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Slaughter, carcass and egg traits of domestic geese raised in the Aegean region of Turkey

Y. Akın[#] & M.F. Çelen
Department of Animal Science, Uşak University, TR-64100 Uşak, Turkey

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Abstract

This study was conducted to determine the slaughter, carcass, and egg quality characteristics of domestic geese reared in Uşak, Afyon, and Kütahya provinces of the Aegean region. Ninety-six eggs were obtained from 38- to 44-week-old geese from four locations in each province. Slaughter and carcass characteristics were recorded for 48 female and male geese between 28 and 32 weeks old. Heavier eggs were produced in Afyon and Kütahya than in Uşak. Shape index, eggshell ratio and thickness, and yolk colour were significantly different between provinces. Birds from Kütahya were lighter at slaughter than those from Uşak and Afyon. This difference was also manifest in the weights of hot and cold carcass, blood, neck, wing, leg, breast, and back. The weights of blood, feathers, liver, gizzard, heart and neck varied significantly relative to cold carcass weight between provinces. Male geese were significantly larger than females in all respects except for liver weight. Because females weighed less, the various ratios to cold carcass weight were significantly greater than for males. Interestingly, the relative weight of the breast was significantly greater for males than for females. These differences among provinces might be attributable to environmental factors and genetic differences among the geese themselves.

Keywords: Aegean provinces**,** breeder conditions, carcass traits, egg quality, geese liver
[#]*Corresponding author: yüksel.akin@usak.edu.tr*

Introduction

Poultry farming is one of the most popular forms of livestock production in Turkey. It includes laying hens, broiler chickens, quail, geese, ducks and turkeys, and is carried out almost nationwide. Poultry farms consisting of a few chickens, geese, turkeys, and ducks for domestic consumption are common in rural areas. However, new operations practise intensive industrial production. In the Turkish poultry sector, chickens constitute approximately 99% of production (66% broilers and 33% layers), and 1% consists of geese, ducks, turkeys and other poultry (TAGEM, 2018). Because of the desirability of chicken as a white meat source, there is momentum for the development of the broiler industry in Turkey.

Goose production lagged behind the broiler industry for various reasons. Consumption of goose meat was localized to the regions where it is produced. It was not promoted adequately and the number of scientific studies about production was limited (Aral & Aydın, 2007). The level of goose production was compromised by low egg production, infertility, and low hatchability (Tilki *et al.*, 2011). Despite these negative factors, a recent rise in consumer interest in goose meat and products increased the impetus for goose breeding (Boz *et al.*, 2014). Goose breeding takes place mostly in North East Anatolia (Kars, Ardahan and surrounding provinces), Central Anatolia (Yozgat, Aksaray and Kırşehir), Aegean (Kütahya, Afyonkarahisar, and Uşak), Black Sea regions (Samsun interior and around Çorum) and in cities with a continental climate (Akın & Çelen, 2020a; Boz *et al.*, 2014; Taşkın *et al.*, 2017; Tekbalkan, 2017; Tilki & İnal, 2004a).

The main factors that affect carcass characteristics in geese are methods of feeding and care, slaughter age, genotype, gender, and environmental interactions (Sarıca *et al.*, 2015; Tilki & İnal, 2004b). Although some slaughtering occurs at nine weeks, optimum muscle development takes place when the geese are between 11 and 17 weeks old. Slaughtering at an older age contributed to higher carcass yield (Guy *et al.*, 1996). For example, the meat yield of 10-week-old geese was higher than at 8 or 9 weeks old. and bones and skin were lower proportions of carcass weight at these ages (Cave *et al.*, 1994). The average

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slaughter weight of geese in Turkey at 24 to 25 weeks old was 4.2–4.7 kg with a hot carcass weight of 2.8–3.1 kg (Kırmızıbayrak, 2002; Tilki *et al.*, 2011).

In geese, egg weight varies among genotypes, but the average is between 130 g and 205 g (Puchajda *et al.*, 1989; Puchajda *et al.*, 1998; Selçuk *et al.*, 1983). At Kars, it was reported that egg weight ranged between 155 g and 168 g (Önk, 2009). In an earlier study, egg weight ranged from 144.2 g to 172.3 g, with an average of about 154.9 g (Tilki & İnal, 2004a), which is consistent with the average egg weight of 153 g for white Italian x Cuban hybrid geese (Mazanowski & Bernacki, 2006). Generally, shape index values in geese were reported as 65.8%, 66.3%, and 68.5% (Mazanowski & Bernacki, 2006; Saatçi *et al.*, 2002; Tilki & İnal, 2004a). The shells of goose eggs (average 0.52 mm) are thick compared with other poultry (chicken 0.31 to 0.36 mm; turkey 0.394 mm; quail 0.16 to 0.23 mm) (Akın & Çelen, 2020b; Erişir *et al.*, 1999; Poyraz, 1989; Tilki & İnal, 2004a).

Thus, this study was designed to compare slaughter, carcass, and egg quality characteristics of domestic geese reared under breeder conditions in the Aegean region. It was intended that these values should serve as a point of reference for future studies because the current study was the first to be conducted in that region.

Material and Methods

This study was conducted within the scope of the decision of Uşak University Rectorate Animal Experiments Local Ethics Committee (UÜHADYEK), dated 21 December 2018, number 2018/02.

To determine egg quality characteristics, 96 eggs were obtained from geese between 38 and 44 weeks old in February and March from 12 farms. The farms were located in Uşak, Afyon, and Kütahya provinces in the Aegean region. Thirty-two eggs from each province (8 eggs from each farm) were assessed in the student laboratories of the Faculty of Agriculture of Uşak University. The weight of each egg and its width and length were determined first. An electronic scale with a sensitivity of 0.01 g was used to weigh the eggs. After 10 minutes the egg was broken and weight of the eggshell, colour of the yolk (Roche yolk colour fan (scale 1 to 16), height and diameter of the egg white, and height of the yolk were recorded. A digital calliper was used to measure the length and width of each egg, the diameters of the yolk and albumen, and the length of the albumen. A tripod micrometer (0.01 mm sensitivity) was used to measure the heights of the yolk and albumen. In addition, the thickness of the eggshell was measured at the sharp and blunt ends and at its equator with a micrometer after the shell membranes had been removed. Indexes (Anderson *et al.,* 2004) that had been used to characterize egg quality were applied to the data:

$$Shape\ index\ (SI) = 100x\ egg\ width/egg\ length$$

$$Albumen\ index\ (AI) = 100x\ albumen\ height/0.5(albumen\ width + albumen\ diameter)$$

$$Yolk\ index\ (YI) = 100x\ yolk\ height/yolk\ diameter$$

$$Haugh\ unit\ (HU) = 100xlog(7.6 - 1.7(egg\ weight, g)^{0.37} + (albumen\ height, mm))$$

Breeders in all three provinces stated that the goslings were fed grain products (leftover bread, wheat, corn, barley, etc.), and at one month old they were given access to pasture. The 48 geese that were slaughtered in this study were gathered from the same local breeders as the eggs. There were 16 geese from each province (two males and two females from each farm). Slaughter and carcass evaluations were carried out according to Jones (1984). The geese were fasted for at least 12 hours before slaughter, which started in the early morning. Live weight was recorded before slaughter. After being bled out for 10 to 15 minutes, the decapitated geese were weighed again and the difference between live weight and the bled-out weight was recorded as the weight of the blood. The feet were then removed and weighed. Next the coarse feathers were removed, and the carcass was soaked in hot water at 65–70 ºC for 5 minutes, then the remaining fine feathers were removed and the plucked carcass was weighed again. The difference in carcass weights before and after plucking was recorded as the weight of the feathers. The abdominal cavity of the plucked goose was split and the internal organs were removed. The abdominal fat was cleaned of extraneous tissue and weighed. Then the gizzard, heart and liver were also cleaned and weighed. The sex of each goose had been determined before slaughter and was confirmed by the presence of testicles or ovaries. After these processes, the hot carcass weight of each goose was determined. The cold carcass weight of each goose was recorded after the carcass had been refrigerated for 24 hours at 4 ºC. The carcass components were dissected in accordance with Jones (1984). The live weight and carcass parts were weighed on electronic scales sensitive at 0.1 g, and internal organs at a sensitivity of 0.01 g. Relative weights of the carcass components were calculated by dividing the component weights by the weight of the cold carcass.

Statistical analyses of the data were conducted using SPSS (version 16) software (IBM Corp., Armonk, New York, USA). The linear model used to analyse the data was:

$$Y_{ij} = \mu + P_i + e_{ij}$$

where Y_{ij} = an observed value, μ = the mean of the observations, P_i= the effect of the ith province, and e_{ij}= the residual effect that was used as error to test te effects of province. Duncan's multiple comparison procedure was used to compare the means. Percentage data were transformed using the arcsine transformation to homogenize the variance before further statistical evaluation. Genders were compared using Student's *t*-test for independent samples.

Results and Discussion

The internal and external indicators of quality for eggs that were produced in each province are shown in Table 1. The differences in egg weight from geese raised in the Uşak, Afyon, and Kütahya provinces were significant (P <0.01). Although the eggshell weights were not detected as being different in these provinces, significant differences were observed when the eggshell weight was expressed as a ratio to egg weight (P <0.01). Eggshell thickness and yolk colour differed significantly (P <0.05). The eggs also differed in shape (P <0.01). No significant differences were detected in the internal indicators of egg quality such as the yolk index, albumen index, and Haugh unit values.

Table 1 Internal and external indicators of quality of goose eggs from three provinces in Turkey

Egg quality traits	Province			*P*-value
	Uşak	Afyon	Kütahya	
Egg weight, g	140.40 ± 1.806[b]	146.74 ± 1.363[a]	146.89 ± 1.617[a]	0.006
Eggshell weight, g	22.21 ± 0.311	22.74 ± 0.367	22.06 ± 0.322	0.326
Shape index	68.18 ± 0.432[c]	70.98 ± 0.532[a]	69.63 ± 0.308[b]	0.001
Yolk index	34.98 ± 0.449	35.50 ± 0.350	35.48 ± 0.450	0.613
Albumen index	6.30 ± 0.085	6.50 ± 0.165	6.18 ± 0.063	0.141
Haugh unit	76.20 ± 0.532	76.49 ± 0.751	75.88 ± 0.538	0.778
Eggshell ratio	15.83 ± 0.157[a]	15.48 ± 0.159[a]	15.00 ± 0.098[b]	0.001
Eggshell thickness, mm	0.53 ± 0.005[b]	0.55 ± 0.006[a]	0.53 ± 0.008[b]	0.017
Egg yolk colour (Roche yolk fan)	7.15 ± 0.262[a]	6.15 ± 0.191[b]	6.78 ± 0.098[ab]	0.016

[a,b,c] Within a row, means with a similar superscript were not significantly different (P >0.05)

Arslan & Saatçi (2003) observed egg weights of 128.85 g for one-year-old geese and 148.15 g for two-year-old geese in Kars province. Thus egg weight increased with age. The geese that produced eggs for the current study were more than three years old. The egg weights observed in the current study were heavier than the 137.37 g reported by Peşmen & Yönetken (2020a) in a study of one-year-old geese conducted in Afyon, and 122.09 g reported by Sarı *et al.* (2019) for Linda geese of indeterminate age raised in Burdur province. In other studies that were conducted in Kars, egg weights ranged from 154.9 g to 172.3 g (Önk, 2009; Tilki & İnal, 2004a; Akın & Çelen, 2022). The eggshells produced in the current study were heavier compared with previous studies (Arslan & Saatçi (2003); Peşmen & Yönetken (2020a); Sarı *et al.* (2019); Önk, 2009; Tilki & İnal, 2004a) in which eggshell weights ranged from 18.4 g to 20.4 g, However, Akın & Çelen (2022) observed even heavier eggshells. Expressed as ratios to egg weight, the geese in the current study generally produced eggs with relatively heavy shells compared with those from earlier studies (Mazanowski & Bernacki, 2006; Saatçi *et al.,* 2002; Sarı *et al.*, 2019; Tilki & İnal, 2004a). Again, the results from Akın & Çelen (2022) were an exception to this generality. It was thought that the differences might be caused by feeding, environmental conditions, age of the geese, and measurement errors. The eggshells from the geese in the present study were thicker than those by Tilki *et al.* (2004a), Sarı *et al.* (2019), and Alaşahan *et al.* (2019), similar to the values from Juaodka *et al.* (2012) and Dodu (2010), and lower than the 0.72 mm observed by Saatçi *et al.* (2002) and Akın & Çelen (2022). These differences between the studies might be because of differences in the amount of calcium in the feed.

Although fewer goose eggs are consumed than chicken eggs, egg yolk colour is still an important criterion affecting how consumers view eggs. It has been stated that this value should be 10 (Gürbüz *et al.,*

2003). Because there were no comparable values for goose eggs, the values observed in the current study were compared with those of other poultry eggs and were generally lower than in previous studies (Akın & Çelen, 2020b; Akın & Çelen, 2022; Roberson *et al.*, 2005; Sarı *et al.*, 2019; Turan, 2006; Yörük *et al.*, 2004). The internal quality of the eggs was reflected by the egg albumen index, which was higher than was observed by Sarı *et al.* (2019) for Linda geese, but lower than those in studies conducted in Kars (Saatçi *et al.,* 2002; Sarı *et al.,* 2019; Mazanowski & Adamski, 2006). The yolk index values in the current study were higher than those reported by Sarı *et al.* (2019), Mazanowski & Adamski (2006), and lower than those reported by Saatçi *et al.* (2002) and Tilki & İnal (2004c). The eggs from the current study had Haugh unit values that were higher than those reported in Adamski *et al.* (2016) and Tilki & İnal (2004c), but lower than those in Saatçi *et al.* (2002) and Sarı *et al.* (2019).

The values in the current study for the shape index were higher than those of Peşmen & Yönetken (2020a), Sarı *et al.* (2019), Saatçi *et al.* (2002), Tilki (2001), Önk (2009), Arslan & Saatçi (2003), and were similar to those by Tilki & İnal (2004c), Mazanowski & Bernacki (2006), Zhang *et al.* (2017).

The means for carcass and slaughter characteristics of geese from Uşak, Afyon and Kütahya are shown in Table 2. Birds from Kütahya were lighter at slaughter than those from Uşak and Afyon, with this difference also being manifest in the weights of hot and cold carcass, blood, neck,, wing, leg, breast, and back. No significant difference was observed in the weight loss during the cooling stage, that is, the difference between hot and cold carcass weights. Across all three provinces, the weights of the head, feet, feathers liver, heart, gizzard, and abdominal fat were also similar.

Table 2 Slaughter weight and weights of carcass components of domestic geese from three provinces in Turkey

Weights of carcass components	Province			*P*-value
	Uşak	Afyon	Kütahya	
Slaughter weight, kg	4.427 ± 81.54[a]	4.304 ± 85.36[a]	4.076 ± 70.01[b]	0.011
Blood weight, g	160.56 ± 2.25[a]	153.38 ± 2.84[ab]	149.25 ± 2.58[b]	0.015
Head weight, g	142.25 ± 1.89	138.38 ± 2.21	136.00 ± 2.33	0.129
Feet weight, g	121.38 ± 1.56	117.62 ± 1.52	115.25 ± 2.14	0.057
Feather weight, g	309.81 ± 5.42	304.00 ± 3.81	302.06 ± 5.30	0.514
Liver weight, g	76.89 ± 4.39	70.53 ± 4.09	82.37 ± 3.64	0.130
Heart weight, g	26.02 ± 0.51	26.23 ± 0.62	25.71 ± 0.58	0.818
Gizzard weight, g	133.60 ± 1.27	134.76 ± 1.57	131.86 ± 1.96	0.453
Abdominal fat weight, g	176.02 ± 17.44	162.19 ± 6.46	148.53 ± 7.49	0.255
Hot carcass, kg	3.107 ± 61.54[a]	3.025 ± 67.54[a]	2.820 ± 48.82[b]	0.004
Cooling stage, g	61.56 ± 2.71	59.75 ± 3.30	55.75 ± 3.16	0.398
Cold carcass, kg	3.046 ± 61.65[a]	2.965 ± 65.30[a]	2.764 ± 46.45[b]	0.004
Neck weight, g	237.06 ± 3.88[a]	240.75 ± 3.45[a]	223.81 ± 3.38[b]	0.004
Wing weight, g	473.88 ± 10.37[a]	477.69 ± 9.38[a]	428.44 ± 6.79[b]	0.001
Leg weight, g	641.06 ± 11.21[a]	633.06 ± 16.81[a]	593.44 ± 7.22[b]	0.021
Breast weight, g	962.88 ± 33.65[a]	926.06 ± 25.56[ab]	856.12 ± 18.47[b]	0.022
Back weight, g	731.31 ± 17.48[a]	687.81 ± 18.04[ab]	662.81 ± 16.32[b]	0.025

[a,b,c] Within a row, means with a similar superscript were not significantly different (P >0.05)

Provincial means of the slaughter and carcass traits expressed relative to cold carcass weight as ratios are shown in Table 3. Across the three provinces, the hot carcass was approximately 70% of the live weight (Uşak 0.2 ± 0.5%, Afyon 70.2 ± 0.2%, Kütahya 69.2 ± 0.2%) (P =0.066). Because the weight lost during cooling was approximately 1.4% across the three provinces, the differences between provinces in cold carcass weights were also small (Uşak 68.8 ± 0.5%, Afyon 68.9 ± 0.2%, Kütahya 67.8 ± 0.2%) (P =0.084). Boz (2015) summarized several studies of domestic goose production in Turkey and reported that carcass yield was generally around 63% to 68%. Blood was a smaller proportion of cold carcass weight in geese from the Afyon province than in geese from Kütahya. The relative weights of feathers, liver, heart and

gizzard in geese from Uşak and Afyon were similar and lower than for those from Kütahya. The necks of geese from Uşak were relatively lighter in weight than for those from Afyon and Kütahya, which were similar to each other.

Table 3 Relative weights of carcass components of domestic geese from three provinces in Turkey expressed as ratios to cold carcass weight

Relative weights of carcass components, %	Province			*P*-value
	Uşak	Afyon	Kütahya	
Blood	3.63±0.026[ab]	3.56±0.027[b]	3.66±0.021[a]	0.026
Head	3.22±0.042	3.22±0.033	3.33±0.045	0.079
Feet	2.74±0.034	2.74±0.031	2.82±0.030	0.103
Feathers	7.01±0.111[b]	7.08±0.078[b]	7.41±0.078[a]	0.007
Liver	2.47±0.143[b]	2.35±0.159[b]	2.91±0.111[a]	0.018
Heart	0.84±0.017[b]	0.86±0.015[b]	0.91±0.010[a]	0.005
Gizzard	4.32±0.093[b]	4.47±0.061[b]	4.68±0.046[a]	0.003
Abdominal fat	5.64±0.529	5.34±0.136	5.25±0.234	0.704
Cooling stage	1.39±0.065	1.37±0.061	1.35±0.063	0.913
Neck	7.84±0.100[b]	8.10±0.087[a]	8.10±0.047[a]	0.009
Wing	15.58±0.264	16.15±0.304	15.50±0.135	0.134
Leg	21.10±0.349	21.33±0.248	21.50±0.253	0.612
Breast	31.48±0.532	31.18±0.277	30.93±0.211	0.580
Back	24.02±0.374	23.18±0.235	23.94±0.294	0.111

[a,b,c] Within a row, means with a similar superscript were not significantly different (P >0.05)

The slaughter weights recorded in the present study were lower than those reported by Boz (2015), Tilki & İnal (2004b), and Kırmızıbayrak (2002), similar to those reported by Peşmen & Yönetken (2020b) and Mazanowski *et al.* (2005), and higher than those of Kaya & Yurtseven (2021), Akbaş *et al.* (2020), Çelik & Bozkurt (2009) and Sole *et al.* (2016). Hot and cold carcass weights were higher in the present study than those by Peşmen & Yönetken (2020b), Kırmızıbayrak (2002), Çelik & Bozkurt (2009), close to those by Sarıca *et al.* (2015), and lower than those reported by Tilki & İnal (2004b).

The liver is one of the most desired by-products of goose slaughter. The liver weights and ratios to carcass weight in the current study were similar to those of Tilki & İnal (2004b), Akbaş *et al.* (2020), higher than the values of Kaya & Yurtseven (2021), Çelebi (1999), Fortin *et al.* (1983) and Peşmen & Yönetken (2020b), but lower than Şahin *et al.* (2008). Based on these differences, it was speculated that the liver weight of domestic geese might be changed through differences in feeding practices (Ristic *et al.,* 1995).

Rosinski (2002) emphasized that genotype and gender affected the feather weight of geese. the values in the current study were similar to other studies conducted on domestic geese in Turkey that varied in their genotype (Boz, 2015; Mazanowski *et al.*, 2005; Tilki & İnal, 2004b).

The amount of abdominal fat and its ratio to cold carcass weight were similar to those observed by Peşmen & Yönetken (2020b) on domestic geese in Afyon, but were lower than those in studies of domestic geese that were raised in other regions (Peşmen & Yönetken, 2020b; Tilki & İnal, 2004b). Climate conditions are less harsh in the Aegean region compared with other areas of Turkey, and geese begin to be being fattened for slaughter earlier (December-January) than anticipated. Ratios of blood, head, foot, heart, and gizzard to carcass weight were within the ranges of values in the literature.

The weights and ratios of the various parts of the goose carcass in the current study were generally within the range of those reported in other studies. The neck weight and ratio in the current study were within the range of values reported by Tilki & İnal (2004b). The wing ratio was higher than the values of Tilki & İnal (2004b), and lower than those reported by Cave *et al.* (1994). The leg ratio was similar to that of Tilki & İnal (2004b), lower than that of Peşmen & Yönetken (2020b), and higher than that of Mazanowski & Smalec (1998). The back ratio, on the other hand, was lower than the values of Peşmen & Yönetken (2020b) and higher than in other studies (Peşmen & Yönetken, 2020b, Sarı *et. al.*, 2019). The breast weights and ratios in

the present study were higher than those in Peşmen & Yönetken (2020b) and Tilki & İnal (2014b) and lower than those by Mazanowski & Smalec (1998) and Fortin *et al.* (1983). The back ratio, on the other hand, was lower than the values of Peşmen & Yönetken (2020b) and higher than the values stated in other studies (Peşmen & Yönetken, 2020b, Sarı *et al.*, 2019).

Geese are not sexually dimorphic, so there are no obvious external morphological traits with which to distinguish the genders (Parés-Casanova, 2014). Male geese tend to be larger than females (Hamadani *et al.*, 2020; Juodka *et al.*, 2012), but size is not a reliable indicator of gender. In the present study, the male geese were significantly larger than the females in all respects except for liver weight (Table 4).

Table 4 Carcass and slaughter traits of domestic male and female geese in the Aegean region of Turkey

Carcass and slaughter traits	Male	Female	*P*-value
Slaughter weight, kg	4.488 ± 62.88	4.050 ± 43.47	0.001
Blood weight, g	161.00 ± 2.03	147.79 ± 1.77	0.001
Head weight, g	142.83 ± 1.61	134.92 ± 1.63	0.001
Feet weight, g	121.62 ± 1.49	114.54 ± 1.14	0.001
Feather weight, g	315.75 ± 3.52	294.83 ± 3.23	0.001
Liver weight, g	77.79 ± 3.35	75.40 ± 3.48	0.623
Heart weight, g	27.30 ± 0.41	24.67 ± 0.34	0.001
Gizzard weight, g	137.35 ± 0.91	129.47 ± 1.18	0.001
Abdominal fat weight, g	179.14 ± 9.49	145.35 ± 8.41	0.011
Hot carcass, kg	3.150 ± 48.03	2.818 ± 35.27	0.001
Cooling stage, g	64.62 ± 2.22	53.41 ± 2.25	0.001
Cold carcass, kg	3.085 ± 47.47	2.765 ± 34.42	0.001
Neck weight, g	243.71 ± 2.88	224.04 ± 2.13	0.001
Wing weight, g	475.83 ± 8.16	444.17 ± 7.76	0.007
Leg weight, g	644.12 ± 10.30	600.92 ± 9.55	0.004
Breast weight, g	983.50 ± 22.19	846.54 ± 13.97	0.001
Back weight, g	738.17 ± 13.05	649.79 ± 10.94	0.001

Hot and cold carcass weights had similar proportions of slaughter weight for males and females. There were significant differences between males and females in the ratios of blood, feather, gizzard, neck, wing, leg, head, foot, and breast to cold carcass weight (Table 5). Differences attributable to gender were not significant for the other traits. Because females weighed less, these ratios to cold carcass weight were significantly greater than for males. Interestingly, the relative weight of the breast was significantly greater for males than for females.

Table 5 Relative weights, expressed as ratios to cold carcass weight, of carcass components of domestic male and female geese in Turkey

Relative weights of carcass components, %	Male	Female	P-value[1]
Blood	3.588 ± 0.020	3.648 ± 0.021	0.047
Head	3.187 ± 0.028	3.332 ± 0.034	0.002
Feet	2.714 ± 0.027	2.830 ± 0.020	0.001
Feather	7.052 ± 0.080	7.287 ± 0.075	0.039
Liver	2.481 ± 0.114	2.686 ± 0.127	0.239
Heart	0.870 ± 0.014	0.877 ± 0.012	0.708
Gizzard	4.380 ± 0.064	4.605 ± 0.054	0.011
Abdominal fat	5.653 ± 0.254	5.170 ± 0.294	0.221
Hot carcass	70.157 ± 0.262	69.585 ± 0.327	0.180
Cooling stage	1.440 ± 0.047	1.315 ± 0.051	0.082
Cold carcass	68.718 ± 0.273	68.267 ± 0.330	0.300
Neck	7.912 ± 0.055	8.11 ± 0.081	0.045
Wing	15.435 ± 0.173	16.065 ± 0.217	0.028
Leg	20.904 ± 0.228	21.725 ± 0.207	0.011
Breast	31.806 ± 0.297	30.595 ± 0.246	0.003
Back	23.940 ± 0.263	23.495 ± 0.248	0.225

Conclusion

The results of this study could serve as benchmarks for goose production in the Aegean region of Turkey. Differences among the provinces indicated/ the need to be cognizant of local conditions in evaluating eggs and meat produced by geese.

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Authors’ Contributions

YA: data collection, research area, project design, drafting the article; MFÇ: manager of the project, statistical analysis, translation control.

Conflict of Interest Declaration

The authors have no conflict of interest.

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