

Morphological and morphometric traits of Türkiye's Aseel chicken

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ABSTRACT

This research studies the morphology and morphometry traits of Aseel chickens raised in various regions of Türkiye. We used Turkish Aseel genotypes to assess the live weight and physical features of 60 female and 58 male subjects of varying ages. We measured brood length, breadth, head and beak width, neck and body length, chest width, depth, and circumference, thigh diameter, length, and depth, and leg length. Males' average live weight, chest circumference, thigh length, and comb length, which affect game efficacy, are 3.23 kg, 37.88 cm, 20.69 cm, and 40.20 mm, respectively. Although there was a statistically significant difference between the gender groups for all evaluated characteristics, there was only a statistically significant difference between the age groups for head width and chest circumference, shank depth, diameter, and length, and live weight ($P<0.05$). The data showed differences among different areas, particularly about the measurements of the comb, prompting researchers to propose a hypothesis suggesting a potential correlation between these changes and regional temperature disparities. We evaluated Turkish Aseels for feather, comb, eye color, markings, and comb type. Medium-weight breeds with hair, earlobes, beards, and spurs Weight and characteristics determine the Turkish Aseel breed. Comb structures were shorter, and their live weight was lower than that of other game roosters or Aseel kinds. Based on their morphology, domestic Aseel males may have a distinct genotype and subtype. Evaluating morphometric characteristics is an important aspect of the research. However, conducting additional comparative research is crucial. Genotyping studies with larger numbers are necessary for greater accuracy.

Introduction

In accordance with its advantageous location at the crossroads of Europe and Asia, Türkiye has been recognized as an important commercial hub for several years. The development of many distinct kinds of bioclimates in this area, which comprises three distinct phytogeographical zones, has resulted in an abundance of animal and plant species. It is common knowledge that part of the animal gene resources that make up the current state of animal biodiversity come from endemic species that have been in existence since ancient times. Humans have also brought some of these endemic species into

these regions. It is thought that the Aseel genotype was introduced to Anatolia from South Asian countries such as India and Pakistan in order to be used in sporting activities for more than a century as a game bird (2).

It is well known that Aseel may survive in regions with harsh weather and a variety of pathogens. According to the findings of a study (18), there are around 500 different types of Aseel and well over a thousand different strains. The physical structure of Aseel's is muscular and compact, and they have a powerful beak that is curved (5, 19). People commonly produce Aseel in nations like India and Pakistan because it grows more quickly than the local

chicken breeds of those countries, and its meat is considered tastier than that of the native chicken breeds (19, 24).

According to information obtained from interviews conducted with breeders who are registered with federations or various poultry associations in Türkiye, Turkish Aseel chickens differ from Indian Aseel's or various Aseel varieties grown in other countries in terms of morphological characteristics as well as other characteristics. While the morphological structure of Aseel's growth in some locations of Türkiye has been detected via a review of the literature, a more significant and in-depth investigation has not been conducted.

The objective of this study was to examine the morphological and morphometric attributes of Turkish Aseel chickens that were reared in various regions of Türkiye.

Materials and Methods

We used animals from one or more different age groups as the research material in this study. There was a total of 118 animals used, including 60 females and 58 males. These animals were raised on a variety of farms that were registered with federations or poultry associations in Türkiye's Marmara, Black Sea, Aegean, and Mediterranean regions, all of which are areas with a significant amount of Turkish Aseel male and female breeding activity. To ensure an accurate measurement, the animals came from no less than five different breeders throughout the region, with each breeder being limited to providing no more than three animals' total. Several morphological characteristics, including eye color, comb type, and feather color, as well as morphometric characteristics, such as comb length and width, beak length and width, head length and width, chest width, depth, and circumference, neck length, body length, shank depth, length, and diameter, and thigh length, were analyzed on the Aseel's, and the live weights were also evaluated (5, 9, 16). The body measurements used in the study-the length and width of the bump, the length and width of the beak, the length and width of the head, and the depth of the shank-were measured with a metal caliper, and the width, depth, and circumference of the chest, the neck length, the body length, the shank length and diameter, and the thigh length were measured with a measuring strip (Figure 1). We used a scale with a precision of 0.01 grams to determine the live weights. The enterprises established the ages of the animals based on their records but carried out the processes of caring for and feeding the animals according to their regular program.

Statistical analysis: We categorized the live weight and certain morphological characteristics of Turkish Aseel females and males based on their age, gender, and places of production. We used the GLM (general linear model)

to identify variations among groups based on age, gender, and location of origin. We deemed a P-value less than 0.05 statistically significant. If the GLM showed a statistically significant result ($P < 0.05$), we used the Tukey test for further pairwise comparisons (17). The statistical analyses were conducted using the SPSS 18 software (21).

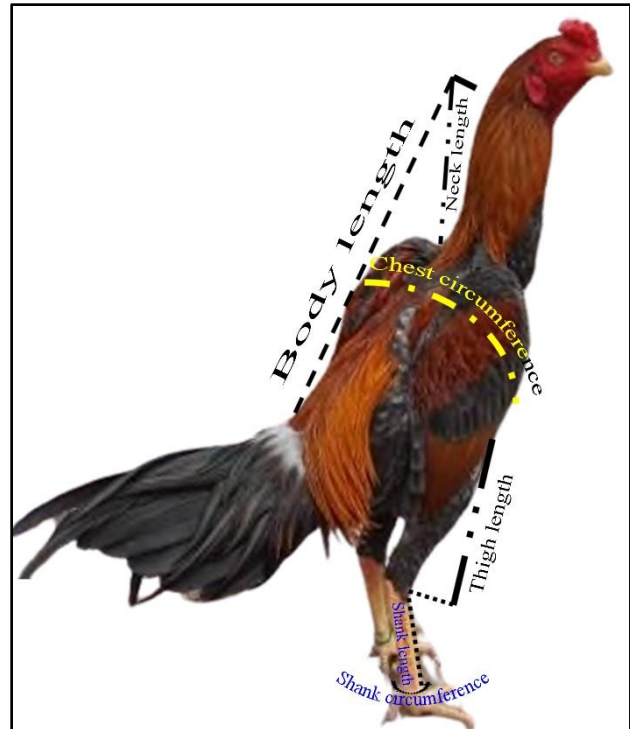


Figure 1. Locations where anatomical measurements were recorded from birds.

Results

Table 1 displays the live weight values and morphometric characteristics for both males and females of the Turkish Aseel's. When the data were analyzed in terms of the studied characteristics, it was discovered that the influence of gender on all of the tested attributes was statistically significant ($P < 0.01$) and that males had a greater value than females. We discovered a significant relationship between age and head width, chest circumference, shank depth, diameter, and length, as well as live weight values ($P < 0.05$). The variations in the regions in which they were grown substantially influenced the diameter and length of the comb, as well as the head width, neck and body length, chest width, and thigh length values ($P < 0.05$).

When the morphological characteristics of the Turkish Aseel's were examined, Atasoy et al. (5) reported that similar data were obtained to the color definitions they reported: red (the part of the animal where the tail, legs, body and neck are attached to the body is covered with black-bright blue feathers, the neck and back area are covered with red-colored feathers) (Figure 2A and Figure 2B), ashy (the legs and body part are covered with feathers of light gray-white-black colors, the neck, wing tip, the

Table 1. Values of live weight and some morphometric characteristics in Turkish Aseel's ($\bar{X} \pm Se$).

	N	Comb Length (mm)	Comb Width (mm)	Beak Length (mm)	Beak Width (mm)	Head Length (mm)	Head Width (mm)	Neck Length (mm)	Body Length (cm)
REGION									
Marmara	24	29.62±2.03 ^a	11.23±1.26 ^a	22.15±0.62	13.96±0.32	73.99±2.75	33.51±0.74 ^a	17.54±0.44 ^c	24.16±0.62 ^a
Black Sea	51	34.11±1.13 ^{ab}	11.25±0.92 ^a	22.22±0.34	14.29±0.26	76.77±0.86	35.13±0.32 ^b	16.22±0.37 ^{bc}	29.67±0.45 ^c
Mediterranean	28	36.47±2.11 ^b	16.15±1.90 ^b	22.90±0.58	14.02±0.29	78.34±1.32	32.37±1.13 ^a	15.28±0.41 ^{ab}	28.39±0.51 ^{bc}
Aegean	15	29.31±1.58 ^a	11.78±5.33 ^a	21.38±0.53	13.71±0.34	74.71±0.94	32.92±0.35 ^a	14.20±0.40 ^a	27.20±0.49 ^b
P		*	*	ns	ns	ns	*	***	***
SEX									
Female	60	26.31±0.89	7.10±0.75	20.97±0.36	13.44±0.23	73.04±1.13	33.83±0.50	15.03±0.31	26.34±0.35
Male	58	40.22±1.03	18.03±0.86	23.60±0.42	14.75±0.27	79.70±1.31	34.93±0.58	17.02±0.35	29.58±0.40
P		***	***	***	***	***	**	***	***
AGE									
1	18	37.02±1.58	14.15±1.77	22.31±0.59	14.25±0.34	79.56±1.20	34.21±0.69 ^b	16.38±0.45	29.80±0.69 ^c
2	40	33.74±1.09	12.72±1.11	22.44±0.41	13.88±0.27	77.08±0.94	34.68±0.52 ^b	15.85±0.37	28.08±0.57 ^{abc}
3	15	33.18±1.64	13.56±2.41	22.33±0.66	13.99±0.53	72.66±4.22	30.93±1.89 ^a	16.10±1.02	28.80±1.04 ^{bc}
4	17	28.60±1.73	9.81±1.65	21.67±0.63	14.16±0.35	72.91±1.33	32.98±0.58 ^{ab}	15.38±0.57	28.80±1.05 ^a
5	13	36.23±1.82	14.67±2.83	22.79±0.98	14.60±0.49	78.70±1.95	35.38±0.70 ^b	17.50±0.48	28.80±1.06 ^{abc}
6	15	29.37±1.73	9.84±1.08	21.87±0.77	14.00±0.44	75.81±1.60	33.91±0.51 ^b	15.33±0.56	28.80±1.07 ^{ab}
General Mean	118	33.15±0.86	12.47±0.69	22.26±0.25	14.08±0.15	76.31±0.75	33.87±0.35	16.01±0.23	27.93±0.33
P		ns	ns	ns	ns	ns	**	ns	ns
	N	Brest Width (mm)	Brest Depth (mm)	Brest Circumference (cm)	Thigh Length (cm)	Shank Diameter (mm)	Shank Circumference (cm)	Shank Length (cm)	Live Weight (kg)
REGION									
Marmara	24	92.40±2.88 ^a	119.49±2.49	36.77±0.65	15.88±0.43 ^a	16.85±0.47	5.97±0.16	10.24±0.33	2.94±0.08
Black Sea	51	81.48±1.42 ^b	119.06±1.59	35.41±0.42	17.92±0.35 ^b	16.15±0.31	6.22±0.11	10.33±0.29	2.65±0.07
Mediterranean	28	79.13±1.64 ^b	121.45±1.61	35.67±0.57	21.12±0.45 ^c	16.29±0.54	6.01±0.14	10.10±0.38	2.69±0.13
Aegean	15	73.12±1.71 ^a	114.19±1.99	34.40±0.66	20.60±0.50 ^d	15.70±0.59	5.73±0.16	9.86±0.23	2.57±0.10
P		***	ns	ns	***	ns	ns	ns	ns
SEX									
Female	60	76.78±1.35	112.82±1.25	33.91±0.36	17.18±0.22	14.65±0.25	5.55±0.08	9.23±0.18	2.38±0.05
Male	58	87.56±1.57	125.59±1.44	37.38±0.41	20.08±0.25	17.94±0.28	6.59±0.09	11.20±0.20	3.04±0.06
P		***	***	***	***	***	***	***	***
AGE									
1	18	82.35±1.92 ^{abc}	124.93±2.20 ^a	36.55±0.67 ^{bc}	20.07±0.65	17.03±0.58	6.11±0.15	18.86±0.97	2.72±0.11 ^a
2	40	84.86±2.37 ^{bc}	118.16±1.69 ^b	35.17±0.50 ^{ab}	18.21±0.31	15.97±0.37	6.16±0.12	15.89±0.66	2.63±0.08 ^a
3	15	80.35±2.67 ^{abc}	120.81±2.29 ^{ab}	35.13±0.75 ^{ab}	18.46±1.00	15.96±0.63	5.90±0.21	17.50±1.16	2.65±0.13 ^a
4	17	75.96±2.21 ^a	113.87±2.33 ^a	34.20±0.64 ^a	18.50±0.87	15.40±0.53	5.70±0.16	16.70±0.94	2.43±0.11 ^a
5	13	87.31±2.47 ^c	122.16±2.86 ^b	37.61±0.95 ^c	19.00±1.16	17.74±0.74	6.46±0.24	17.42±1.34	3.38±0.13 ^a
6	15	78.46±2.36 ^{ab}	114.97±2.79 ^{ab}	36.06±0.57 ^{abc}	17.83±0.72	16.16±0.54	5.96±0.20	15.13±1.19	2.69±0.09 ^a
General mean	118	82.08±1.09	119.10±0.97	35.62±0.28	18.60±0.27	16.27±0.22	6.06±0.07	16.73±0.40	2.71±0.05
P		*	**	*	ns	ns	ns	ns	***

ns: P>0.05, *: P<0.05, **: P<0.01, ***: P<0.001, The difference between the means with different letters in the same row is significant.

place where the wing is attached to the body and the back area is gray) (pure ashy) (Figure 2C and Figure 2D), honey (ashy-boney) (Figure 2E and Figure 2F), dark red (ashy-red) (Figure 2G and Figure 2H), chicken feathers or cuts, and the body part of the body is covered with light gray-white-black colored feathers, black feathers (Figure 2I and Figure 2J). In addition, the white feather color (body completely covered with white feathers) (Figure 2K) was only observed in females (5%), whereas the freckled feather color (white feathers between the completely covered black or dark brown feathers of the body) (Figure 2L) was only observed in males (3.45%). In Turkish Aseel males, white hairs (12.06%) localized only at the base of the tail were found in the body of some animals as markings (Figure 2E and Figure 2G).

In the analysed population, females and males were found to have yellow (83.33% and 84.48%) (Figure 3B) and pale blue (11.67% and 15.52%) (Figure 3A) eyes. Only hens (2.54%) (Figure 3C) had the red, capillary-veined look on yellow or light blue feathers. Although

peas (Figure 4B) and a flat (Figure 4C) comb were seen on both male and female Turkish Aseel's, only females had a strawberry (Figure 4A) comb. In addition, it was established that the beaks of both males and females were yellow and that there was no feather on the feet. Just five percent of the females were found to have the spur structure, whereas one hundred percent of the males did. It was noted that the morphology in the form of sagging skin, which is classified as a beard in animals, was not present in females, although most males (75.86%) had it. Both males and females were found to have earlobes that were a dark brown or black color. Only females have the white coloration in their earlobes. It was established that the size of the ear lobe was small and rudimentary (100%) in all of the females, but the size of the ear lobe was typically medium-sized (79.31%) in males.

The statistical ratios of several morphological characteristics identified in Turkish Aseel's Table 2 shows the results of this investigation, which comprise 118 instances.

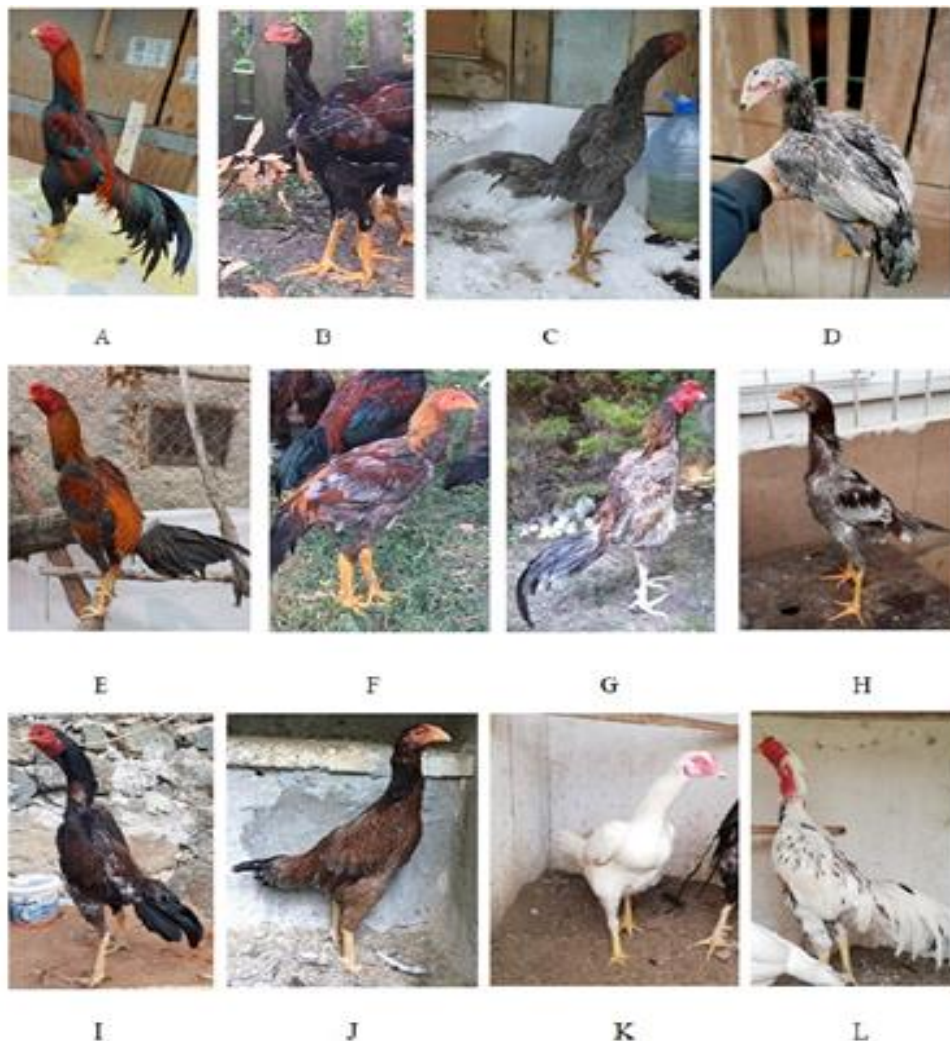


Figure 2. Feather color determined in Turkish Aseel males and females.

A and B: Red; C and D: Ashy; E and F: Ashy-Honeyed; G and H: Ashy-Red; I and J: Chicken Plumage -Chestnut; K: White; L: Freckled.



Figure 3. Eye colors determined in Turkish Aseel's.

A: Light blue-white B: Yellow; C: Blue, white and veined.



Figure 4. Comb shapes in Turkish Aseel females and males.

A: Strawberry, B: Pea, C: Flat.

Table 2. Occurrence of some morphological characteristics (%).

Characters	Male n=118	Female n=118	General n=118
Plumage			
Red	60.34	23.34	41.53
Ashy	24.14	36.66	30.50
Chicken Plumage –Chestnut	12.07	35.00	23.73
White	-	5.00	2.54
Freckled	3.45	-	1.70
Comb Color			
Pale pink	-	75.00	38.14
Pink	25.86	16.67	21.19
Red	74.14	8.33	40.67
Marking			
White plumage at the base of the tail	12.06	-	5.93
Comb Type			
Pea	81.03	6.67	43.22
Strawberry		58.33	29.66
Flat	18.97	35.00	27.12
Eye Color			
Yellow and its shades	84.48	83.33	83.90
Light blue	15.52	11.67	13.56
Yellow or light blue veined	-	5.00	2.54
Ear lobe			
Small	20.69	100.00	61.02
Middle	79.31	-	38.98
Ear lobe Color			
Black	68.97	26.67	47.46
Dark brown	31.03	68.33	50.00
White	-	5.00	2.54
Wattles	75.86	-	37.29
Spurs	100	5	51.69

Discussion and Conclusion

Morphological characteristics: The research found that the eye colors found in Turkish Aseel's chickens (capillary appearance spreading on light blue and yellow tones and a light blue color) were compatible with the eye colors determined by different researchers in various Aseel's varieties (5, 13, 20). However, the black eye color found in the majority of Aseel's grown in India (99%) was not found in this genotype (19).

In the current research, the medium-sized beard structure, which was not seen in females but was identified in the majority of males (75.86%), was also observed in males of Aseel varieties produced in different nations (19, 20).

All chickens, including Kulung, Lakha, Peshawari, and Syndrian Aseel's, have a small (primitive) earlobe shape. While little ear structure was seen in males (20.69%), the majority had medium-sized ears (79.31%), similar to Java Aseel's (13).

The beak color of both males and females of Turkish Aseel's is 100% yellow. The black-yellow color detected in the majority of Peshawari (85%) and Sindhi (79%) Aseel's and the black-white mixed color determined in Java Aseel's (69%) (13), were not found in Aseel's of this study.

It has been reported that various forms of comb in chickens emerge from animal selection studies and differences at distinct gene loci (10, 25). In the current research, pea comb structure, which was reported to be high in males (81.03%), was identified. This shows that the animal was chosen by the breeders to inflict less discomfort throughout the game. In addition to this, it was found that the comb forms that were found were similar to the comb shapes that were observed in other Aseel's and Brazilian game roosters and reported in various studies (5, 13, 19, 20).

Body color might be counted among the main characteristics for the identification of animals (1). In the current investigation, it was found that the red color that is often noticed in Turkish Aseel males was also found in other Aseel's (13, 20). White (5, 13, 18), black (5, 13, 18, 20), wheat color, or light-dark brown (13) were not found in Turkish Aseel males. We believe that the white feathers at the base of the tail, which we identify as markings in some of the males, are in the color combinations that various researchers express when characterizing the body color of the males (13, 20). There was found to be 5% white feather color in female Turkish Aseel's, as well as Bangladeshi Aseel's and female Sindhi Aseel's (13, 20). The black color seen in many Aseel's (13, 19, 20) was not observed in Turkish Aseel's. The ashy hair color seen in both males and females of Turkish Aseel's has not been observed in any other Aseel's studied throughout the

world (13, 19, 20). This may be due to the fact that breeders prefer animals of this color and subject them to selection in this way, or it may be that different researchers define colors differently.

In terms of morphological characteristics, no sexual dimorphism was found in Turkish Aseel's, as in other poultry species.

Morphometric characteristics: Sexual dimorphism was found between sex-related body weight and some morphometric characteristics in Turkish Aseel's (like some other poultry species), and it was observed that males had higher values than females in the examined characteristics (4, 15). A study (6) stated that sexual dimorphism may be influenced by gender-specific hormonal effects. So according to another study (11), male-based dimorphism is more widespread in chickens, which is consistent with the findings of our research; however, this cannot be generalized. Average live weight values obtained in Turkish Aseel females (2.38 kg) and males (3.04 kg) are higher than the values reported for Sindhi bred in India (13), Mianwali Aseel's bred in Pakistan (13), and Aseel's bred in Turkey (5) in different age groups. And it was found to be lower than the values reported for Mushka, Lakha, Java, Kulung, and Sindhi Aseel's raised in Pakistan and Lakha and Bihangam Aseel's raised in India in the age group of six and above (5, 13, 18). In addition, it was discovered that the body weight values obtained in Turkish Aseel males were lower than the values obtained from males grown in Brazil, which are referred to as game birds, as well as males bred in Japan (O-Sahamo, Chu-Sahamo), and Thailand (Kai Chon) (8, 14). According to the data obtained, it is thought that Turkish Aseel's can be included in the group of medium-weight breeds. Breeders prefer to have their birds stay in the arena for a longer period of time, especially the males during the competition, to be defensive rather than attack, but at the same time, they want them to be agile and active. In chickens, the shank diameter, shank length, and spinal bone length are regarded as indices of skeletal development (22). A study (12) reported that the growth of the shank, in particular, may influence the development of the legs and, therefore, the breasts. In the present study, it was determined that the average shank circumference value (6.06 cm) of animals of different ages was generally lower than the values obtained in different Aseel varieties (7.88–9.57 cm) raised in Bangladesh, India, and Pakistan, and the shank length value (10.52 cm) was similar to them (8.37–12.79 cm) (13, 18, 20). The thigh length (18.60 cm) was often greater than the reported values for Aseel types in Bangladesh, India, and Pakistan (15.8–17.6 cm) (13, 18, 20), Brazilian game males, and O-Samolar (14, 23). According to a study (2), Aseel's belong to a category of

chicken that matures much later than other birds. Based on the data that was collected, it seems that this genotype matures at a later stage than other types do and that it has a more organized constitution. It is necessary, however, to conduct more in-depth research in which chicks' growth and development are tracked after they have hatched from their eggs in order to arrive at a conclusion that can be considered final.

The study found that the length of the neck, as well as the length and width of the beak, were comparable to those previously reported for Brazilian game roosters. On the other hand, the height and width values of the comb were discovered to have been significantly lower (14). Breeders are believed to make selections in this direction, particularly to ensure that the animal suffers less damage to its comb during contests.

In poultry, the chest width is the criterion that proves the animal's ability to produce meat, while in competitive animals; the chest circumference is the criterion that demonstrates how well the animal has developed its lung capacity (22). It was found that the chest width of the Turkish Aseel's, which measured 82.08 mm, was much narrower than the chest width of numerous Aseel breeds that were bred in Türkiye (5) and the Mushka breed of Pakistan, but it was larger than other Pakistani Aseel's (13). The average chest circumference was 35.62 cm, similar to the measurements taken from Aseel grown in Türkiye (5) and Brazilian game roosters (14). This suggests that these animals are not bred for the purpose of yielding meat but rather to participate in sports and that they are subjected to selection in this manner.

It is possible to count the values of the comb size as one of the characteristics that assist in identifying the animals individually in poultry and are helpful in creating the hierarchy in the flock as well as the success of mating (7, 26). As the temperature of the surrounding environment rises, the superficial veins that are located on the comb are able to provide conductive cooling of the blood via the process of vasodilation. This enables the body to better regulate its temperature (3). The large comb structure of game roosters may be a negative trait in breeding since it causes animals to injure one another and inflict severe harm throughout the event. The comb length (33.15 mm) and depth (12.47 mm) values in Native Aseel's were found to be lower than the values reported for Brazilian game roosters (43.40 mm and 17.00 mm) (14) and some Aseel males comb length raised in India (Lakha, Bihangam, Beard Kulang, and Wilaete clation Aseel's) (18) and higher than the values reported for Aseel's bred in Türkiye (30.92 mm and 6.51 mm) (5). As a result, it is thought that the fact that these animals, which are game birds, are used more widely as defenders than attackers, that they are asked to stay in the arena for a long time, and that the selection of animals in this direction may

cause differences in the form of comb Comparing the places where Turkish Aseel's were reared, the length and width of the comb were found to be greater in the Mediterranean, where seasonal temperatures were often higher than in other regions. The fact that the animals lack sweat glands and regulate their temperature stress based on the width of their coats may have influenced the breeders' selection procedures.

When considering the morphological and morphometric data together, there is a clear conclusion. It means that Turkish Aseels belong to a distinct genotype or variant. However, additional research is necessary to analyze morphological data in conjunction with phylogenetic approaches in order to obtain descriptive data.

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Ethical Statement

This study was carried out after the animal experiment was approved by Ankara University Local Ethics Committee (Decision number: 2017-25-206).

Conflict of Interest

The authors declared that there is no conflict of interest.

Author Contributions

AK, FTÖB, BYÖ and CÖ conceived and planned the experiments. AK and FTÖB carried out the experiments. AK and FTÖB planned and carried out the simulations. AK and FTÖB contributed to sample preparation. AK and FTÖB contributed to the interpretation of the results. AK and FTÖB took the lead in writing the manuscript. All authors provided critical feedback and helped shape the research, analysis and manuscript.

Data Availability Statement

The data supporting this study's findings are available from the corresponding author upon reasonable request.

Animal Welfare

The authors confirm that they have adhered to ARRIVE Guidelines to protect animals used for scientific purposes.

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