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Carcass analysis of yearling males of local autochthonous Bulgarian Gray cattle

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Abstract

Carcass composition analysis was conducted on yearling males of the Bulgarian Gray cattle breed. Four half carcasses from 12-month-old, pasture-reared animals in Southwestern Bulgaria were examined. Each half carcass was divided into 11 cuts, with fat, meat, bones, and tendons separated. The hot carcass weight of the halves was 36.5 kg, with meat, fat, and bones/tendons accounting for 62.80%, 7.23%, and 29.97%, respectively. The leg had the highest proportion, representing 33.08% of the carcass. The tenderloin, shank, and steak were identified as the leanest cuts. The lowest percentage of bones and tendons was found in the flank and shoulder, while the highest was recorded in the shanks. No fat was separated from the tenderloin. In most cuts, muscle without bones, tendons, or fat constituted more than 50% of the total weight, indicating excellent yield and balanced distribution. Cuts obtained from Bulgarian Gray yearling males can be classified as high-quality products, suitable for boutique market niches or for producing geographically significant products.

Keywords: Bulgarian Gray cattle, yearlings, carcass analysis, meat

INTRODUCTION

In Europe for obtaining a high-quality beef production are used specialized meat breeds. Local cattle breeds are still unique in terms of their adaptability. There is an increasing interest and research related to their advantages and meat quality in comparison to commercial breeds. A number of studies (Albertí et al., 2008; Insausti et al., 2001) revealed that the differences in carcass qualities are determined by the breed. The sustainable conservation of genetic resources in cattle breeding and the efficiency of raising a breed strongly depend on its multifunctionality and production quality (Cafe et al., 2011; Scarpa et al., 2003). Sudden and unpredictable changes in climate can affect the resilience of some breeds (Gregory, 2010) and hence the quality of their production including meat. In recent years, the

consumers of beef prefer to purchase a product with a clear origin and quality, associated mostly with the local breeds (Kühl et al., 2021; Felderhoff et al., 2020). These factors are closely linked to biodiversity preservation in a given environment. Pasture-based rearing further enhances meat product quality, positioning it within an exclusive market niche that sets it apart from conventional production (Stampa et al., 2020). The current genetic trend in terms of carcass traits is to improve meat cut quality without increasing the carcass weight (Judge et al., 2019). The quality of cuts depends on several factors, in particular production system (especially the feeding strategy and pasture), which affects the sensory and technological properties of the meat (Clinquart et al., 2022). Bulgarian Gray cattle is a local, autochthonous breed - part of the national gene pool, with population in the category of

endangered cattle breeds (Executive Agency for Selection and Reproduction in Animal Breeding, IASR, 2025). Its conservation and the implementation of breeding activities by main characteristics regarding its sustainability play key role for the future development of the breed. The animals of Bulgarian Gray cattle are raised in specific areas according to the natural climatic and feed conditions (Lidji & Gorinov, 2013). With their endurance and viability in the habitats they are raised, the cattle provide occupation for the local population, maintain biodiversity and are part of the production system where cultural breeds would have difficulty to survive (Gorinov, 2004). So far, no detailed studies have been carried out on the quality of the carcasses of the Bulgarian Gray cattle. Such analysis will support future guidelines for the conservation of the breed in the context of its uniqueness and adaptability to the conditions of our country.

Hence, the purpose of the present study was to analyze the carcass qualities of pasture-raised yearling males from the local autochthonous Bulgarian Gray cattle breed.

MATERIALS AND METHODS

The carcass analysis was performed in 2022 with a total of four half carcasses from 12-month-old Bulgarian Gray cattle males. The animals were sourced from the farm of agricultural producer Ivan Bikov in Krupnik village, Blagoevgrad district. The farm is situated southwest of Simitli, on the northeastern slopes of Krupnishki Hill, along the western bank of the Struma River. The region is characterized by frequent summer and winter droughts and generally poor grass

quality. The suckling period of the animals lasted 210 days. The animals were raised entirely on pasture without any concentrate supplementation. They remained free ranged except in winter when housed under a three-wall shed, allowing unrestricted movement and pasture preferences. At 12 months of age, the animals were slaughtered at an average live weight of 142.52 kg. Carcasses were divided along the midline without fragmenting the cervical, thoracic, lumbar or sacral vertebrae, passing through the sternum and pelvic symphysis. Humane slaughter and hygiene protocols were strictly followed. The analysis was conducted on the right half carcasses, which were dissected into 11 cuts following the method of Marinova & Popova (2011). Meat, fat, bones, and tendons were separated and weighed using an electronic scale. Descriptive statistics (mean and standard deviation) of the studied indicators were calculated using the JMP v.7 software package.

RESULTS AND DISCUSSION

The dressing percentage of the Bulgarian Gray yearlings was 51.57%. The average hot weight of the half carcasses was 36.75 kg (Table 1).

After 12 h of slow chilling at 3-5°C, the mean weight was 35.10 kg, and the weight losses were 4.46 % (1.65 kg). The weight losses in carcasses of Nelore bulls in Brazil were estimated at 5.09 ± 0.24 kg, or 1.73 ± 0.09 % at conventional air chilling ($2 \pm 1^\circ\text{C}$) for 24 h (Prado et al., 2021). The weight and the percentage of the separate cuts in the half carcass are presented in Figure 1 and Figure 2, respectively.

Table 1. Carcass weights and weight losses in Bulgarian Gray yearling males

Parameter	Mean	SD
Hot weight of the half carcass, kg	36.75	3.59
Cold weight of the half carcass, kg	35.10	3.33
Weight losses, kg	1.65	0.86
Weight losses, %	4.46	2.31

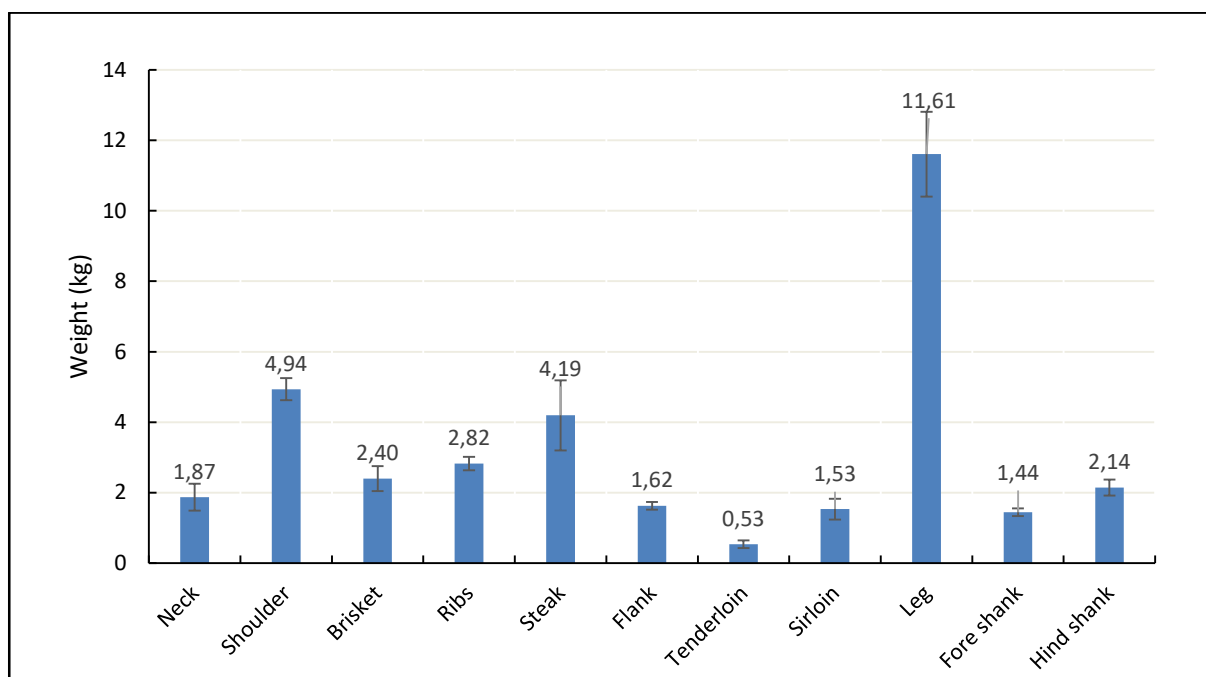


Figure 1. Weight of the carcass cuts in Bulgarian Gray yearlings

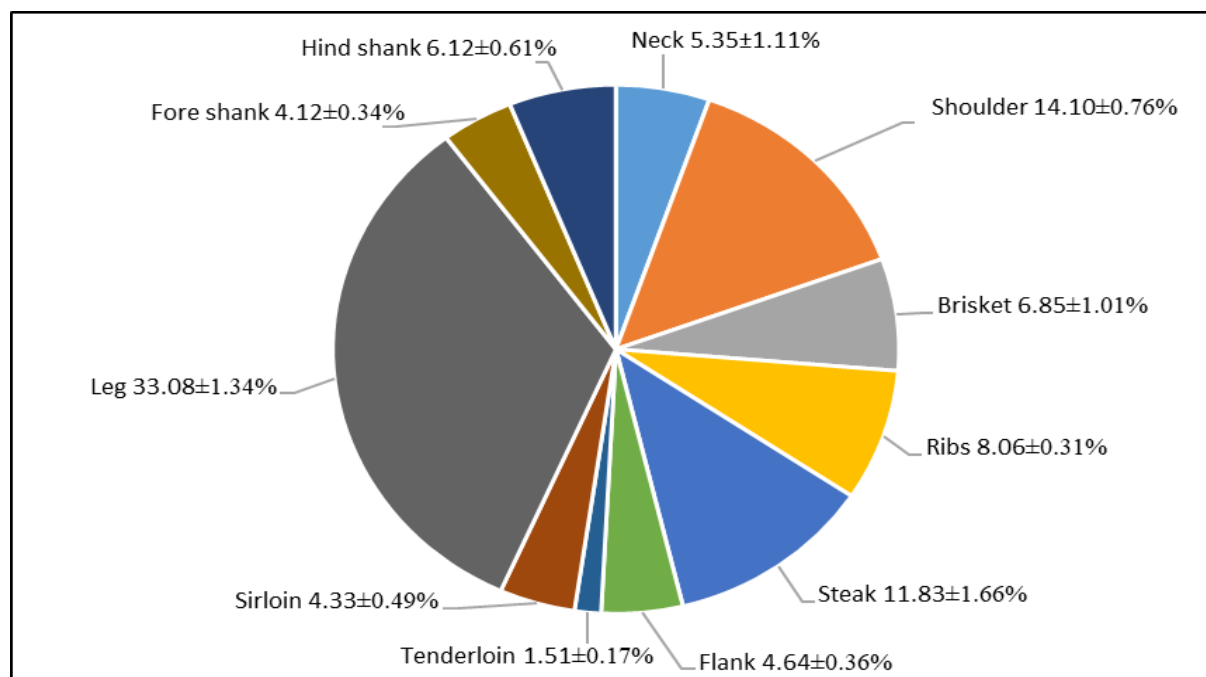


Figure 2. Percentage of the carcass cuts in Bulgarian Gray yearlings

The anterior anatomical parts of the carcass half included neck, shoulder, brisket, ribs, steak and fore shank. The weight of the cuts was 1.87, 4.94, 2.40, 4.19, and 1.44 kg, respectively (Fig. 1), and accounted for 50.49% of the total weight (Fig. 2). The middle part of the half – flank (1.62 kg), sirloin (1.53 kg) and

tenderloin (0.53 kg) were 10.48% of the total weight, and the rear part of the carcass, which includes the leg (11.61 kg) and hind shank (2.14 kg), formed 39.2% of the total weight. Naserkheil et al. (2021) reported the following heritability in the relative proportion of cuts from Hanwoo cattle, top round - 0.52 (0.06),

bottom round - 0.50 (0.06), chuck – 0.21 (0.04), brisket – 0.51 (0.06). The leg had the highest proportion in the half carcass (33.08%) of the total weight (Fig.2), whereas the lowest percentage was recorded for the tenderloin with a weight of 0.53 kg (Fig.1) or 1.51% of the total weight (Fig.2). The round in the carcass of animals of the Arsi breed accounted for 18.2%, in the Boran breed - 17.25% and in the Harar breed - 19% (Tefera et al., 2019). In carcass halves of Jersey (496 kg live weight) - round was 16.12 kg, flank (steak) weighed 0.66 kg with 24.08 % fat and 20.96 % bone in the carcass (Jaborek et al., 2019). The steak and the shoulder accounted for 11.83% and 14.10% of the weight of the half carcass, respectively (Fig.2). Anatomical parts such as neck, flank and sirloin have a similar proportion to the total weight within 4.33-5.35%. The neck was 0.25 kg heavier than the flank, and 0.34 kg heavier than the sirloin. It accounted for 5.32% of the half carcass. According to Lamanov et al.

(2020) percentage of the neck in the carcass of Simmental was 10.0 %, while in Black cattle it was 9.6 % of the total weight. In a similar to the analysis in the current study, the carcass halves of bulls in Kazakhstan, Aberdeen's neck weighed 16.3 ± 0.27 kg with 10.4% fat, in Hereford it was 16.6 ± 0.27 kg with 10.4% fat, and in Kazakh white-headed – 15.3 ± 0.19 kg with 10.3% fat (Nurgazy et al., 2022). The ribs formed 8.06% of the weight of the halves, and it was 0.42 kg heavier than the brisket, and accounted for 6.86%. The brisket of calves of the local Romanian breed BNR (weight 350-400 kg) was 17.77 kg, leg - 17.08 kg; in the Brună breed brisket – 16.48 kg, leg – 15.84 kg (Usturoi, 2020). The two shanks were 10.24% of the total weight of the half, with the hind shank heavier than the fore shank by 0.7 kg.

The percentages of meat, fat, bones and tendons in the animals estimated in the current study were 62.80 %, 7.23 %, 29.97 %, respectively (Fig. 3).

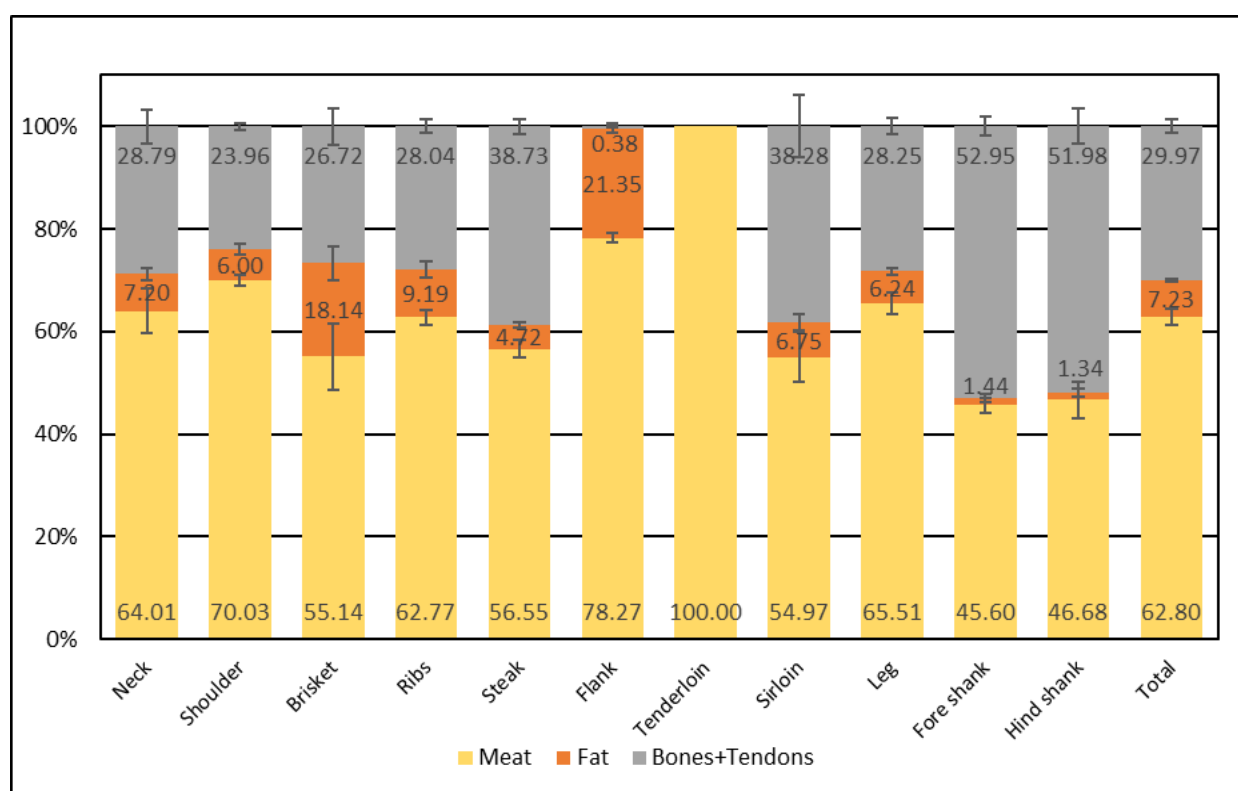


Figure 3. Composition of the cuts (%) in Bulgarian Gray yearling males

According to Musa et al. (2021), the proportion of the meat and fat in the carcass was significantly influenced by the interaction between breed and age in three local breeds (Arsi, Boran and Harar) as well as in a Holstein-Friesian cross with a local breed. In extensively reared Aberdeen x Saller cattle the percentage of the meat and fat in the carcass was 66.57% and 15.35%, respectively (Liu et al., 2022). Higher than the current results were the values determined in Ethiopian cattle breeds (Mummed & Webb, 2019) since the percentage of meat in Arado breed was $67.35 \pm 0.89\%$, in Barka – $68.38 \pm 0.67\%$, and in Raya – $67.89 \pm 0.54\%$. In comparison to commercial breeds, raised in Turkey, the percentage of the bones in Limousin cattle was 13.83 %, in Charolais – 14.17%, in Aberdeen – 14.64%, and in Hereford - 14.61% (Kayar & İnal, 2022). At an age similar to that of the animals in the current experiment, the proportion of the fat in the carcass of young Aberdeen bulls, Jersey and Holstein was – 7.32%, 6.57% and 6.65%, respectively (Berry et al., 2018). The half carcasses of 18-month-old bulls of Kazakh White headed cattle had $65.1 \pm 0.56\%$ meat, $17.9 \pm 0.10\%$ bones and $4.0 \pm 0.04\%$ cartilage and tendons (Nikonova et al., 2021).

In the current study, a meat content exceeding 60% was recorded in the neck, shoulder, ribs, tenderloin, leg, and flank. Excluding the tenderloin, the flank had the highest meat percentage at 78.27%, while the lowest was observed in the fore shank at 45.60%.

Several studies have highlighted the quality of cuts with a higher proportion of meat and lower bone and fat content (Pesonen et al., 2015; Jung et al., 2016; Yeh et al., 2018). In the current analysis, the yield from the rear part of the half carcass – including the flank, sirloin, tenderloin, leg and hind shank – was 51.01%. Pabiou et al. (2011) reported positive genetic correlations between different cut weights in steer carcasses, ranging from 0.45 (SE = 0.08) to 0.89 (SE = 0.03).

The content of meat in the leg and neck was similar, with a difference of 1.5% in favor of the leg (Fig. 3). The percentage of the meat in the steak and brisket was similar, with a difference of 1.41% (Fig.3). The leg of Simmental calves in Germany (with a live weight of 400 kg) contained 75.6% meat and 13.3% bone, while the hind shank had 40.9% meat and 40.9% bones (Honig et al., 2020). The proportion of meat below 50%, when compared to the total weight of the cut, was observed in the fore and hind shank, with a difference of 1.08%. The highest proportion of bones and tendons, more than half the weight in the cut, was observed in the fore and hind shank. Higher values than estimated in the current analysis were observed by Barcellos et al. (2017) who reported 11.05% bones in the carcass of Nelore steers in Brazil and 17.87% fat content. In the same experiment, the authors found that in Nelore and Aberdeen crossbred bulls 17.73% bone and 18.87% fat content. In most of the cuts – shoulder, brisket, ribs, leg and neck – the bone and tendon content was below 30%.

Kwon et al. (2022) found that the total weight of prime cuts in Hanwoo beef cattle in Korea –characterized by a higher proportion of meat, fat, and bone – increased significantly with rising market weight ($p < 0.05$). In the current study, the amount of bones and tendons in the ribs, leg and neck ranged, from 28.04 % to 28.79%, with negligible differences between them. Similarly, minimal variation were observed between the fore and hind shank, where bone and tendon percentage were 51.98% and 52.95%, respectively. In general, fat content in the half carcass accounted for 7.23% of the total weight. Ferrinho et al. (2019) found that carcass cuts from pasture-finished Hereford calves had lower fat content and an improved fatty acid profile compared to those reared indoors.

In the flank exhibited a very low proportion of bones and tendons (Fig.3). As part of the abdomen, it had the highest fat percentage at 21.35%. The fat in this region serves as

reserve fat with protective functions. Another cut with a high fat content was the brisket. In all other cuts, fat content was below 10% of the total weight.

Yim et al. (2015) reported that in carcass halves of Hanwoo calves, the brisket weighed 10.51 ± 0.31 kg ($11.77 \pm 0.71\%$), while in Holstein calves, it was 17.60 ± 4.47 kg ($18.14 \pm 7.31\%$). The lowest fat content was found in the fore and hind shank, though these cuts exhibited higher meat content (Fig. 3). Similarly, the leg, neck, and shoulder showed a high percentage of meat and a low proportion of fat. At the same time, the sirloin had a relatively high content of meat, but also high proportion of bones and tendons. The combination of a large amount of muscle tissue, low bone proportions and optimal levels of subcutaneous fat are particularly important in the production and consumption of beef hindquarter cuts (Boito et al., 2017). In both shanks, the distribution of meat and bone with tendons predominates, while fat content remains low. In the shoulder compared to the leg, the content of meat was 4.52% higher and the percentage of bones, while the tendons was 4.29 % lower. The percentage of fat was also reduced by 0.24%. Compared to the leg, the neck had 1.5 % lower proportion of meat, a 0.96 % higher proportion of fat and a 0.54 % higher proportion of bones and tendons. The neck in the half carcass had 9.04% and 9.49% higher proportion of meat and bone with tendons compared to the loin and 0.45 % lower proportion of fat. Within the ribs, the meat had 7.63% and the bones and tendons 1.32% higher proportion compared to the brisket. In comparison to ribs the brisket fat was 8.95% higher. Pogorzelska-Przybyłek et al. (2018) reported a rib fat content of 26.26% in young bulls (Hereford x Holstein) slaughtered at 15 months of age.

The neck, shoulder, rib, flank, tenderloin and leg have more than 60% meat content. In the fore and hind shank, the proportion of meat was less than 50%, the content of fat less than 2%, bones and tendons more than 51%. Brisket and

loin cuts have more than 15% fat content. The leg, steak, striploin, shoulder and neck have between 4 and 8% fat content. Five of the cuts had bone and tendon content in the range between 20% and 30%. Similarly, bulls of the Nelore breed in Brazil, reared on dry pastures with moderate herbage, have a relative share of hindquarters in the carcass half - 35.4%, forequarters - 30.5%, and bones - 18.6% (Oliveira et al., 2018).

CONCLUSIONS

The carcass analysis of the Bulgarian Gray cattle yearling males showed that the proportion of meat, fat and bones did not differ significantly from other breeds. The amount of meat in the carcass half of the yearlings reached 62.74%, and bone and tendon accounted for 30% of the total weight. In most cuts, muscles without bones, tendons and fats accounted for more than 50% of the total weight, indicating excellent yield and balanced distribution. Cuts obtained from Bulgarian Gray yearling males can be classified as high-quality products, suitable for boutique market niches or for producing geographically significant products.

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