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Slaughter and Carcass Traits of Gray Hungarian and German Mast Geese

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ABSTRACT This study was carried out to determine the slaughter and carcass traits of Gray Hungarian and German Mast geese raised in private farm conditions in Kars province, and the effect of genotype and sex on these traits. A total of 113 geese, 71 females (51 Gray Hungarian geese and 20 German Mast geese) and 42 males (28 Gray Hungarian geese and 14 German Mast geese) were slaughtered at approximately 6 months of age. The mean live weights of Gray Hungarian and German Mast geese before slaughter were 4291.96 and 3007.59 g, respectively. Statistically significant differences were found between Gray Hungarian and German Mast geese in slaughter and carcass traits except gizzard weight ($p<0.001$). No statistically significant difference was detected between the two genotypes in terms of hot carcass weight, blood ratio, and feather ratio ($p>0.050$). There was a statistically significant difference in gizzard weight between the sex groups of Gray Hungarian geese ($p<0.001$). A statistically significant difference was found only in hot carcass yield among all traits examined between the sex groups of German Mast geese ($p<0.001$). In conclusion, it was determined that Gray Hungarian geese reared in commercial enterprise breeding conditions in Kars province were generally superior to Mast geese in terms of slaughter and carcass traits. Apart from local goose breeds, it may be suggested that breeders may prefer Gray Hungarian geese compared to German Mast geese to obtain heavy carcasses at an earlier age.

Keywords: *Carcass traits, Genotype, Goose, Sex, Slaughter weight.*

ÖZ

Gri Macar ve Alman Mast Kazlarının Kesim ve Karkas Özellikleri

Bu çalışma, Kars ilinde özel bir işletme koşullarında yetiştirilen Gri Macar ve Alman Mast kazlarının kesim ve karkas özellikleri ile bu özellikler üzerine genotip ve cinsiyetin etkisini belirlemek amacıyla gerçekleştirilmiştir. Araştırmada bu amaçla yaklaşık 6 aylık yaşta 71'i dişi (51 Gri Macar kazı, 20 Alman Mast kazı) ve 42'si erkek (28 Gri Macar kazı, 14 Alman Mast kazı) olmak üzere toplam 113 kaz kesilmiştir. Elde edilen bulgulara göre Gri Macar ve Alman Mast kazlarında kesim öncesi canlı ağırlık ortalamaları sırasıyla 4291.96 ve 3007.59 g olarak belirlenmiştir. Gri Macar ve Alman Mast kazları arasında taşlık ağırlığı hariç incelenen kesim ve karkas özellikleri bakımından istatistiksel olarak önemli farklılıklar bulunmuştur ($p<0.001$). İki genotip arasında sıcak karkas randımanı, kan oranı ve tüy oranı bakımından ise istatistiksel olarak önemli bir farklılık ($p>0.050$) tespit edilmemiştir. Gri Macar kazları cinsiyet grupları arasında taşlık ağırlığı bakımından istatistiksel olarak önemli bir farklılık olduğu saptanmıştır ($p<0.001$). Alman Mast kazı cinsiyet gruplarında incelenen tüm özellikler içinde sadece sıcak karkas randımanı bakımından istatistiksel olarak önemli fark bulunmuştur ($p<0.001$). Sonuç olarak, Kars ilinde özel bir işletme koşullarında yetiştiriciliği yapılan Gri Macar kazlarının genel olarak kesim karkas özellikleri bakımından Mast kazlarına göre daha üstün olduğu belirlenmiştir. Yerli kaz ırklarına alternatif olarak daha erken yaşta ağır karkas elde etmek isteyen yetiştiricilere Alman Mast kazlarına göre Gri Macar kazı yetiştiriciliği yapmaları önerilebileceği düşünülmektedir.

Anahtar Kelimeler: *Cinsiyet, Genotip, Karkas özellikleri, Kaz, Kesim ağırlığı.*

INTRODUCTION

Among poultry species, chicken farming is the main source of commercial poultry meat production worldwide; however, production of goose meat playsan important role as an alternate food of animal origin. Today, many different genotypes of geese are bred. Although the production share of goose meat is lower than chicken, it increases consumer demand due to the differences in the taste and composition of the meat (Gumułka and Połtowicz

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2020; Razmaitė 2022). In addition to meat, goose breeding has a high commercial potential due to its products such as fat, feather and fatty liver. Geographical and cultural differences have led to significant commercial earnings from geese breeding in some countries and regions. In Türkiye, despite some regional, geographical, and cultural advantages, commercial goose breeding is extremely limited (Guemene et al. 2012; Kırmızıbayrak 2018).

The geese population density in Türkiye differs significantly due to geography. In Türkiye, goose breeding is most intensively practiced in Kars and Ardahan provinces in Northeastern Anatolia and Muş province in Eastern Anatolia Region. Although depends on year, approximately 35% of Türkiye's geese population is found in Kars province (TÜİK 2021). The fact that goose breeding is the most common poultry farming in Kars and surroundingregions is associated with the high habit of consumption of geese meat, the traditional extensive breeding conditions by the local community, and the low cost of meat production. The goose meat obtained primarily contributes to the nutrition of the people of the region, thus supporting the regional and national economy (Kırmızıbayrak and Önk 2011; Saatcı et al. 2021).

Goose farms in Kars and its surroundings generally include local genotypes. Although low-capacity family farms traditionally use natural incubation method, the number of goose farms and the population of geese in Kars province have increased in recent years (TÜİK 2021). The rapid increase in the demand for goose carcasses in the region has increased the importance given to goose breeding, and breeders have begun searching for alternative sources of outside the region in order to increase goose meat productıon. For this purpose, live goose or their carcasses are brought to the region from other provinces such as Şanlıurfa, Diyarbakır, Muş, Yozgat, and Aksaray. In addition, some breeders have started to breed foreign genotype geese in order to obtain higher egg and meat yields. Due to this demand, foreign genotype geese such as Chinese, Hungarian, Linda, and Mast have been brought to Kars in recent years. Some small-scale breeders have improperly and randomly crossbred the local and foreign goose genotypes (Boz et al. 2020; Kırmızıbayrak 2020).

The studies on geese in Türkiye are generally conducted with indigenous genotypes, and there is a limited number of studies focusing on foreign goose genotypes. It is crucial to examine the yield traits of geese with foreign genotypes under breeding conditions similar to those for local breeds. This study aimed to investigate the slaughter and carcass traits of Gray Hungarian and German Mast breeds raised in Kars, and the effect of genotype and sex on these characteristics.

MATERIAL AND METHODS

This study was carried out after obtaining approval from the Kafkas University's Ethics Committee for Animal Experiments (KAÜ-HADYEK). (Decision Number: KAÜ-HADYEK/2023-023).

The animal material in the study consisted of 113 Gray Hungarian and German Mast geese (71 females and 42 males), which were raised under private enterprise conditions in the center of Kars province in Türkiye and were approximately 6 months old at the time of slaughter. The goose eggs were hatched inMay. Following hatching, chicks were placed in growing cages and the temperature inside the cages was set at 30±2 °C until 7 days of age. A stove was used for heating. Thetemperature inside the poultryhouse was reduced to 25±2°C when the goslings were 7 days old. Goslings were fed growth feed until two weeks of age (Table 1). The goslings, which were removed from the cages to the ground at the end of three weeks of age, were fed with approximately 250-300 g feed per animal during this period and the heating process inside the poultryhouse was terminated. In addition, crushed barley was given in addition to concentrate feed. In the following weeks (week 4-6), the amount of feed given to the goslings was increased, and 300-350 g feed was given per goose.

Table 1: Nutrient contents of the growth feed used in the study, %.

CP	22.0
CS	4.0
RO	3.2
CA	5.4
ME (Kcal/kg)	3000
Ca	0.9
Na	0.2
P	0.7
Lys	1.3
M	0.9

(CP: Crude protein, CC: Crude cellulose, RO: Raw oil CA: Crude ash, ME: Metabolic energy, Ca: Calcium, Na: Sodium, P: Phosphorus, Lys: Lysine, M: Methionine).

The farm management terminated the use of concentrate feed from 6 weeks of age in order to reduce feed costs, and the geese were fed only 400-450 g of crushed barley. Geese grazed from 8 weeks of age until slaughter and the same amount of barley was given to the geese after grazing. One month before slaughter, the movement area of the geese was restricted and they grazed close to their shelters, and 400–450 g of barley was given per goose. The geese were slaughtered at the end of October. The geese were starved for 12 hours before slaughter and only water was given during this period. On the day of slaughter, the geese were numbered and their live weights were determined. Blood, head, wing, and foot weights were determined after slaughter. The birds were plucked by a plucking machine and the feather weight was calculated. After the abdomen was opened, the sex of the birds was confirmed by observing the presence of testes or ovaries. Hot carcass, heart, liver, gizzard, and intestine weights of each carcass were determined. Since the farm sold the carcasses with the abdominal fat, the abdominal fat remained on the carcass and could not be weighed separately. Different parts of the carcasses were weighed using a digital scale with a sensitivity of 0.01 g.

Statistical Analysis

Statistical analysis of the data was performed using the software SPSS version 26. Normality of the data was checked with the shapiro-wilk test. The t-test was used to determine the statistical significance of the differences between the means of the slaughter and carcass traits, genotype groups, and sex groups.

RESULTS

The means and standard error values of slaughter and carcass traits of geese with different genotypes and sexes in this study and the statistical significance of the differences between group means are given in Table 2 and Table 3. There were statistically significant differences

between Gray Hungarian and German Mast geese in slaughter and carcass characteristics except gizzard weight (p<0.001). The pre-slaughter live weight means of Gray Hungarian and German Mast geese were 4291.96 and 3007.59 g, respectively, and statistically significant differences were found between the genotype group means and between the sex groups of the two genotypes (p<0.001).

Table 2: Mean ($\bar{x}$) and standard error ($S\bar{x}$) values of slaughter and carcass traits.

Slaughter traits (g)	Genotype	Gender			General
		Male $\bar{x}\pm S\bar{x}$	Female $\bar{x}\pm S\bar{x}$	p	$\bar{x}\pm S\bar{x}$
Live weight	GHG	4411.39±192.57	4226.39±76.97	0.378	4291.96±84.27
	GMG	3162.50±182.66	2899.15±111.95	0.203	3007.59±100.83
	p	0.001	0.001	-	0.001
Hot carcass weight	GHG	2897.61±135.27	2816.00±59.21	0.584	2844.92±60.95
	GMG	2241.21±108.49	1880.00±73.00	0.007	1994.88±73.36
	p	0.003	0.001	-	0.001
Blood weight	GHG	235.32±13.11	208.53± 9.34	0.096	218.03±7.70
	GMG	170.79±13.58	141.50±13.02	0.139	153.56±9.68
	p	0.004	0.001	-	0.001
Feather weight	GHG	306.93±15.85	287.86±8.92	0.300	294.62±8.05
	GMG	235.21±20.44	200.95±14.73	0.172	215.06±12.24
	p	0.010	0.001	-	0.001
Head weight	GHG	159.71±4.31	151.39±2.45	0.074	154.34±2.23
	GMG	130.57±3.72	126.70±4.56	0.542	128.29±3.06
	p	0.001	0.001	-	0.001
Feet weight	GHG	104.96±6.61	101.25±2.23	0.598	102.57±2.73
	GMG	82.79±5.45	79.50±5.04	0.667	80.85±3.68
	p	0.013	0.001	-	0.001
Heart weight	GHG	33.54±1.33	32.04±0.78	0.304	32.57±0.69
	GMG	28.07±1.40	26.20±0.68	0.197	26.97±0.71
	p	0.014	0.001	-	0.001
Liver weight	GHG	79.32±3.87	73.25±1.73	0.160	75.41±1.78
	GMG	70.43±1.89	68.75±2.20	0.589	69.44±1.50
	p	0.046	0.150	-	0.012
Gizzard weight	GHG	141.50±4.26	130.84±2.65	0.028	134.62±2.34
	GMG	138.21±7.03	127.45±4.21	0.173	131.88±3.86
	p	0.676	0.498	-	0.532
Intestine weight	GHG	262.29±10.10	255.94±5.09	0.578	258.19±4.84
	GMG	218.50±17.36	206.45±10.21	0.529	211.41±9.23
	p	0.025	0.001	-	0.001

(p: statistical significance value, $\bar{x}$: arithmetic mean, $S\bar{x}$:standard error value, GHG: Gray Hungarian Geese, GMG: German Mast Geese)

Hot carcass weight means were 2897.61 and 2241.21 g for males and 2816.00 and 1880.00 g for females of Gray Hungarian and German Mast goose, respectively, and statistically significant differences were found between the same sex groups of both genotypes *(*p<0.001). Although there was no statistical difference between the sex groups of the Gray Hungarian genotype (p>0.05), it was found that the hot carcass weight means of the German Mast goose males was higher (p<0.001) than the females. The overall means of hot carcass weight were 2844.92 g and 1994.88 g in Gray Hungarian and German Mast geese, respectively, and the difference between the group means was statistically significant (p<0.001). Evaluation of the same sexes between the two genotypes revealed that the examined traits were superior in male geese and were found to be consistent with the results of other studies (Mazanowski et al. 2005; Saatcı et al. 2009; Kırmızıbayrak and Önk 2011), in which genotype and sex had aneffect on carcass weight.

Goose feather has high economic value. In addition to the direct sale of goose feather, breeders use it to make quilts, pillows, and mattresses. In this study, the mean feather weight was 294.62 g of the Gray Hungarian geese and 215.06 g of the German Mast geese, and there was a significant difference between the averages, and also the feather weight of Gray Hungarian male and female geese was higher than German Mast geese (p<0.001).

Table 3: Ratios ($\bar{x}$) and standard error ($S\bar{x}$) values of slaughter and carcass traits examined in geese.

Carcass parts (%)	Genotype	Gender		p	General $\bar{x}\pm S\bar{x}$
		Male $\bar{x}\pm S\bar{x}$	Female $\bar{x}\pm S\bar{x}$		
Hot carcass yield	GHG	65.63±0.75	66.62±0.65	0.343	66.27±0.50
	GMG	72.05±2.91	65.16±1.40	0.026	67.99±1.55
	p	0.050	0.286	-	0.295
Blood rate	GHG	5.42±0.27	4.91±0.20	0.128	5.09±0.16
	GMG	5.62±0.51	4.85±0.35	0.211	5.17±0.30
	p	0.712	0.883	-	0.808
Feather rate	GHG	6.99±0.23	6.87±0.22	0.717	6.91±0.16
	GMG	7.61±0.83	6.96±0.48	0.477	7.23±0.44
	p	0.365	0.862	-	0.507
Head rate	GHG	3.77±0.17	3.62±0.07	0.425	3.68±0.08
	GMG	4.34±0.30	4.47±0.20	0.729	4.42±0.17
	p	0.080	0.001	-	0.001
Feet rate	GHG	2.42±0.14	2.41±0.05	0.941	2.42±0.06
	GMG	2.86±0.37	2.80±0.19	0.880	2.82±0.19
	p	0.294	0.057	-	0.043
Heart rate	GHG	0.78±0.03	0.76±0.02	0.615	0.77±0.01
	GMG	0.92±0.07	0.92±0.03	0.983	0.92±0.03
	p	0.060	0.001	-	0.001
Liver rate	GHG	1.85±0.09	1.76±0.06	0.414	1.79±0.05
	GMG	2.32±0.14	2.42±0.10	0.570	2.38±0.08
	p	0.005	0.001	-	0.001
Gizzard rate	GHG	3.41±0.21	3.15±0.09	0.245	3.24±0.09
	GMG	4.45±0.20	4.50±0.20	0.871	4.48±0.14
	p	0.001	0.001	-	0.001
Intestine rate	GHG	6.11±0.24	6.11±0.12	0.991	6.11±0.11
	GMG	7.11±0.64	7.19±0.33	0.904	7.16±0.32
	p	0.158	0.005	-	0.004

(p:statistical significance value, $\bar{x}$: arithmetic mean, $S\bar{x}$: standard error value, GHG: Gray Hungarian Geese, GMG: German Mast Geese)

The mean values of blood, head, feet, heart, liver, and intestine weight are given in Table 2. There was a statistically significant difference between the same sex groups of the two genotypes in terms of these traits ($p<0.001$). The overall mean of gizzard weight in Gray Hungarian and German Mast geese were determined as 134.62 and 131.88 g, respectively, and there was no statistically significant difference between the genotype groups for the same sex ($p>0.050$), whereas a statistically significant difference was found between males and females in favor of males in Gray Hungarian geese ($p<0.001$).

Proportional (%) mean values and standard error values of slaughter carcass traits in this study are given in Table 3. Hot carcass dressing percentagevalues were 66.27% and 67.99% in Gray Hungarian and German Mast geese, respectively. In literature, carcass dressing percentage in geese generally varies between 60-73% and increases with age (Tilki et al. 2004; Kırmızıbayrak and Önk 2011; Akbaş et al. 2020; Boz and Sarıca 2021). The carcass yield of approximately 67-68% obtained in the present study is considered to be at an acceptable level considering the nutritional conditions and age. There was no statistically significant difference ($p>0.050$) between the two genotypes in blood and feather ratio. Statistically significant differences ($p<0.001$) were found among the other traits analyzed.

DISCUSSION AND CONCLUSION

Pre-slaughter live body weight means of the goose genotypes examined in this study were compared with other study findings. The values of the present study were lower than those reported by Boz and Sarıca (2021) for Turkish indigenous geese in Yozgat province, Tilki et al. (2004) for 8 months old Turkish indigenous geese, Kırmızıbayrak (2002) for 6–7 months old Turkish indigenous geese, Uhlířováet al. (2018) about 2 and 4 months old Eskildsen Schwer and Czech geese, Lewko et al. (2022) on commercial hybrids of White Kołuda (W-31) and Pomeranian and Kielecka geese, Biesiada-Drzazga (2014) for in W11, W33 and W31 White Koluda geese, Tilki et al. (2009) and Güner et al. (2004). Pre-slaughter body weight value for male geese reported by Şahin et al. (2008) was similar to the value reported for Gray Hungarian geese in the present study. The value reported for female geese was higher than the pre-slaughter body

weight of German Mast geese in this study. A study by Akbaş et al. (2020) reported similar values for Linda geese as in the present study for German Mast geese, but lower than those reported for Gray Hungarian geese. Yakan et al. (2012) investigated geese slaughtered at the age of 8–9 months and the reported values were for Gray Hungarian geese and higher for German Mast geese in this study. The values reported by Boz (2019) were close to our results. It can be concluded that the finding values of this study were lower than the literature reports on local geese genotypes in the region. This situationcan be explained by the fact that the geese slaughtered in other studies were generally at the age of 8-10 months, while the foreign genotype geese in this study were slaughtered at earlier age of approximately 6 months following the short fattening period, and the nutritional conditions of the geese in the enterprise were below the mark.

In the present study, hot carcass weight was higher in male geese for both genotypes. The mean weight of hot carcass obtained in this study was lower than those of Tilki et al. (2004) and Çelik and Bozkurt (2009). The mean weight of hot carcass determined for Gray Hungarian geese in this study was similar to those reported by Kırmızıbayrak and Önk (2011), Yakan et al. (2012), and Boz and Sarıca (2021); whereas lower for German Mast geese compared to other studies.

The overall mean of feather weight determined as 294.62 g in Gray Hungarian geese and 215.06 g in German Mast geese werelower than those of native breeds reported by Tilki and İnal (2004), similar to those of reported by Boz (2019), and higher than those of reported by Kırmızıbayrak and Önk (2011). The mean blood weight in Gray Hungarian and German Mast geese was lower than the values in the study of Akbaş et al. (2020), Kırmızıbayrak and Önk (2011), and Boz (2019), and similar to the values reported by Tilki et al. (2004), Saatcı et al. (2009), and Kırmızıbayrak and Kuru (2018). It is suggested that these differences may be due to possible differences in genotype, age, or duration of bleeding. The mean weight of head and foot for German Mast geese was similar to those determined by Kırmızıbayrak and Kuru (2018) and higher for Gray Hungarian geese. The mean values for head and foot weights in this study were similar to those reported by Boz (2019) and Kırmızıbayrak and Önk (2011), but higher than the mean values reported by Boz and Sarıca (2021).

We found the mean weight of liver and gizzard among edible organs to be lower than those reported by Boz and Sarıca (2021) for geese in Yozgat province; heart weight on the other hand was similar. The heart and gizzard weights reported by Tilki et al. (2009) for domestic geese were similar to the findings of this study, while liver weight was higher than our findings. The mean heart and liver weights obtained in this study were similar to those reported by Yakan et al. (2012) and Tilki et al. (2004). The mean gizzard weight in this study was lower than the values reported by Akbaş et al. (2020) and Tilki et al. (2004), while higher than the values reported by Kırmızıbayrak and Önk (2011), and similar to the values reported by Sarıca et al. (2015).

In conclusion, the traits of Gray Hungarian goose and German Mast goose, which are preferred by breeders in Kars province as an alternative to indigenous Turkish breeds in goose meat production in Türkiye, were compared under commercial enterprise conditions, and it was concluded that Gray Hungarian goose was superior to German Mast goose. It was also demonstrated that the Gray Hungarian geese can reach the appropriate carcass weight in a much shorter feeding period. In order to reveal the better traits of foreign goose genotypes as an alternativeto local indigenous genotypes, comparing their performance with thesegenotypes under the same conditions will provide more accurate information. The results obtained in this study were significant as the study was carried out under commercial enterprise conditions in Kars province, where at least $^1/_3$ of Türkiye's goose population is raised and has a significant share in the Turkish goose meat market.

CONFLICTS OF INTEREST

The authors report no conflicts of interest.

AUTHOR CONTRIBUTIONS

Idea / Concept: SK
Supervision / Consultancy: TK
Data Collection and / or Processing: SK
Analysis and / or Interpretation: BBK
Writing the Article: TK, BBK, SK
Critical Review: TK, BBK, SK

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