cm ²)	100.95 \pm 16.35	109.94 \pm 11.00	ns
Kidney fat (%)	0.70 \pm 0.24	0.74 \pm 0.06	ns
CL Cooling loss ⁶ (%)	3.17 \pm 0.44	3.27 \pm 0.05	ns
Head (%)	2.59 \pm 0.09	2.65 \pm 0.14	ns
Tail (%)	0.17 \pm 0.02	0.21 \pm 0.06	ns

¹ ADG – average daily gain; ² PS – Pre- slaughter; ³ WC – Warm carcass; ⁴ CC– cooled carcass; ⁵ MLD – *Musculus longissimus dorsi*; ⁶ CL – loss of weight during cooling; ns – not significant

Maurić et al. (2016) state that the slaughter yield of the Simmental cattle ranges from 58.11–59.95% in pre-slaughter body weights from 526–588 kg. *Iwanowska and Pospiech (2010)* have established a yield of 54.96% for the Simmental breed in the body weight before slaughter of 595 kg, with a warm carcass weight of 327 kg. The results of a study by a large number of authors confirm that the use of heat-treated flax seeds in beef nutrition has no significant effect on the quality of the carcass (*Dawson et al., 2010; Barton et al., 2007; Leanne, 2008*). *Quinn et al. (2008)*, *Şentürkklü and Landblom (2014)*, *Hernández-Calva et al. (2011)* and *Corazzin et al. (2012)* have found no significant differences in the final weight and slaughter yield between groups of cattle depending on the diet with flaxseed. *Albertía et al. (2014)* confirm that the consumption of concentrate mixture with the addition of 5% of flax seed has no effect on the carcass traits. Likewise, *Maddock et al. (2003; 2004)* and *Alvarado-Gilis et al. (2015)* find that the addition of 3–6% of flax seeds in the final nutrition of cattle does not affect the carcass traits. Results obtained by *Maddock et al. (2006)* show that the inclusion of 8% of flax seeds in the diet improves the carcass traits but it can lead to an increase in the amount of fat that negatively affects some of the properties of meat quality. *Kim et al. (2004)* have established higher slaughter yields of the cattle (57.8% and 57.7%) fed diets containing 10% and 15% of flax seeds in relation to the control group (57.1%), but these differences were not statistically significant. These authors have concluded that flax seed is an acceptable source of fat without adversely affecting the final fattening of the cattle. According to *Drouillard et al. (2002)* the inclusion of flax seed in the diet for cattle at different ages has no significant effect on the carcass traits compared to those who did not consume the flax seed. In general, the results of these studies are in accordance with the data presented in our study where it has been established that flax seed has no significant effect on the differences in the slaughter properties of beef carcasses.

The surface of *M. longissimus dorsi* cross section (Table 1) was not statistically significantly different ($p > 0.05$) under the influence of the examined factor. The larger surface area of the *M. longissimus dorsi* was recorded in young bulls of group FXS. *Rotta et al. (2009b)* and *Quinn et al. (2008)* have found a larger surface area of the *M. longissimus dorsi* cross section in cattle that consumed flax seed in the diet compared to cattle without flax seed in their diet. *Maddock et al. (2006)* obtained a larger surface area of the *M. longissimus dorsi* cross section in cattle that consumed 8% of the ground flax compared to the young bulls consuming the same amount of whole flax seed.

The loss of weight after 24 hours of cooling of the carcass sides at a temperature of -1 to +4°C did not differ significantly ($p > 0.05$) between the tested groups. *Hernández-Calva et al. (2011)* state that the loss of weight during cooling did not significantly change under the influence of flax seed nutrition.

The share of the main carcass parts is shown in Table 2. The shares of the most valuable parts of the carcass (beefsteak and round) were approximately the same between the groups and showed no statistically significant ($p > 0.05$) differences between the groups. In the CON and FXS group the same value for the share of beef steak was determined. The share of round varied from 28.05% in CON to 28.97% in FXS. The shares of the loin part, back, shoulders and short ribs were not significantly different ($p > 0.05$) between the groups under the influence of the examined factor. The share of loin ranged from 4.84% to 5.32%. A higher share of the back was determined in CON. FXS showed lower share of the shoulder, while the share of the short ribs was higher.

Table 2. The effect of the addition of flax seed in the feeding of cattle on the share of main carcass parts *

(%)	CON	FXS	p
Beef steak	2.41 ± 0.45	2.41 ± 0.25	ns
Round	28.05 ± 1.21	28.97 ± 0.29	ns
Loin	4.84 ± 1.15	5.32 ± 0.61	ns
Back	5.48 ± 0.69	5.32 ± 0.33	ns
Shoulder	12.60 ± 0.73	11.63 ± 0.24	ns
Leg	3.66 ± 0.52	3.91 ± 0.10	ns
Fore shank	2.78 ± 0.26	3.16 ± 0.14	ns
Neck	10.14 ± 1.01	9.96 ± 0.57	ns
Chest	5.18 ± 0.64	5.26 ± 0.38	ns
Short ribs	11.90 ± 0.43	12.26 ± 0.59	ns
Ribs	6.75 ± 1.43	6.03 ± 0.62	ns
Flank	6.16 ± 0.77	5.70 ± 0.60	ns

*Relative to the processed carcass; ns – not significant

Petričević et al. (2015) state following values for major carcass parts of young bulls not consuming flax seed in diet: round (28.36%), shoulders (12.20%), legs (3,59%) and fore shanks (2.73%).

The consumption of flax seed in the final stage of the cattle fattening did not have an effect on the share of the intestines in the pre- slaughter weight (Table 3). *Petričević et al. (2011)*, in their study, show similar values for the share of intestines in cattle fed without the addition of flax seed.

Table 3. The effect of the addition of flax seed in the cattle diet on the share of intestines**

(%)	CON	FXS	p
Kidneys	0.17 ± 0.02	0.18 ± 0.01	ns
Liver	1.01 ± 0.11	1.24 ± 0.10	ns
Lungs	0.55 ± 0.08	0.55 ± 0.03	ns
Heart	0.30 ± 0.02	0.28 ± 0.07	ns
Spleen	0.18 ± 0.03	0.22 ± 0.01	ns
Tongue	0.24 ± 0.03	0.29 ± 0.03	ns

**Relative to the pre-slaughter weight; ns – not significant

Conclusion

The addition of flax seed in the feed during the final phase of fattening of the cattle showed no statistically significant ($p > 0.05$) impact on fattening (average daily gain of cattle, feed conversion ratio) and slaughter traits (weight and yield of warm and cooled carcass, share of main carcass parts, share of intestines). The results of the research confirm that the use of heat-treated flax seed in the diet of cattle does not have a negative effect on the quality of the carcass.

ISPITIVANJE TOVNIH I KLANIČNIH OSOBINA JUNADI POD UTICAJEM ISHRANE SA SEMENOM LANA

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Rezime

Eksperiment je postavljen sa ciljem da se ispita efekat dodavanja semena lana, u ishranu junadi, u završnoj fazi tova. Za ogled je odabrano 30 muških junadi simentalske rase ujednačenih početnih telesnih masa, koja su podeljena u 2 grupe (KON (kontrolna) i FS (ogledna)). Kontrolna grupa junadi nije konzumirala seme lana kao dodatak ishrani. Junad ogledne grupe su konzumirala seme lana u količini od 3,75% (300 g dnevno) koncentrovanog dela obroka u poslednjih 90 dana tova, tj. 300 g dnevno. Istraživanje je obuhvatilo ispitivanje rezultata tova, klanične karakteristike i sastava trupa junadi. Nakon klanja izvršeno je pojedinačno merenje toplih polutki sa i bez bubrežnog loja. Posle hlađenja leva polutka je rasecana u osnovne delove prema Pravilniku. Rezultati istraživanja su pokazali da dodatak semena lana u ishrani nije imao statistički značajan uticaj na masu junadi na kraju ogleada. Utvrđeno je da dodatak semena lana u ishranu tokom završne faze tova nije imao uticaj na razlike u prosečnom ukupnom prirastu (PUP) junadi i konverziji hrane. Na osnovu podataka dobijenih rasecanjem poluki junadi na osnovne delove utvrđeno je da ishrana sa semenom lana nema značajan uticaj na udeo delova trupa.

Ključne reči: ishrana lanom, mladi bikovi, simentalska rasa

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