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A Morphometrıc Study on The Skull of The Hemshin Sheep

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ABSTRACT The aim of this study is to establish the basic data source for the adult male Hemshin sheep skull and it is to reveal the similarities and differences between Hemshin sheep and different sheep breeds. In the study, 10 adult male Hemshin sheep heads which were obtained from Artvin and Rize were used. The soft tissues were removed from the skulls and then rinsed with hydrogen peroxide in 25-30 minutes. Afterwards, 39 measurement points were taken from the skulls with digital electronic compass. The mean standard deviation and correlation values of the measurements of skulls were determined in the SPSS (18.0) version program. Correlation analyzes were also performed by calculating craniofacial indices. The profile length of the male Hemshin sheep skull (L1) was measured as 241.20∓ 25.17. The smallest width between the orbits was 77.07 + 4.1 in Hemshin sheep. As a result, morphometric values of the male Hemshin sheep skull were revealed, revealing differences and similarities with other sheep breeds.

Keywords: *Hemshin sheep, Morphometry, Skull*

ÖZ

Erişkin Erkek Hemşin Koyunlarının Kafatası Üzerinde Morfometrik Bir Çalışma

Bu çalışmanın amacı erişkin erkek Hemshin koyunu kafatasına ait temel veri kaynağı oluşturmak, Hemshin koyununun farklı koyun ırkları ile arasındaki benzerlik ve farklılıklarını ortaya çıkarmaktır. Araştırmada Artvin ve Rize Belediye kesimhanelerinden alınan 10 adet erişkin erkek Hemshin koyun başı kullanıldı. Başlardan yumuşak dokular ayrıldıktan sonra, hidrojen peroxide içerisinde 25-30 dakika bekletildi. Daha sonra kafataslarından literatürde belirtilen 39 ayrı noktadan digital kumpas yardımıyla ölçümler alındı. Daha sonra elde edilen ölçümlerin ortalama standart sapma ve korelasyon değerleri SPSS (18.0) versiyon programında belirlendi. Ayrıca craniofacial indexleri hesaplanarak korelasyon analizleri yapıldı. Erkek Hemshin koyun kafatası profil uzunluğunun (U1) 241.20∓ 25.17 cm. orbita'lar arası en küçük genişliğinin ise 77.07+4.1 cm. olduğu görüldü. Sonuç olarak erkek Hemshin koyunu kafatasının morfometrik değerleri ortaya çıkarılarak, diğer koyun ırkları ile arasındaki farklılıkları ve benzerlikleri tespit edildi.

Anahtar Kelimeler: *Hemşin koyunu, Kafatası, Morfometri*

INTRODUCTION

The regional anatomy of the skull is important because it contains some important organs such as the brain, tongue, eyes, lips, teeth, nose, eyelids and horns. A good knowledge of the regional anatomy allows practicing in terms of clinical and surgical intervention, knowing the details of the region-related structure in any case (Dyce 1996).

Morphometric analysis is a preferred method for revealing differences between sexes, in zooarchaeological studies, in osteologic evaluations, to reveal differences in shape due to internal and external factors (Ketani 2009, Çakır 2012).

Hemshin sheep, which is the homeland of Turkey, is generally preferred in meat and milk breeding in Artvin and Rize. The Hemshin sheep, which adapts to the rainy and moist climate of the Black Sea region, is mostly unhorn (Akçapınar 2000). Literature scans have been carried out in various researches on skull morphometry in sheep and in different species, but no morphometric study has been found with the Hemshin sheep skull.

In our study, it was aimed to reveal the similarities and differences between the other sheep breeds as well as providing new basic data on the craniometric values of the male Hemshin sheep skulls.

MATERIALS and METHODS

A total of 10 adult male Hemshin sheep heads were used in this study. Materials were procured from Artvin and Rize municipal slaughterhouses. This study was approved by the local ethics committee of the Animal Experiments of Kafkas University (KAÜ-HADYEK / 2016-027). The soft

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tissues were removed from the skulls and then placed in hydrogen peroxide for 25-30 minutes. Measurements were taken from 39 different points with digital calipers from skulls (Figure 1-4). The mean standard deviation and correlation values of all measurements obtained after taking skull photographs were evaluated in the SPSS (18.0) version program. Also craniofacial indexes are calculated. The values determined are indicated in Tables 1-4. The research was based on the terms Nomina Anatomica Veterinaria (2012).

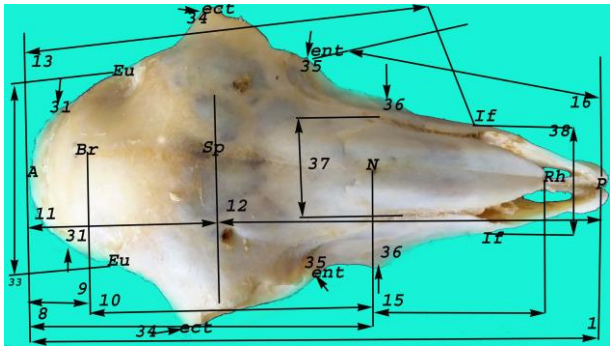

Figure 1. Measurements of the skull of the Hemshin sheep (dorsal view)

1:Profile length, 8: Median frontal length, 9: Akrokranion-Bregma, 10: Frontal length, 11: Upper neurocranium length, 12: Facial length, 13: Akrokranion-infraorbitale of one side, 15: Greatest length of the nasals, 16: Short lateral facial length, 31: Least breadth of parietal, 33: Greatest neurocranium breadth=greatest breadth of the braincase, 34: Greatest breadth across the orbits=Greatest frontal breadth, 35: Least breadth between the orbits, 36: Facial breadth, 37: Greatest breadth across the nasals, 38: Greatest breadth across the premaxilae.

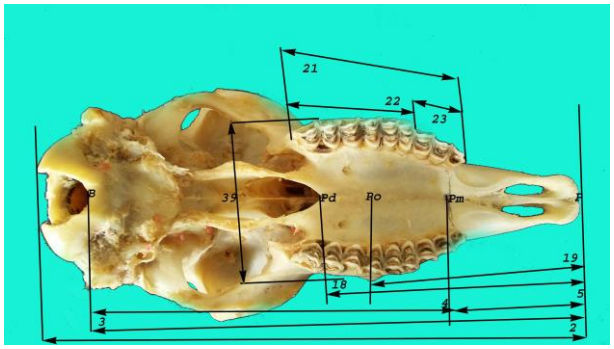

Figure 2. Measurements of the skull of the Hemshin sheep (ventral view)

2: Condylobasal length, 3: Basal length, 4: Short skull length, 5: Premolare-Prosthion, 18: Dental length, 19: Oral palatal length, 21: Length of the cheektooth row, 22: Length of the molar row, 23: Length of premolar row, 39: Greatest palatal breadth.

Measuring points in Hemshin sheep skull

Akrokranion (A): the most aboral point on the vertex of the cranium in the median plane, **Basion (B):** the orobasal border of the foramen magnum in the median plane, **Bregma (Br):** the median point of the parieto-frontal suture, **Ectorbitale (Ect):** the most lateral point of the frontal bone on the occipital side of the orbit, **Entorbitale (Ent):** the naso-medial indentation of the orbit that corresponds with the inner angle of the eye in the living animal, **Euryon (Eu):** the most lateral point of the braincase, **Infraorbitale (If):** the (dorso) aboral point of the foramen infraorbitale, **Nasion (N):** the median point of the naso-frontal suture, **Nasointermaxillare (Ni):** the most aboral point of the premaxilla on the facial surface, **Opisthion (O):** the nuchodorsal border of the foramen magnum in the median plane, **Otion (Ot):** the most lateral point of the mastoid region, **Prosthion (P):** the median point of the line joining the most oral points of the premaxillae, **Postdentale (Pd):** the median point of the line joining the aboral points of the alveoli of the hindmost cheekteeth, **Premolare (Pm):** the median point of the line joining the oral points of the alveoli of the foremost cheekteeth, **Palatinoorale (Po):** the median point of the palatine-maxillary suture, **Rhinion (Rh):** the median point of the line joining the most oral points of the nasals, **Supraorbitale (Sp):** the median point of the line joining the aboral borders of the supraorbital foramina (Von den Drisch 1976).

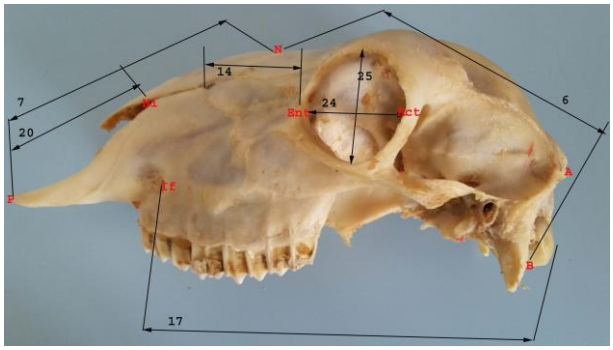

Figure 3. Measurements of the skull of the Hemshin sheep (lateral view)

6:Neurocranium length, 7:Viscerocranium length, 14:Greatest length of the lacrimal, 17:From the aboral border of one occipital condyle to the infraorbitale of the same side, 20: lateral length of the premaxilla, 24: Greatest inner length of the orbit, 25: Greatest inner height of the orbit,

Measured points on the skull

L1: Profile length (Akrokranion-Prosthion), **L2:** Condylobasal length (aboral border of occipital condyles-Prosthion), **L3:** Basal length: (Basion-Premolare), **L4:** Short skLl length (Basion-Premolare), **L5:** Premolare-Prosthion **L6:** NeLrocraniLm length (Basion-Nasion), **L7:** ViscerocraniLm length (Nasion-Prosthion), **L8:** Median frontal length (Akrokranion-SLpraorbitale), **L9:** Akrokranion-Bregma, **L10:** Frontal length (Bregma-Nasion), **L11:** Lpper neLrocraniLm length (Akrokranion-SLpraorbitale), **L12:** Facial length (SLpraorbitale-Prosthion), **L13:** Akrokranion-infraorbitale of one side, **L14:** Greatest length of the lacrimal, **L15:** Greatest length of the nasals (Nasion-Rhinion), **L16:** Short lateral facial length (Entorbitale-Prosthion), **L17:** From the aboral border of one occipital condyle to the infraorbitale of the same side, **L18:** Dental length (Postdentale-Prosthion), **L19:** Oral palatal length (Palatinoorale-Prosthion), **L20:** lateral length of the premaxilla (Nasointermaxillare-Prosthion), **L21:** Length of the cheektooth row, **L22:** Length of the molar row, **L23:** Length of the premolar row, **L24:** Greatest inner length of the orbit (Ectorbitale-Entorbitale), **L25:** Greatest inner height of the orbit, **L26:** Greatest mastoid breadth (Otion-Otion), **L27:** Greatest breadth of the occipital condyles, **L28:** Greatest breadth at the bases of the paraoccipital processLss, **L29:** Greatest breadth of the foramen magnLm, **L30:** Height of the foramen magnLm (Basion-Opisthion), **L31:** Least breadth of parietal, **L32:** Greatest breadth across the orbits, **L33:**

Greatest neLrocraniLm breadth=greatest breadth of the braincase (ELryon-ELryon), **L34:** Greatest breadth across the orbits=Greatest frontal breadth (Ectorbitale-Ectorbitale), **L35:** Least breadth between the orbits (Entorbitale-Entorbitale), **L36:** Facial breadth, **L37:** Greatest breadth across the nasals, **L38:** Greatest breadth across the premaxilae, **L39:** Greatest palatal breadth (Von den Drisch 1976).

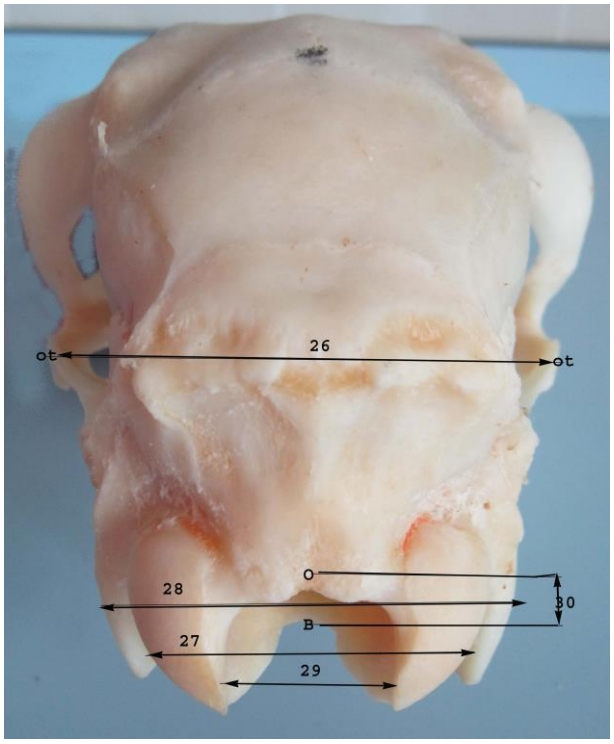

Figure 4. Measurements of the skull of the Hemshin sheep (occipital view).

26: Greatest mastoid breadth, 27: Greatest breadth of the occipital condyles, 28: Greatest breadth at the bases of the paraoccipital processuss, 29: Greatest breadth of the foramen magnum, 30: Height of the foramen magnum.

Figure 5: Fronto-nasal and internasal suture.

Cranio-facial index

Facial index: Maximum zygomatic width X 100/ viscerocranial length,

Nasal index: Greatest breadth across the nasals X 100/ greatest length of the nasals,

Neurocranium index: Maximum width of the neurocranium X 100/ Neurocranium length,

Basal index: Maximum width of neurocranium X 100 / basal length,

Skull index: Maximum zygomatic width X 100 / skull length.

RESULTS

The mean and standard deviation values of the male Hemshin sheep skull in this study are shown in Table 1, and the mean and standard deviation values of the cranio-facial indexes are shown in Table 2, correlation analysis of craniofacial indexes Table 3, and the statistically significant correlation values of the skull measurements are shown in Table 4.

Table 1. The mean and standard deviations values of male Hemshin sheep.

Length	Mean ± Std. Deviation	Length	Mean ± Std. Deviation
L1	241.20±25.17	L21	63.78±9.13
L2	218.60±13.23	L22	40.94±8.45
L3	203.98±15.43	L23	21.16±1.89
L4	145.30±11.49	L24	40.07±2.07
L5	59.70±3.83	L25	37.00±2.03
L6	131.00±14.85	L26	104.50±10.94
L7	122.08±12.96	L27	50.03±4.87
L8	123.45±7.70	L28	67.71±6.30
L9	52.82±8.39	L29	23.24±2.15
L10	84.91±6.89	L30	22.39±2.03
L11	78.65±22.76	L31	38.48±4.96
L12	170.87±8.01	L32	82.19±10.86
L13	158.64±9.16	L33	66.07±4.21
L14	45.60±5.20	L34	109.87±5.24
L15	82.51±7.89	L35	84.37±4.89
L16	131.96±13.64	L36	70.29±5.47
L17	152.85±9.79	L37	37.72±3.96
L18	120.13±11.49	L38	41.85±4.26
L19	95.64±7.89	L39	61.89±5.74

Table 2. The mean and standard deviation values of craniofacial indices of male Hemshin sheep.

Craniofacial index	Mean	Std. Deviation
I1. Nasal index	45.8738	4.32453
I2. Facial index	90.6150	7.46102
I3. Skull index	75.8775	4.63106
I4. Neurocranium index	60.1388	17.14587
I5. Basal index	38.0486	12.25641

Table 3. Correlation of craniofacial index

	I1	I2	I3	I4	I5
I1	1	-.359	.807*	-.085	-.230
I2		1	-.382	-.116	.0.18
I3			1	.003	-.150
I4				1	.971**
I5					1

*: p<0.05, **: p<0.01.

Table 4. The correlation values of skull male Hemshin sheep

	L1	L2	L3	L9	L10	L14	L15	L16	L19	L21	L22	L25
L3	**0.930****	**0.971****										
L4			**0.991****									
L13			**0.934****									
L16		**0.966****					**0.966****					
L18		**0.972****	**0.960****									
L19		**0.964****						**0.956****				
L21		**0.935****										
L22		**0.940****							**0.968****	**0.972****		
L25						**-0.708***	**-0.772***				**-0.736***	
L26												**-0.828***
L27												**-0.863****
L28												**-0.795***
L31				**-0.776***	**0.773***							
L32												**-0.760***
L34						**0.967****						
L36												**-0.818***

* p<0.05. ** p<0.01

DISCUSSION

In our study, although we measured the average length of the male Hemshin sheep skull to profile length 241.20∓25.17 mm. the smallest width between orbits, 77.07 ± 4.1 mm. In the literature (Özcan 2010) was measured profile length is 204.49 mm in Morkaraman sheep, 198.09 mm in Tuj sheep and the smallest width between orbits, 70.41 ± 2.538 mm in Morkaraman sheep and 66.58 ± 2.263 mm in Tuj sheep.

When we compared cranio-facial index calculations on male Hemshin sheep (skull index. basal index. neurocranium index and nasal index) the values were higher than Morkaraman and Tuj sheep index values, but Morkaraman and Tuj sheep facial index values were found to higher than Hemshin sheep facial index values (Özcan 2010).

Different species of skull index was calculated and they found different results. Some of those, 41.95 cm in the kagani goat's (Sarma 2006), 53.57 cm in the Mehraban sheep (Karimi 2011), 47.77 ± 1.96 cm in the Markhoz goat's (Nader 2014). This index was calculated 75.87 ± 4.63 cm in male Hemshin sheep.

Correlation analysis of the measurements made on the Hemshin sheep skull and the high correlation values between the measurements are shown in Table 4. Accordingly the profile there was a strong correlation between the length and the basal length in the positive direction.

It was also found that there was a strong correlation between condylo-basal length and basal and dental length in the positive direction. There is a positive strong correlation between the basal length and the short skull length. while the length 25 (Greatest inner height of the orbit) and the length 27 (between the greatest breadth of the occipital condyles) 26 (Greatest mastoid breadth (Otion-Otion)) there was a strong correlation in the negative direction.

According to the correlation analysis of the cranio-facial index values in the sheep skull of the Hemshin, it was determined that there is a positive correlation between the neurocranium index (I4) and the basal index (I5), between the nasal index (I1) and the skull index (I3). When the values obtained after statistical analysis of the values belonging to the materials were compared with the literatüre, it was determined that the values of Hemshin sheep skulls were higher than those of Tuj and Morkaraman sheeps.

Although (Sarma 2006) indicated that the fronto-nasal sutura was in the form of a '' V '' in Kagani goat, it was seen that the frontal nasal suture of the male Hemshin sheep skull was in the form of '' U'' (Figure 5).

As Nickel (1981) noted, the sutura between the nasal bones of the male Hemshin sheep skull was also flat (Figure 5).

CONCLUSION

As a result, craniometric and various correlation values of male Hemshin sheep skulls were revealed in our study. These findings were compared with other sheep / goat races. It is thought that these data obtained from the male Hemshin sheep skulls will contribute to the literature.

APPRECIATION

This investigation. 1st International Congress on Advances in Veterinary Sciences and Technics (Icavst). Sarajevo Bosnia and Herzegovina 25th- 29th August 2016. presented as poster.

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