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# THE STUDY OF THE SHARE OF TISSUES IN BOVINE CARCASS PARTS UNDER THE INFLUENCE OF THE FLAXSEED DIET

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**Abstract:** The aim of the experiment was to investigate the effect of adding flax seed to the cattle diet in the final stage of fattening. A total of 30 male Simmental cattle of uniform initial weight were selected for the trial, which were divided into 2 groups (KON (control) and LS (experimental)). Animals in the control group did not consume flax seed as a dietary supplement, and animals in the experimental group consumed flax seeds in the amount of 3.75% of the concentrated portion of the meal in the last 90 days of fattening, i.e 300 g per day. After slaughtering and cooling, the left carcass side was cut into basic parts according to the Regulation. The study included examination of the tissue fraction of parts of the carcass of the young, determined by dissection. The results of the study showed that the addition of flax seed in the diet had no statistically significant effect on the composition of the carcass parts of the young bulls at the end of the experiment.

**Key words**: flaxseed diet, young bulls, Simmental breed

## Introduction

The quality of carcasses of slaughtered animals is a subject of interest, both in primary production and in the meat industry *(Petrović et al., 2016*). On the basis of the estimated value of the carcasses of slaughtered animals and their classification into classes, it is possible to make adequate financial compensation to the producers, i.e. to the animal owners and thus to stimulate them to produce the highest quality animals for slaughter. The criteria for evaluating beef carcass most often are its weight, conformation, carcass coverage by fat tissue, and muscle to fat ratio. The pre-slaughter body weight of young bulls has a significant impact on carcass yield, carcass meat yield and meat quality.

*Aleksić et al. (2001*) state that meat quantity and quality are phenotypic characteristics in function of the genotype and diet. *Pečiulaitienė et al. (2015)* state that with increasing body weight and age of the animal the yield and increases carcass meat yield also improve. The amount of fat tissue and its distribution plays a significant role in the value of the carcass, since too much fat can have a negative economic effect. Excess of intermuscular or subcutaneous fat tissue is removed when processing the carcass or parts of the carcass and it is an economic loss for manufacturers and processors *(Harper et al., 2001).* As a consequence, the amount of carcass fat tissue has decreased over time, with a negative effect on the physico-chemical characteristics of the fat tissue *(Allen and Foegeding, 1981*). The ratio of muscle to fat is very important for the quality of the carcass. However, since fat tissue has an effect on improving the meat's tenderness, succulence and aroma, an increase in the share of fat tissue in the carcass is preferable since it enhances the sensory quality of the meat *(Aleksić et al., 2005).*

One of the most important factors that significantly affect the quality of beef and meat is the diet (*Abrahão et al., 2005; Prado et al., 2008*). Diet for fattening beef must be balanced in terms of dry matter content, energy, protein, minerals and vitamins. Grains are a major source of energy in the final stages of nutrition, but oils and fats can also be used as alternative components *(Rotta et al., 2009).* It is very important that the meal is tasty so that animals can better consume it.

Flaxseed is present in animals' diet because of the specific and nutritional aspect of the desired fatty acid composition. Due to its high oil content, flaxseed is used in the bovine diet as a source of fat. This characteristic makes flaxseed an extremely interesting raw material for the production of functional nutrients that can increase the intake of essential fatty acids in animals, and thus change the fatty acid composition of fats and meat, and increasing the intake of essential fatty acids in humans. The positive effect of flaxseed on the fatty acid composition of the meat of animals fed flaxseed, especially on the increase in the amount of α-linolenic fatty acid (ALA) was established in the research of *Larsen et al. (2012).* The increase in the content of essential fatty acids in meat depends on the animal species and the amount of flaxseed added to the diet. However, since the fat content in bovine diet is limited to a maximum of 5% in dry matter, the maximum amount of flaxseed in bovine diet may not exceed 12 to 14% of dry matter, depending on the chemical composition of the mixture (*Byers and Schelling, 1988*). Flaxseed can also be used as an alternative source of protein in ruminant diets, but in limited quantities due to its high oil content (*Lardy and Anderson, 1999*). Flaxseed thermally treated (toasting, extruding) has a greater impact on meat yield than untreated seeds *(Maddock et al., 2004).* The study was carried out in order to determine that the use of heat treated flaxseed in the cattle diet has no detrimental effect on the carcass composition.

## Materials and Methods

The study was performed on the experimental farm and in the experimental slaughterhouse of the Institute of Animal Husbandry in Zemun (Serbia). The experiment used male young bulls, domestic Simmental breed. Total of 30 animals of uniform body weight were selected for the experiment. They consumed food of the same composition until they reached the age of 390 days. The feeding of beef before the experiment was performed according to the valid recipes for fattening cattle used on the farm of the Institute for Animal Husbandry (whole maize plant silage and concentrate mixture with 12% of total proteins). The fattening of the beef was carried out in a free system. In order to fulfil the aim of the experiment it was necessary to prevent the movement of the animal in the clamp while consuming the concentrated portion of the meal, so that it can be safely claimed that each animal consumed the intended amount of concentrate. At the age of 390 days, two groups of 15 young bulls were formed: control group (KON) in which the animals did not consume thermally treated flax seeds and experimental group (LS) in which part of the concentrate was replaced by thermally treated flax seeds, so that each animal consumed 300 grams of flax seed per day.

The final weight before slaughter was about 570 kg. One day before slaughter, the bulls did not receive food but had free access to water. Slaughter and primary processing were carried out at the Experimental slaughterhouse of the Institute of Animal Husbandry. Animals were weighed immediately before slaughter and then slaughtered according to standard commercial procedures. After primary treatment, the carcasses were refrigerated at $4^0$C for the next 24 hours. After chilling, the carcasses were measured and split along the vertebral column in two halves. The left side of each carcass was divided into the twelve anatomical regions: round, beefsteak, loin, shoulder, back, neck, chest/brisket, chuck, ribs, abdomen, fore shank and rear shank, using a standard technique. The carcass sides were dissected according to the Regulation ("Official Gazette of the SFRY", No. 34/74, 26/75, 13/78 - other regulations, 1/81 - other regulations and 2/85 - other regulations). The procedure for dissecting and categorizing carcass sides into parts was as follows: The leg is separated from the loin/flank by a cut between the last lumbar and the first sacral vertebra, and from the knee in the knee joint; the lumbar portion is separated from the back by a cut between the 12th and 13th ribs, and from the round by a cut between the last lumbar and the first sacral vertebra; the flank is separated from the loin by a cut that runs parallel to the spinal column so that it begins at the point which is farthest away from the tips of the transverse lumbar processes of the loin vertebra to their length; the back is separated from the chunk by a cut between the 6th and 7th ribs and from the loin by a cut between the 12th and 13th vertebrae and the 12th and 13th ribs; the ribs are separated from the back by a cut transversely to the direction of the ribs so that the top third of the

associated ribs remains on the back; the shoulder is separated from the chunk and brisket/chest by a natural muscle connection; the fore shank is separated from the shoulder at the elbow joint; the chunk is separated from the neck by a cut between the last cervical and the first thoracic vertebrae; the chest/brisket is separated from the shoulder by a transverse incision in the direction of the ribs, so that only the ends of the first six ribs remain on the brisket/chest.

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 ± standard deviation. The statistical significance of the difference between mean values was determined by t-test.

## Results and Discussion

The share of the main carcass parts is shown in Table 1. The shares of the most valuable carcass parts (steak and round) were approximately the same between the groups and did not differ significantly between the groups ($p > 0.05$).

**Table 1. Effect of flax seed supplement in beef diet on the share of main carcass parts ***

| (%) | KON | LS | p |
|---|---|---|---|
| **Extra category carcass parts** | | | |
| Beef steak | 2.41 ± 0.45 | 2.41 ± 0.25 | ns |
| **I category carcass parts** | | | |
| Round | 28.05 ± 1.21 | 28.97 ± 0.29 | ns |
| **II category carcass parts** | | | |
| 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 |
| **III category carcass parts** | | | |
| Rear shank | 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/Brisket | 5.18 ± 0.64 | 5.26 ± 0.38 | ns |
| Chuck | 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 |

*In relation to processed carcass; ns – not significant

In the KON and LS groups, the same value was found for the share of steaks. The round content ranged from 28.05% in KON to 28.97% in LS. The shares of the loin, back, shoulder and chuck did not differ significantly ($p > 0.05$) between the groups influenced by the examined factor. The share of the back ranged from 4.84% to 5.32%. A higher share of back was found in KON group. LS had a lower shoulder share, while the share of chuck was higher. *Petričević et al.*

*(2015)* report the following shares of main carcass parts of bovines that did not consume flaxseed in the diet: round (28.36%), shoulder (12.20%), rear shank (3.59%) and fore shank (2.73%).

The effect of feeding young bulls flaxseeds on the composition of beefsteak and rounds is shown in Table 2. The processing of the obtained data did not reveal significant differences in the composition of carcass parts of extra and I category.

**Table 2. Effect of flax seed supplement in the bovine diet on the share of individual tissues in the beefsteak and round**

| (%) | KON | LS | p |
|---|---|---|---|
| **Beefsteak (extra category parts)** | | | |
| Processed beef steak | 57.76 ± 6.65 | 51.91 ± 10.50 | ns |
| Remaining muscle tissue | 18.57 ± 5.73 | 28.93 ± 9.84 | ns |
| Fat tissue | 23.56 ± 5.91 | 19.03 ± 3.88 | ns |
| **Round (I category parts)** | | | |
| Muscle tissue | | | |
| Dorsal part of the round | 9.30 ± 0.34 | 10.39 ± 2.23 | ns |
| Medial part of the round | 20.96 ± 1.97 | 22.17 ± 0.96 | ns |
| Caudal part of the round | 16.32 ± 0.68 | 16.85 ± 0.64 | ns |
| Cranial part of the round | 11.59 ± 1.80 | 12.87 ± 0.58 | ns |
| *Semitendinosus m*uscle | 6.24 ± 0.36 | 6.76 ± 0.13 | ns |
| Remaining muscle tissue | 13.74 ± 2.86 | 11.14 ± 1.23 | ns |
| Fat tissue | 9.42 ± 2.19 | 7.36 ± 1.29 | ns |
| Bones | 12.38 ± 1.33 | 12.44 ± 1.04 | ns |

ns – not significant

The share of beefsteak muscle tissue was higher in the KON group. Similar values were found between groups for the shares of all parts of the muscular tissue of the thigh (Dorsal part of the round, medial part of the round, caudal part of the round, cranial part of the round and *Semitendinosus*). The fat content of beefsteak and round under the influence of flaxseed diet was lower compared to the KON group. These differences were not statistically significant ($p>0.05$). The share of bones of the round e were similar between the groups.

*Aleksić et al. (2009)* have found that at an average pre-slaughter weight of young bulls of 597 kg, the share of muscle tissue in the round was about 86% and in the carcass parts of the II category (shoulder) about 78%. *Petričević et al. (2011)* have found the share of muscle tissue in the round of 81.52%, while *Karolyi et al. (2008)* reports lower values (76.97%).

The effect of feeding flax seed on the composition of the bovine loin, back and shoulder is shown in Table 3. The share of muscle, fat and bone in the category II carcass parts did not differ significantly ($p> 0.05$) between the studied groups.

**Table 3. Effect of flax seed supplement in the bovine diet on the share of individual tissues in the category II carcass parts**

| (%) | KON | LS | p |
|---|---|---|---|
| **Loin** | | | |
| Muscle tissue | | | |
| MLD | 48.31 ± 3.53 | 47.05 ± 2.64 | ns |
| Remaining muscle tissue | 15.68 ± 4.85 | 18.41 ± 4.38 | ns |
| Fat tissue | 13.64 ± 3.52 | 12.22 ± 2.83 | ns |
| Bones | 22.26 ± 3.48 | 22.21 ± 0.93 | ns |
| **Back** | | | |
| Muscle tissue | | | |
| MLD | 37.18 ± 3.27 | 31.02 ± 1.07 | ns |
| Remaining muscle tissue | 26.96 ± 6.48 | 40.56 ± 1.85 | ns |
| Fat tissue | 10.72 ± 1.80 | 8.40 ± 0.16 | ns |
| Connective tissue | 0.94 ± 0.33 | 0.67 ± 0.03 | ns |
| Bones | 24.14 ± 3.61 | 19.23 ± 3.11 | ns |
| **Shoulder** | | | |
| Muscle tissue | 75.40 ± 3.02 | 76.06 ± 2.47 | ns |
| Fat tissue | 8.36 ± 2.17 | 6.35 ± 1.07 | ns |
| Bones | 16.20 ± 1.80 | 17.53 ± 1.78 | ns |

ns – not significant

The share of total muscle tissue of the loin (65.46%), back (71.58%) and shoulder (76.06%) were higher in the LS group, while young bulls of the KON group had higher fat content for all category II parts.

The results of *Ragni et al. (2014)* obtained by dissection of the loin show significantly lower fat content, significantly higher muscle content, and significantly lower bone content in young bulls that consumed flax seed in the diet.

The effect of the addition of flax seed in the final stage of fattening on the composition of Category III carcass parts is shown in Table 4. The addition of flax seed had no significant effect on the composition of chest/brisket, ribs, neck, chuck, flank, rear shank and fore shank.

For the LS group, higher content of muscle tissue was found in the chest/brisket (59.96%), ribs (66.95%), neck (81.98%) and chuck (70.74%). The lowest values were recorded for the neck, chuck and flank in the KON group (76.12%, 67.78%, 58.52%, respectively). The share of muscle tissue of rear shank (41.44%) and fore shank (48.93%) was higher in the KON group. A lower share of fatty tissue in the chest/brisket, ribs, neck, chuck and flank was recorded in beef of the LS group. In their research, *Karolyi et al. (2008)* report the share of chest/brisket muscle tissue of 59.99%, ribs 57.21%, neck 77.46% and flank 74.40% for young Simmental bulls over 500 kg. *Petričević et al. (2011)* state that the share of neck bones for Simmental breed bovines is 11.30%.

**Table 4. Effect of flax seed supplement in the bovine diet on the share of individual tissues in the Category III carcass parts**

| % | KON | LS | p |
|---|---|---|---|
| **Chest/Brisket** | | | |
| Muscle tissue | 55.03 ± 1.75 | 59.96 ± 4.10 | ns |
| Fat tissue | 30.42 ± 3.40 | 24.82 ± 1.90 | ns |
| Bones | 14.16 ± 2.32 | 15.11 ± 2.33 | ns |
| **Ribs** | | | |
| Muscle tissue | 65.34 ± 8.04 | 66.95 ± 2.88 | ns |
| Fat tissue | 17.65 ± 3.00 | 16.94 ± 1.86 | ns |
| Bones | 16.94 ± 4.83 | 16.10 ± 1.10 | ns |
| **Neck** | | | |
| Muscle tissue | 76.12 ± 1.65 | 81.98 ± 3.68 | ns |
| Fat tissue | 11.21 ± 0.83 | 9.82 ± 2.90 | ns |
| Connective tissue | 1.34 ± 0.36 | 1.21 ± 0.23 | ns |
| Bones | 11.13 ± 1.58 | 6.93 ± 0.75 | ns |
| **Chuck** | | | |
| Muscle tissue | 67.78 ± 3.98 | 70.74 ± 2.03 | ns |
| Fat tissue | 14.88 ± 3.69 | 13.91 ± 0.84 | ns |
| Connective tissue | 1.05 ± 0.27 | 1.29 ± 0.33 | ns |
| Bones | 16.24 ± 3.03 | 14.02 ± 1.19 | ns |
| **Flank** | | | |
| Muscle tissue | 58.52 ± 8.57 | 65.74 ± 6.49 | ns |
| Fat tissue | 39.02 ± 8.59 | 31.50 ± 7.31 | ns |
| Connective tissue | 1.32 ± 0.41 | 1.53 ± 0.89 | ns |
| Bones | 1.04 ± 0.14 | 1.13 ± 0.06 | ns |
| **Rear shank** | | | |
| Muscle tissue | 41.44 ± 1.23 | 40.36 ± 5.44 | ns |
| Fat tissue | 4.84 ± 0.91 | 8.20 ± 2.14 | ns |
| Connective tissue | 4.83 ± 0.15 | 4.05 ± 2.20 | ns |
| Bones | 48.85 ± 1.66 | 47.24 ± 2.75 | ns |
| **Fore shank** | | | |
| Muscle tissue | 48.93 ± 1.31 | 48.32 ± 5.85 | ns |
| Fat tissue | 6.46 ± 1.00 | 6.77 ± 1.87 | ns |
| Connective tissue | 1.92 ± 0.45 | 2.26 ± 0.34 | ns |
| Bones | 42.59 ± 3.01 | 42.58 ± 4.03 | ns |

ns – not significant

Table 5 shows the effect of the consumption of flax seed in the bovine diet on the composition of the categories II and III carcass parts.

**Table 5. Effect of flax seed supplement in the bovine diet on the composition of the carcass parts**

| % | KON | LS | p |
|---|---|---|---|
| **Category II carcass parts** | | | |
| Muscle tissue | 70.38 ± 3.23 | 72.21 ± 2.64 | ns |
| Fat tissue | 10.43 ± 2.73 | 8.24 ± 1.26 | ns |
| Connective tissue | 0.21 ± 0.08 | 0.21 ± 0.08 | ns |
| Bones | 18.92 ± 2.04 | 19.27 ± 1.68 | ns |
| **Category III carcass parts** | | | |
| Muscle tissue | 62.37 ± 2.87 | 66.77 ± 2.93 | ns |
| Fat tissue | 19.30 ± 4.82 | 15.81 ± 1.95 | ns |
| Connective tissue | 1.00 ± 0.15 | 1.29 ± 0.04 | ns |
| Bones | 17.32 ± 2.12 | 16.07 ± 1.06 | ns |

ns – not significant

The LS group had higher shares of muscle tissue in the carcass parts of both categories. The differences found in the carcass parts for both categories did not differ significantly between the groups. A higher share of muscle tissue and a lower share of fat tissue in category II and III carcass parts of animals in the LS group, caused the ratio of muscle to fat tissue to be higher compared to the KON group. *Karolyi et al. (2008)* report the share of connective tissue in category II and III carcass parts of 4.76% and 6.55%, respectively, for bovines weighing over 500 kg of the Simmental breed, while the share of muscle and fat tissue, bone and connective tissue in the carcass of 70.45%, 7.46%, 16.33% and 5.76%, respectively.

## Conclusion

The addition of flaxseed to the diet during the final stage of fattening had no statistically significant ($p>0.05$) effect on the share of carcass parts. The results of the study confirm that the use of thermally treated flax seed in the bovine diet does not have a negative effect on the carcass composition as determined by dissection of carcass parts.

## Ispitivanje udela tkiva delova trupa junadi pod uticajem ishrane sa semenom lana

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## Rezime

Ogled 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 LS (ogledna)). Kontrolna grupa junadi nije konzumirala seme lana kao dodatak ishrani. Junad ogledne grupe su konzumirala seme lana u količini od 3,75% koncentrovanog dela obroka u poslednjih 90 dana tova, tj. 300 g dnevno. Nakon klanja i hlađenja leva polutka je rasecana u osnovne delove prema Pravilniku. Istraživanje je obuhvatilo ispitivanje udela tkiva delova trupa junadi, koje je utvrđeno disekcijom. Rezultati istraživanja su pokazali da dodatak semena lana u ishrani nije imao statistički značajan uticaj na sastav delova trupa junadi na kraju ogleda.


**Ključne reči:** ishrana lanom, junad, Simentalska rasa


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