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Comparison of Carcass Weight and Carcass Characteristics in Some Cattle Breeds

Okan OYAN[1] Hasan Hüseyin ŞENYÜZ[2*] Cem Çağdaş ARKÖSE[3]

[1] Amasya Cattle Breeder's Association, Merzifon, Amasya, Türkiye, https://orcid.org/0009-0003-6332-5347

[2] Necmettin Erbakan University, Faculty of Veterinary Medicine, Department of Animal Nutrition and Nutritional Disease, Ereğli, Konya, Türkiye, https://orcid.org/0000-0002-3695-1794

[3] Amasya Cattle Breeder's Association, Merzifon, Amasya, Türkiye, https://orcid.org/0000-0002-3871-7731

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* **Corresponding Author:**
Hasan Hüseyin ŞENYÜZ,
hasansenyuzvet@yahoo.com

ABSTRACT

Beef is an indispensable source of protein for humans. The production is increased in recent years with the effect of increasing population. Besides of beef cattle breeds, male calves of dairy breeding and combined productive animals are also been fattened. The aim of the study investigate the carcass yield and characteristics of the some beef cattles. In the study hot carcass weights, carcass characteristics and skin weights of 588 male Holstein, Brown-Swiss, Simmental and Montbeliarde cattle breeds raised in Amasya region were used. For this purpose, the hot carcass weight data was taken at the slaughterhouse shortly after dressing and the weights of mince, cubed meat, steak, tenderloin, ribeye at the chilled carcass and skin weights of the beef cattle raised by the members of the Amasya Cattle Breeders Association were investigated. Slaughtered animals were fed mainly concentrated feed with commercial fattening feed. The hot carcass weights of slaughtered animals in Holstein, Brown-Swiss, Simmental and Montbeliarde cattle breeds were 343.70±3.12 kg, 319.80±15.50 kg, 336.56±3.58 kg and 349.44±6.06 kg respectively. The hot carcass weights of the animals according to age of 13-15 months, 16-18 months, 19-21 months, 22-24 months and +24 months were 316.44±8.20, 337.44±3.18, 342.00±3.62, 339.98±5.48 and 370.35±9.11 kg respectively. While the effect of breed on hot carcass weight was insignificant ($p>0.05$), the effect of age was significant ($p<0.05$). The breed and age interaction were significant ($p<0.05$). The highest skin weight was determined in the Simmental breed, and the lowest in the Holstein breed. While the effect of breed on mince, cubed meat, steak, tenderloin fillet was insignificant ($p>0.05$) and it was significant on ribeye ($p<0.05$). However, while the effect of age on mince, cubed meat, steak, tenderloin was significant ($p<0.05$), it was not significant on ribeye ($p>0.05$). As a result of the study, it was evaluated that different breeds reached their target slaughter weights in different times, and that breeders determine the target slaughter time according to carcass yield rather than age.

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INTRODUCTION

Animal originated food play a big role in human nutrition. They contain protein, vitamins and minerals that are essential for human. The digestibility of these nutrients is also quite high (Ardıçlı, 2018). Animal foods include meat, milk and eggs. For the continuity of human life, the production of animal foods must continue without interruption.

The male calves of dairy and combined yielded cows are also fattened besides of beef calves in Türkiye. These breeds include Limousin, Charolais, Angus, Hereford, Holstein, Montofon, Simmental and Montbeliard. Artificial insemination undoubtedly plays a major role in raising superior quality breeding animals. In this way, breeding program has been successful throughout the country (Kayar and İnal, 2019; Şenyüz et al., 2020; Kayar and İnal, 2022; Fidancı et al., 2022). Average beef carcass meat has reached the average of developed countries in Türkiye. Average carcass weight ofcattle were 218.20 kg in the world, 267.90 kg in European countries, 284.50 kg in Türkiye and 311.40 kg in America (FAO, 2022).

In order to obtain optimum carcass yield in cattle, beef or combined yield animals must reach sufficient maturity. Carcass yield varies depending on breed. Fattening period is between 15-18 months. This period is suitable for economical meat production (Ergün et al. 2020). However, this period may take longer due to various reasons in terms of animal husbandry. Likewise, the carcass is expected to have a certain weight in order to be evaluated economically. While the bone ratio is high in the carcasses of animals that have not completed their maturation, the fat ratio increases in the carcasses of animals that are subjected to excessive fattening. This situation affects the evaluation of the carcass. The skin, another animal product obtained during slaughter, is varies depending on the breed and age of the animal. In the literature, carcass weights were 251.1 - 320.0 kg in Holstein steers, 293.3 - 344.4 kg in Simmental steers, 268.2 - 289.4 kg in Brown-Swiss steers, and 297.4 - 343.2 kg in Montbeliarde steers (Alberti et al., 2008; Çatıkkaş and Koç, 2017; Nikoloau et al., 2020; Sipahi et al., 2022).

Shredding of beef carcasses is generally done according to the valuable meat classification (Alpan, 1972; Sarıözkan et al. 2013). However, there is not much evaluation in terms of final consumer use. In this study, hot carcass yields, carcass characteristics and skin weight were examined which obtained from beef cattle slaughtered in the Amasya Region. The aim of the study investigate the carcass yield and characteristics of the Holstein, Brown-Swiss, Simmental and Montbeliarde beef cattles.

MATERIAL AND METHOD

In the research data obtained from animals after slaughtering in the slaughterhouse in Amasya. For this purpose, 588 male cattle were examined which slaughtered between 2018 and 2021. Amasya Breeding Cattle Breeders Association (ABCBA) slaughter data was used. The breeds of the cattle were Holstein (n = 268), Brown-Swiss (n = 18), Simmental (n = 231) and Montbeliarde (n = 71). The animals were fattened to intensive in different enterprises and fed with concentrated feed based. The breed and age information of the animals was checked from the Breeding Association records.

After the animals were slaughtered in the slaughterhouse, their hot carcass weight and skin weights were determined via electronic scale (0.1 kg sensitivity) and recorded. After this stage, the carcasses were kept in +4 C° cold storage for 24 hours and cooled to +4 C°. Chilled carcasses were stripped from the bones and divided into minced, cubed meat, steak, tenderloin and ribeye in processing plant of ABCBA according to the Alpan (1972). Each separated portion of meat was weighed and recorded.

The data were analyzed with Anova multivaried comparison test in the SPSS (2001) package program, and in case of a difference between the groups, the Tukey test was applied. The significance level was determined as 0.05.

RESULTS

The hot carcass weights and standard errors in the study were presented in Table 1. There were no difference was between breeds in terms of hot carcass weight ($p>0.05$). The effect of breed was significant in terms of skin weights ($p<0.05$). While the effect of breed was insignificant in terms of minced, cubes meat, steak and tenderloin obtained by deboning after cooling the carcass ($p>0.05$), it was significant in terms of ribeye ($p<0.05$). The hot carcass weights, skin weights, chilled carcass weights of minced, cubes meat, steak, tenderloin and ribeye of the animals according to their slaughter ages were given in Table 2. The hot carcass weight was significant according to slaughter ages ($p<0.05$). Likewise, a significant difference was found between skin weights according to age ($p<0.05$). While minced, cubed meat, steak and tenderloin obtained after deboning the chilled carcass was significant according to age ($p<0.05$), ribeye was insignificant ($p>0.05$). Breed*age interaction was significant in all parameters ($p<0.05$).

Table 1. Carcass, skin and carcass charasteristic weights of cattle breeds.

Breed	n	Carcass Weight (Kg)	Skin Weight (Kg)	Mince Weight (Kg)	%	Cubed Meat Weight (Kg)	%	Steak Weight (Kg)	%	Tenderloin Weight (Kg)	%	Ribeye Weight (Kg)	%
Holstein	268	343,70±3,12	42,70±0,42^{b}	152,99±2,50	44.51	73,41±3,37	21.36	8,00±0,14	2.33	3,99±0,06	1.16	9,33±0,12^{a}	2.72
Brown-Swiss	18	319,80±15,50	41,94±1,74^{b}	168,10±0,40	52.56	59,16±2,96	18.50	7,55±0,60	2.36	4,09±0,44	1.28	7,68±0,72^{b}	2.40
Simmental	231	336,56±3,58	46,81±0,44^{a}	152,13±2,77	45.20	77,85±2,64	23.13	8,50±0,13	2.53	4,15±0,07	1.23	8,95±0,14^{ab}	2.66
Montbeliarde	71	349,44±6,06	44,67±1,14^{ab}	157,38±4,90	45.04	74,42±7,94	21.30	8,28±0,42	2.37	4,25±0,14	1.22	9,00±0,29^{ab}	2.58
p		0.72	0.001	0.57		0.26		0.65		0.20		0.03	

Table 2. Carcass, skin and carcass charasteristic weights of cattle breeds according to age.

Age (Month)	n	Carcass Weight (Kg)	Skin Weight (Kg)	Mince Weight (Kg)	%	Cubed Meat Weight (Kg)	%	Steak Weight (Kg)	%	Tenderloin Weight (Kg)	%	Ribeye Weight (Kg)	%
13-15	38	316,44±8,20^{c}	40,78±1,67^{c}	135,36±7,48^{b}	42.78	65,28±8,08^{b}	20.63	7,07±0,45^{b}	2.23	3,70±0,22^{b}	1.17	8,33±0,54	2.63
16-18	176	337,44±3,18^{bc}	43,50±0,48^{c}	153,47±2,88^{ab}	45.48	64,84±4,86^{b}	19.22	7,76±0,15^{ab}	2.30	3,92±0,08^{ab}	1.16	9,19±0,14	2.72
19-21	175	342,00±3,62^{b}	43,86±0,73^{bc}	160,22±2,60^{a}	46.85	77,88±3,62^{ab}	22.77	8,29±0,18^{a}	2.42	4,12±0,08^{ab}	1.21	9,28±0,17	2.71
22-24	83	339,98±5,48^{bc}	46,47±0,57^{ab}	155,90±4,36^{ab}	45.86	66,84±2,88^{ab}	19.66	8,45±0,23^{a}	2.49	4,18±0,12^{ab}	1.23	9,36±0,25	2.75
24+	66	370,35±9,11^{a}	46,89±0,73^{a}	157,56±5,71^{ab}	42.54	82,83±3,88^{a}	22.37	8,26±0,20^{ab}	2.23	4,26±0,10^{b}	1.15	9,24±0,23	2.50
p		0.001	0.001	0.03		0.01		0.01		0.02		0.15	

DISCUSSION

In the study, it was observed that the carcass weights of Holstein, Brown-Swiss, Simmental and Montbeliarde were similar. In studies conducted on the Holstein breed, hot carcass weight was reported by Alberti et al., (2008) as 320.0 kg; by Golebiewski and Brzozowski (2011) as 293.7 kg; by Catikkaş and Koç (2017) as 304.36 kg; by Nikolaou et al., (2020) as 251.1 kg and Sipahi et al., (2022) as 264.9 kg. The values in the current study were higher than the literature. However, it was lower than reported by Kim et al., (2021) (442.9 kg). Hot carcass weight value in the Brown-Swiss was higher than determined by Alpan (1972), Kızıl and Aydoğan (2014), Çatıkkaş and Koç (2017), Pınarbaşı and Yazgan (2020) and Sipahi et al., (2022). The data obtained in the current study on the Simmental breed were higher than those Çatıkkaş and Koç (2017), Duru and Sak (2017), Nikolaou et al., (2020), Gao et al., (2022) and Sipahi et al., (2022) and similar with Alberti et al., (2008) and Pınarbaşı and Yazgan (2020), lower than those reported by Kızıl and Aydoğan (2014), Şenyüz et al., (2020) and Ateş and Akbaş (2022). The value obtained in the Montbeliarde breed was higher than reported by Sipahi et al., (2022), similar with by Nikolaou et al., (2020) and Golebiewski and Brzozowski (2011), it was lower than the values reported by Chládek, and Žižlavský (2004) and Chládek, and Žižlavský (2005). It is thought that the difference in hot carcass weights is related to slaughter age and feeding management. It is also important in genetic structure. In fact, it is known that some genes play an important role in parameters that directly affect carcass yield, fat storage, body weight, and body length in cattle (Daş, 2016).

The highest hot carcass weights were obtained from +24 months of age animals. The lowest hot carcass weight was at the age of 13-15 months of age of animals. The values obtained in the current study were, regardless of race, higher than Alberti et al., (2013), Duru and Sak (2017), Özdemir and Yanar (2021) and Sipahi et al., (2022) according to slaughter age. Also similar with Alberti ve ark. (2008) and lower than those of Chládek and Žižlavský (2004), Chládek and Žižlavský (2005) and Kim et al., (2021). The optimum slaughter age was 18 months for beef cattles (Ergün et al., 2020). The findings obtained in the study was resemble with the literature. Carcass yield was low at the slaughter time before the optimum slaughter age, and higher after slaughtering. This situation was expected. However, considering the amount of consumed feed for the carcass yield, it didnot appear to be an advantageous situation. Because, although feed and dry matter consumption increased with age in beef cattle, live weight does not increase at the same rate (Hayırlı, 2022).

There was a significant difference between breeds in terms of skin weight. The highest skin weight was 46.81±0.44 kg in the Simmental, and the lowest was 41.94±1.74 kg in the Brown-Swiss. In the literature, the skin weights reported by Alpan (1972) and Duru and Sak (2017) in Brown-Swiss, Holstein and Simmental were lower than the current study, while the values reported by Kızıl and Aydoğan (2014) and Ateş and Akbaş (2022) were higher. When compared to skin weights obtained in the study were lower in Brown-Swiss and Holstein breeds than the beef cattles, Simmental and Montbeliarde were similar with the Limousin, Charolais, Angus and Hereford (Kayar and İnal, 2022). In cattle, skin weight was directly proportional to body surface area and therefore live weight. It is thought that the difference in skin weights was due to the live weights of the animals at slaughter.

There was no difference between breeds in terms of minced, cubed meat, steak and tenderloin weights. However, ribeye weight was higher in the Holstein than the Brown-Swiss. Depending on the age of cattles, the situation was the opposite. While minced, cubes, steak and tenderloin weights were significant in depending on the age, but it was similar in terms of ribeye weight. There are not many studies on the evaluation of meat. In the literature (Alpan, 1972; Arpacık, 1978), the weight of tenderloin

and steak was lower than the current study, and the minced weight was higher. In a study conducted on the Zavot cattle (Sarıözkan et al., 2013), tenderloin values was similar with the study, but steak and tenderloin values were higher. Especially the rate of valuable meats, the effect of breed and age is important.

CONCLUSION

As a result, the fattening performance of the male steers of the combined breeds was above world standards in the study. The Montbeliarde has the potential to be higher in terms of carcass weights between the breeds. In terms of slaughter age, although the carcass weights of animals slaughtered over 24 months were higher, it was observed that the carcass weights of animals slaughtered at 19-21 months of age were at ideal weights. As a result of the study, it was concluded that breeders determine the slaughter time when they reached the target carcass weight, regardless of breed and age of cattle.

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Ethical approval
Study data were evaluated based on slaughterhouse data. No live animal data was used in the study. The authors declare that an ethics committee decision is not required.

Conflict of Interest
Author declares that there is no conflict of interest. All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by Okan Oyan, Hasan Hüseyin Şenyüz and Cem Çağdaş Arköse. The first draft of the manuscript was written by Hasan Hüseyin Şenyüz and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Additional Information's
This study was presented in the 3rd International Congress on Biological and Health Science, 14-16 Apr 2023 (Online).

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