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Osteometric and topographic measurement of the skull and mandible of Siirt coloured mohair goat with three-dimensional (3D) modelling technique

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The Siirt coloured mohair goat is one of the breeds that has contributed significantly to the existence of mohair goats reared in Türkiye. Morphological and morphometric characteristics of the Siirt coloured mohair goat remained vague owing to a lack of studies. Recent advances in high-tech imaging have replaced conventional two-dimensional anatomical structures with three-dimensional (3D) models. In our study, morphometric features were determined by 3D modelling from computed tomography images obtained from the skull and mandibular bones of Siirt coloured mohair goats. For this purpose, the skulls and mandibular bones of 20 Siirt coloured mohair goats (10 females and 10 males) were used. The images were reconstructed with the help of the 3D Slicer (5.0.2) software program. The craniometric data were analysed in terms of sexual dimorphism, and statistically significant difference was found in the A5, A18, and A31 measurement parameters ($p < 0.05$) and skull index ($p < 0.01$) parameters. In the mandible measurements, there was a statistically significant difference between the sexes in C5, C10 measurement points ($p < 0.05$), C2, C8, C12, C18, and C21 measurement points ($p < 0.001$) and surface area parameter ($p < 0.01$). The morphometric data obtained is a resource in the fields of zoo archaeology, anatomy, forensics, anaesthesia, surgery, and treatment. (Folia Morphol 2024; 83, 3: 689–699)

Keywords: coloured mohair goat, three-dimensional, modelling, skull, mandible, topographic, craniometry

INTRODUCTION

In Türkiye, the breeding of mohair goats in the Eastern and Southeastern Anatolia regions has made a significant contribution to the existence of goats [60]. It has been reported that the coloured mohair goat is mainly raised in the provinces of Siirt, Batman,

and Şırnak [22, 25, 30]. Mohair, which is the raw material of Siirt blankets, is a handicraft product woven on looms in the Siirt region, using wool obtained by shearing goats. It is also used for weaving bags, vests, gloves, berets, socks, and various ornaments offered for touristic purposes [60].

There are morphological differences in the horn and ear structures of the Siirt coloured mohair goat. Male goats have longer horns and more drooping ears than female goats. They usually have black, white, brown, yellow, and red fur [60].

The foramina located in the skull are the exit sites of the nerves. It is important to identify the precise location of these foramina for a local anaesthetic block of their branches. In addition to these palpable foramina in ruminants, foramina such as infraorbital foramen, mental foramen, supraorbital foramen, mandibular foramen, oval foramen, and maxillary foramen are clinically important [1, 24].

The phenotypic characteristics of animals may vary according to geography, race, and nutritional status. These changes occur separately in the skull as well as in the skeletal system [26].

The skull bones are divided into 2 parts: the cranium and the facies. The skull contains centres related to the brain, vision, hearing, and balance. It is also very important in that it includes the initial parts of the digestive and respiratory systems [13, 39]. The formations on the skull and mandible are the distinctive features of each animal and provide differentiation not only between races and species but also between sexes [38]. These distinctive features make it the most commonly used structure in taxonomy [29].

It has been reported that craniometric studies have made an outstanding contribution to comparative anatomy, clinical applications, and taxonomy [36, 41, 47]. It is imperative to note that detailed biometry of the skull is requisite in clinical and biomechanical analyses [48, 57, 61].

Recent advances in high-tech imaging have replaced conventional two-dimensional anatomical structures with three-dimensional (3D) models [33, 55]. Bio-models are developed through cross-sectional imaging methods. Detailed examination of the 3D modelling structure helps in the treatment and prognosis of diseases [21, 42, 49, 53]. Craniometric studies were performed on sheep breeds to draw attention to breed and sex differences [19, 34, 62]. However, 3D craniometric studies on goats are limited and mostly studied on the mandible. Modelling studies were carried out to contribute to the field of osteogenesis [3, 40] and oral health [44] because of its impact on systemic health [52]. Sound topographical and anatomical knowledge of the area to be treated is required to avoid any adverse intervention during treatment [2, 43, 44]. In dentistry, 3D modelling studies of the goat mandible are leading to screw applications [35].

Although various selection studies have been carried out on Ankara mohair goats, depending on the importance of mohair, no conscious selection and breeding studies have been carried out on coloured mohair goats [32, 60].

Morphological and morphometric characteristics of Siirt coloured mohair goats, one of the breeds bred in Türkiye, remain uncertain due to the lack of studies.

In this study, we aimed to investigate and record the morphological, morphometric, and topographic features of the skull and mandible bones of the Siirt coloured mohair goat with a 3D modelling method. In addition, it is among the objectives to contribute anatomically and topographically to the use of clinical and anaesthetic techniques.

MATERIALS AND METHODS

The skull and mandible samples used in our study were collected from a slaughterhouse in Siirt, Türkiye. Morphometric analyses were performed on the skull and mandible of 20 (10 female and 10 male) adult (1–3 years) Siirt coloured mohair goats in total. No clinical findings were found on the skull and mandible bones. Skull and mandibles of Siirt coloured mohair goats were scanned at 80 kV, 200 MA, 639 mGY, and 0.625 mm thickness using 64-slice multidetector computed tomography MDCT (General Electric Revolution). The results of Prokop M. [54] were taken as a reference in the screening dose and protocol. The resulting images were saved in DICOM format. Sections were taken with the CT device at Siirt University Medical Faculty Hospital. Reconstructions were made with the help of 3D Slicer (5.0.2) software (Fig. 1). Taking sources [29] and [58] as references, measurement parameters were determined, and morphometric measurements were performed. The definitions and abbreviations of the measured osteometric parameters are given in Tables 1 and 2. Figures 1, 2, 3, and 4 present measurement points on the skull and mandible. From the obtained CT images, 35 measurement parameters and 4 index calculations were performed on the skull. Cranial
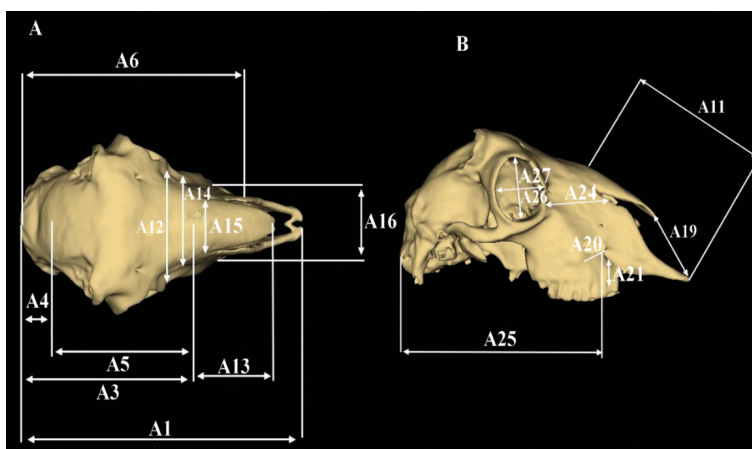
Figure 1. Osteometric measurement points (dorsal and lateral) of the skull of the Siirt coloured mohair goat; **A.** Dorsal; **B.** Lateral.

and facial index formulas are presented in Table 3. Twenty-seven osteometric measurements of the mandible were taken. After the morphometric measurements were completed, the surface area and volume values of the mandible were calculated. The SPSS22.0 program was used for statistical analyses. Mean ± standard error (SD) values were calculated, and an independent t-test determined the difference between male and female goats. The procedures applied in the present study were approved by the Siirt University Experimental Animals Application and Research Centre with the Ethics Committee report numbered 03/2023.

RESULTS

In our study, a total of 35 osteometric and topographic measurements were made on the skull of Siirt coloured mohair goats (Figs. 1, 2). Table 4 and Table 5 show the mean values and standard errors of the measurements. Skull indexes are shown in Table 6. When the craniometric data were analysed in terms of sexual dimorphism, a statistically significant difference was determined in the A5, A18, and A31 measurement parameters ($p < 0.05$) and the skull index ($p < 0.01$). No statistically significant difference was observed between the genders in terms of other parameters ($p > 0.05$).

In the study, 25 osteometric and topographic measurement parameters of the mandible were determined. The measurements are shown in Table 7. The measurement points of the mandible are presented in Figures 3 and 4. The surface area and volumes of the mandible of the Siirt coloured mohair goat were calculated. As a result of the statistical evaluation, it

was determined that the C5 and C10 measurement points showed a significant difference ($p < 0.05$). When the C2, C8, C12, C18, and C21 measurement parameters were examined statistically, a significant difference was observed ($p < 0.001$). The surface area values of the mandible (C24) were found to be statistically significant ($p < 0.01$).

DISCUSSION

Although various selection studies have been carried out on mohair goats, depending on the importance of mohair, no conscious selection and breeding studies have been carried out on coloured mohair goats [60]. Our study is the first to determine the morphometric features of the skull and mandibular bones of Siirt coloured mohair goats.

Regarding the median frontal bone length parameter (A5), while this value was reported as 8.85 ± ± 0.53 cm in females and 8.92 ± 0.61 cm in males in the Sharri sheep breed, no statistically significant difference was observed [34]. The same value was determined to be 8.49 ± 0.68 cm in male Hemshin sheep [15]. In this study, the results of the A5 parameter were close to the data presented in a study on the Bardhoka sheep breed [29]. In addition, statistical difference was observed between sexes in terms of the A5 parameter as in Bardhoka breed sheep [29]. The frontal sinus has been reported to be limited to the frontal bone in small ruminants. Measurement parameters such as the cranium length, the distance from the parietal-frontal suture to the nuchal line, and the median of the frontal bone length have an important place in frontal sinus trephination [10]. The frontal bone also contributed to the formation of the

Table 1. Osteometric and topographic measurement points of the cranium of the Siirt coloured mohair goat.

A1	The total skull length
A2	The skull width (the distance between 2 zygomatic arches)
A3	The cranium length (distance from nuchal line to the junction of the left and right nasofrontal sutures on the median plane)
A4	The distance from parieto-frontal suture to nuchal line
A5	The median of the frontal bone length
A6	The distance from left infraorbital foramen to nuchal line
A7	The condylobasal length — from incisive bone to the occipital condyles
A8	The basal length — distance from incisive bone to the intercondylar incisura
A9	The short skull length — distance from premolar the second (PM2) to the intercondylar incisura
A10	The greatest cranium width
A11	The facial length
A12	The distance between caudal border (margin) of the orbits
A13	The greatest length of nasal bone
A14	The least width between the cranial border (margin) of the orbits
A15	The greatest width between the nasal bones
A16	The facial width (between two facials tuberosity)
A17	The distance from incisive bone to premolar the second (PM2)
A18	The distance from tip of incisive bone to caudal border of the last molar (dental length)
A19	The distance from incisive bone to septal process of nasal bone
A20	The distance from infraorbital foramen to facial tuberosity
A21	The distance from facial tuberosity to alveolar process of maxilla
A22	The molar row length (premolars and molars)
A23	The greatest palatal width (across the outer border of the molars)
A24	The greatest length of the lacrimal bone
A25	The distance from the caudal border of the left occipital condyle to the infraorbital foramen of the same side
A26	The length diameter of the orbit
A27	The width diameter of the orbit
A28	The greatest width of the occipital condyles
A29	The greatest width of the bases of the pre-condylar processes
A30	The greatest width of the foramen magnum
A31	The height of the foramen magnum
A32	The distance between two foramina infraorbital
A33	The distance between foramen infraorbitale and tuber faciale
A34	Distance between foramen infraorbital and premolar tooth
A35	The distance between foramen infraorbitale and orbita

Table 2. Osteometric and topographic measurement points of the mandible of the Siirt coloured mohair goat.

C1	Length between gonion caudale (GOC) and infradentale (ID)
C2	Length between ID and the aboral edge of the condylar process
C3	Length between GOC and aboral alveolar edge of Molar 3 (M3)
C4	Length between ID and the alveolar edge of the M3
C5	Length between GOC and the oral alveolar edge of Premolar 2 (P2)
C6	Length between GOC and aboral end of mental foramen
C7	The total length of cheek tooth row (Premolar 1 — Molar 3)
C8	Molar tooth row length
C9	Premolar tooth row length
C10	Diastema length
C11	Length between gonion ventrale (GOV) and the highest point of condylar process
C12	Length between GOV and the deepest point of the incisura mandible
C13	Length between GOC and coronion
C14	Height of mandibula in the plane of posterior alveolar edge of M3
C15	Height of mandible in plane of anterior alveolar edge of Molar 1
C16	Height of the mandible in the plane of the anterior alveolar edge of P2
C17	Length between ID and oral tip of the mental foramen
C18	Length between the coronion and the highest point of condylar process
C19	Width of mandible at last incisive tooth level
C20	Width of the mandible at the level of the first molar tooth
C21	Width of the mandibular space at the level of the coronoid process
C22	Condylar process width
C23	Mandible volume
C24	Mandible surface area
C25	Distance between first premolar tooth and mental foramen
C26	Distance between lateral incisor tooth and mental foramen
C27	Distance between the base of the mandible and mental foramen

and 4.61 ± 0.008 cm, respectively [11]. In our study, the orbit had an oval appearance, flattened from the sides.

The dental length value (A18) was measured as 12.66 ± 0.66 cm in female Bardhoka sheep and 12.94 ± ± 0.97 cm in males [29]. Also, in Sharri sheep, dental length was reported as 13.85 ± 0.57 cm in females and 13.32 ± 1.52 cm in males [34]. In our study, this parameter was determined as 14.28 ± 0.13 cm in male goats and 12.73 ± 0.067 cm in female goats. Contrary to the Bardhoka race, statistically significant differences were found between the sexes (p < 0.05).
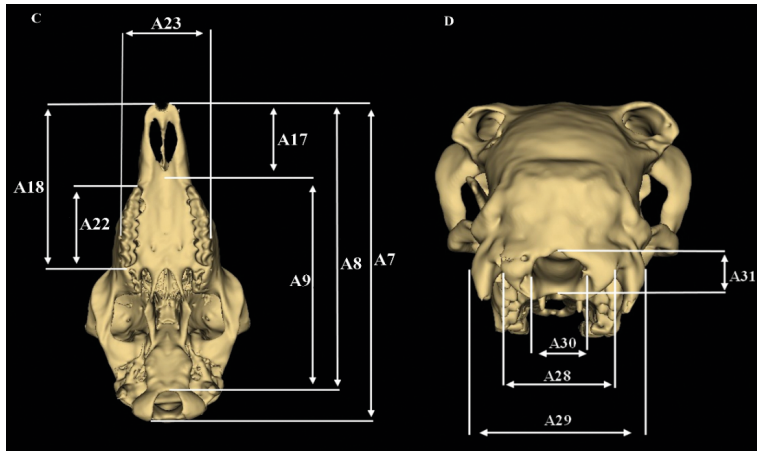
orbita, as reported in blackbuck, and the orbit was circular. The mean maximum height, length, and depth of the orbit were 3.83 ± 0.02 cm, 4.13 ± 0.02 cm,

Figure 2. Osteometric measurement points (Ventral and Caudal) of the skull of the Siirt coloured mohair goat; **C.** Ventral; **D.** Caudal.
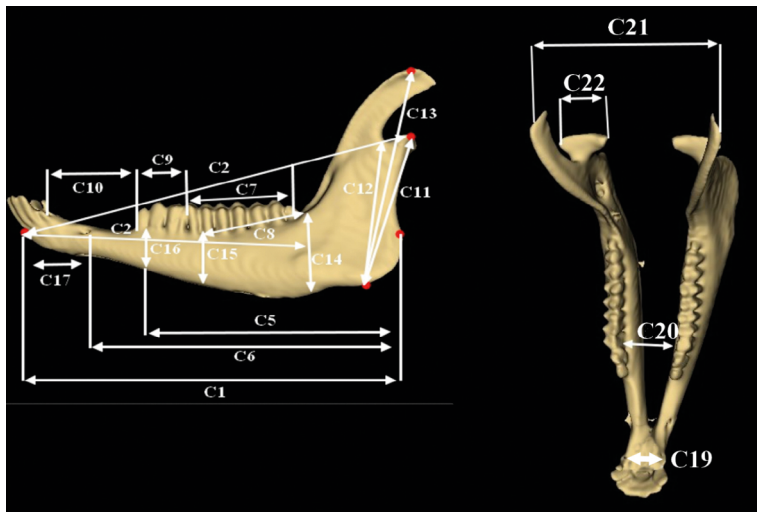

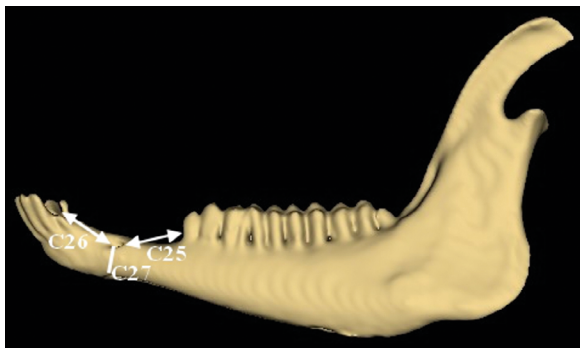**Figure 3.** Osteometric measurement points of the mandible of Siirt coloured mohair goat.

Figure 4. Topographic measurement points of the mandible of the Siirt coloured mohair goat.

Table 3. Cranial and facial index formulas of Siirt coloured mohair goat

Skull index	The skull width (the distance between 2 zygomatic arches) × 100/total skull length
Cranium index	The greatest cranium width × 100/the cranium length (distance from nuchal line to the junction of the left and right nasofrontal sutures on the median plane)
Foramen magnum index	The height of the foramen magnum × 100/the width of the foramen magnum
Facial index	The facial width × 100/facial length

The height and width of the foramen magnum in Georgian goats were reported as 2.23 ± 0.24 cm and 1.98 ± 0.18 cm in females and 2.12 ± 0.23 cm and 2.14 ± 0.34 cm in males, respectively [16]. These parameters were determined as 1.81 ± 0.02 cm and 1.71 ± 0.01 cm in females, and 5.73 ± 0.01 cm and 2.43 ± 0.06 cm in males in Mizoram goats [7]. In our study, foramen magnum height and width parameters had smaller values compared to Kagani

Table 4. Osteometric measurements of the cranium of the Siirt coloured mohair goat [cm].

	Group	N	Mean	Std. error mean	P
A1	Male	10	26.25	0.201	0.054
	Female	10	24.71	0.113	
A2	Male	10	11.10	0.092	0.002
	Female	10	10.62	0.040	
A3	Male	10	14.12	0.054	0.908
	Female	10	13.07	0.059	
A4	Male	10	5.6	0.030	0.517
	Female	10	4.74	0.038	
A5	Male	10	9.78	0.060	0.025
	Female	10	8.82	0.032	
A6	Male	10	18.96	0.058	0.903
	Female	10	17.69	0.062	
A7	Male	10	27.04	0.180	0.640
	Female	10	25.01	0.122	
A8	Male	10	24.3	0.115	0.127
	Female	10	22.74	0.081	
A9	Male	10	18.33	0.049	0.524
	Female	10	17.38	0.072	
A10	Male	10	6.38	0.298	0.075
	Female	10	6.18	0.042	
A11	Male	10	14.99	0.131	0.447
	Female	10	14.22	0.093	
A12	Male	10	13.03	0.070	0.343
	Female	10	11.53	0.051	
A13	Male	10	9.69	0.051	0.229
	Female	10	8.61	0.037	
A14	Male	10	9.74	0.073	0.472
	Female	10	7.97	0.112	
A15	Male	10	4.52	0.077	0.242
	Female	10	3.67	0.100	
A16	Male	10	4.43	0.084	0.686
	Female	10	3.65	0.065	

	Group	N	Mean	Std. error mean	P
A17	Male	10	5.44	0.041	0.307
	Female	10	4.74	0.052	
A18	Male	10	14.28	0.138	0.026
	Female	10	12.73	0.067	
A19	Male	10	5.63	0.040	0.011
	Female	10	6.51	0.070	
A20	Male	10	2.67	0.062	0.791
	Female	10	2.27	0.050	
A21	Male	10	1.83	0.021	0.823
	Female	10	1.47	0.023	
A22	Male	10	6.84	0.033	0.777
	Female	10	6.33	0.037	
A23	Male	10	7.05	0.063	0.253
	Female	10	6.36	0.050	
A24	Male	10	4.53	0.051	0.239
	Female	10	4.06	0.034	
A25	Male	10	16.21	0.046	0.766
	Female	10	15.59	0.048	
A26	Male	10	4.34	0.055	0.725
	Female	10	3.91	0.050	
A27	Male	10	4.11	0.023	0.095
	Female	10	3.62	0.042	
A28	Male	10	6.21	0.031	0.753
	Female	10	4.94	0.027	
A29	Male	10	7.55	0.053	0.510
	Female	10	6.52	0.070	
A30	Male	10	2.25	0.034	0.722
	Female	10	1.8	0.027	
A31	Male	10	2.17	0.009	0.034
	Female	10	1.88	0.023	

goats [56]. In addition, the foramen magnum height had a smaller value compared to the data reported in Beetal goats, while the foramen magnum width value was found to be approximately the same as Beetal goats [23].

The skull index value was analysed [56] as an average of 4.19 cm in Kagani goats, and as 4.92 ± ± 0.34 cm in males and 4.83 ± 0.48 cm in females in Gurcu goats [16]. This index was reported as 5.21 ± ± 0.21 cm in Saanen goats [59], 4.77 ± 0.19 cm in Markhoz goats [28], and 4.78 ± 0.005 cm in Mizoram

goats [7]. In addition, the skull index of Beetal goats was 5.73 ± 0.01 cm in females and 5.77 ± 0.01 cm in males [23], and Abaza goats have been reported as 5.1 ± 0.18 cm [17]. The skull index values determined in our study were lower than the reported goat breeds.

The distance from the infraorbital foramen to the facial tuberosity (A20) parameter is important for following the infraorbital nerve and for anaesthetic applications in the clinic. The infraorbital nerve should be anaesthetised at the level of the infraorbital foramen during manipulations of the upper lip, nostril, and facial skin. Analgesia of the incisor, canine, and

Table 5. Topographic measurement points of the cranium of the Siirt coloured mohair goat

	Group	N	Mean	Std. error mean	P
A32	Male	10	4.57	0.038	0.771
	Female	10	4.26	0.030	
A33	Male	10	2.68	0.038	0.556
	Female	10	2.31	0.032	
A34	Male	10	2.43	0.042	0.205
	Female	10	1.81	0.024	
A35	Male	10	5.72	0.030	0.222
	Female	10	5.31	0.053	

Table 6. Cranial and facial index of Siirt coloured mohair goat

	Group	N	Mean	Std. error mean	P
Skull index	Male	10	4.23	0.049	0.001
	Female	10	4.29	0.015	
Cranium index	Male	10	4.73	0.043	0.696
	Female	10	4.72	0.049	
Foramen magnum index	Male	10	8.81	0.876	0.216
	Female	10	10.47	0.250	
Facial index	Male	10	3.05	0.125	0.164
	Female	10	2.56	0.054	

first 2 premolar teeth is provided by injection of an anaesthetic drug from the infraorbital foramen into the infraorbital canal [4, 5, 6, 8]. The A20 parameter was reported as 2.37 ± 0.009 cm in blackbuck [11], 2.25 ± 0.03 cm in Mizoram goats [7], and as 2.59 ± ± 0.17 cm in females and 2.58 ± 0.3 cm in males [29] in Bardhoka sheep. In our study, the A20 parameter was found to be higher in Siirt coloured mohair goats than in West African dwarf (WAD) goats [45] and Mizoram goats [7] and lower than Bardhoka sheep [29].

The A21 morphometric measurement parameter is very important in infraorbital nerve anaesthesia. In Siirt coloured mohair goats, infraorbital nerve block can be achieved by injecting the anaesthetic drug approximately 2 cm above the root of the upper first premolar tooth in males and approximately 1.5 cm above in females. This value was reported as 1.3–1.6 cm in WAD goats [45], 1 cm in barking deer, and 1.8 cm in sambar deer [7].

Although the diastema region seems to be a suitable region for research on experimental distraction osteogenesis, bone defect, plate, screw type, etc., the presence of the mandibular canal in sheep and goats should be taken into consideration by investigators [27]. The presence of a mandibular canal necessitates a good knowledge of the diastema length. Also, diastema has an important place in mandibular fracture surgery [46]. In our study, C10 parameter values were found to be lower than the data reported in the study [27] conducted in sheep and goats. In male goats, the C10 value was lower than that of males of the Hashmer sheep breed [51]; whereas, in female goats, this value was close to that of females of the Hasmer sheep breed [51]. The same parameter was larger in male goats than in Awassi males [62] and smaller in female goats than in Awassi females [61].

The value of the length between GOC and the oral alveolar edge of P2 (C5) had greater values compared to the Norduz sheep breed [18]. However, the C5 value was very close to the values reported in the Hamdani sheep breed [31].

In a 2014 study, the length between ID and the aboral edge of the condylar process parameter (C2) was reported as 15.55 ± 0.52 cm in Tuj sheep and 16.04 ± 0.72 cm in Morkaraman sheep [20]. In our study, the same parameter was determined to be larger than the Romanov sheep breed.

The length of the molar row is shorter in goats than in sheep. Approximately 49% of the length of the mandible in sheep and 42% in goats is the length of the molar tooth row [27]. Molar tooth row length (C8) value was determined as 2.66 ± 0.19 cm in the right half and 2.57 ± 0.31 cm in the left half in Norduz rams [18]. The same value was reported as 5.72 ± 0.38 cm in Hemsin sheep [14], 3.86 ± 0.99 cm in Awassi rams and 4.38 ± 0.62 cm in ewes [62]. In contrast to the study on sheep and goats [27], Siirt coloured mohair goats were found to have higher values of the C8 parameter than sheep breeds. In addition, the mean value of the length between the GOV and the deepest point of the incisura mandibula (C12) parameter was smaller than the values determined in Hasmer sheep [38] and larger than the values determined in Abaza goats [17].

The length between the coronion and the highest point of the condylar process (C18) was determined as 2.57 ± 0.05 cm in Hamdani rams and 2.5 ± 0.06 cm in sheep [31]. At the same time, in Awassi sheep, it was determined as 2.25 ± 0.3 cm in rams and 2.69 ± ± 0.31 cm in sheep [62]. The C18 parameter values obtained in our study were higher than those of the Awassi and Hamdani sheep breeds. In addition, the

Table 7. Osteometric and topographic measurement points of the mandible in Siirt coloured mohair goat.

	Group	N	Mean	Std. error mean	P
C1	Male	10	17.13	0.148	0.496
	Female	10	16.73	0.120	
C2	Male	10	18.86	0.113	0.09
	Female	10	18.56	0.185	
C3	Male	10	5.74	0.175	0.348
	Female	10	5.12	0.353	
C4	Male	10	12.43	0.143	0.090
	Female	10	12.04	0.213	
C5	Male	10	12.01	0.020	0.038
	Female	10	10.55	0.12	
C6	Male	10	14.16	0.103	0.325
	Female	10	13.61	0.156	
C7	Male	10	6.91	0.126	0.871
	Female	10	6.41	0.102	
C8	Male	10	6.74	0.103	0.002
	Female	10	6.03	0.186	
C9	Male	10	2.08	0.183	0.522
	Female	10	1.94	0.214	
C10	Male	10	5.14	0.326	0.038
	Female	10	4.33	0.136	
C11	Male	10	7.16	0.176	0.424
	Female	10	6.83	0.187	
C12	Male	10	6.73	0.255	0.007
	Female	10	6.40	0.164	
C13	Male	10	9.65	0.102	0.654
	Female	10	9.31	0.115	
C14	Male	10	4.12	0.185	0.975
	Female	10	3.86	0.180	

	Group	N	Mean	Std. error mean	P
C15	Male	10	2.42	0.190	0.502
	Female	10	2.30	0.219	
C16	Male	10	2.07	0.193	0.314
	Female	10	1.17	0.296	
C17	Male	10	3.92	0.174	0.121
	Female	10	3.67	0.207	
C18	Male	10	3.10	0.157	0.003
	Female	10	3.08	0.245	
C19	Male	10	2.96	0.182	0.410
	Female	10	2.70	0.192	
C20	Male	10	3.19	0.136	0.105
	Female	10	2.98	0.180	
C21	Male	10	7.24	0.164	0.001
	Female	10	6.56	0.053	
C22	Male	10	2.32	0.115	0.612
	Female	10	2.11	0.128	
C23	Male	10	5.09	0.179	0.841
	Female	10	4.88	0.172	
C24	Male	10	678.23	363.52	0.001
	Female	10	267.53	795.62	
C25	Male	10	1.66	0.035	0.784
	Female	10	1.55	0.034	
C26	Male	10	2.28	0.031	0.975
	Female	10	2.06	0.029	
C27	Male	10	0.78	0.010	0.081
	Female	10	0.67	0.034	

width of the mandibular space at the coronoid process level (C21) parameter was smaller in female goats than in Awassi sheep [50], while it was higher in male goats. The same parameter in both sexes had higher values than those reported in Hamdani sheep [31].

The distance between the lateral incisor tooth and the mental foramen (C26) parameter is important to determine the location of the mental foramen in regional nerve anaesthesia applications. Anaesthesia through the mental foramen results in sensory loss of the lower incisors, premolars, and lower lip [5, 8, 12]. This distance was reported as 2.45 ± 0.02 cm in blackbuck [9], and 2.84 ± 0.01 cm and 2.78 ± ± 0.01 cm, and 3.04 ± 0.02 cm and 2.96 ± 0.01 cm in Barking deer and Sambar deer males and females,

respectively [37]. According to the study results, a mental nerve block can be achieved extraorally in Siirt coloured mohair goats by injecting the anaesthetic drug approximately 2 cm caudal to the fourth lower incisor, lateral to the margo interalveolaris.

The proportional difference between average values is indicated by the difference between ratios or indexes. This difference creates a difference in surface area. This suggests that the statistically significant difference between males and females occurs in ratios and indexes that are not recognised in linear measurements and may be related to the surface area [50]. A study on the mandibles of gazelles reported that the surface area (C24) was 2.51 ± 0.33 cm^2 in males and 2.12 ± 0.26 cm^2 in females [63]. While the mandibular surface area of Hamdani sheep was determined as 2.43 ± 0.22 cm^2 in males and 2.78 ± 0.32 cm^2 in

females [31], a statistically significant difference was found between male and female animals, similarly to our study (p < 0.01).

CONCLUSIONS

Ours is the first reconstructive and morphometric study on the skull and mandible in Siirt coloured mohair goats. Considering the data obtained, it was concluded that the morphometric values of the skull and mandible showed similarities and differences with the goat breeds bred in Turkey. The data includes key anatomical results that will benefit anatomical, surgical, zoo-archaeological, and taxonomic research. In addition, topographic examinations will help in blocking the terminal branches of the cranial nerves.

ARTICLE INFORMATION AND DECLARATIONS

Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Ethics statement

Not applicable.

Author contributions

Fatma İşbilir: conceptualisation; methodology; data curation; investigation; validation; formal analysis; writing — original draft; writing — review and editing. **Barış Can Güzel:** conceptualisation; methodology; data curation; investigation; validation; formal analysis; writing — original draft; writing — review and editing. **Ali Gülaydin:** conceptualisation; methodology; data curation; investigation; validation; formal analysis; writing — original draft; writing — review and editing. **Om Prakash Choudhary:** conceptualisation; methodology; software; data curation; investigation; validation; formal analysis; supervision; visualisation; project administration; resources; writing — original draft; writing — review and editing. All authors reviewed the manuscript.

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Conflict of interest

The authors declare that there is no conflict of interest.

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