



A Macroanatomic and Morphometric Study on Ossicula Auditus in Male Hemshin Sheep*

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Abstract: This study was carried out to determine ossicula auditus morphometry and macro anatomy of male Hemshin sheep. For this purpose ten adult male sheep were used. The sheep heads were obtained from the local slaughterhouse of Ardanuç district of Artvin province. First, the skulls were cleaned from the muscle and skin. Then, the external ear canal (Meatus acusticus externus) was followed ear ossicles located in the cavum tympani was removed by dissecting. Measurements were taken from 14 different points on the ossicula auditus. In male Hemshin sheep ossicula auditus consists of three bones, os malleus, os incus and os stapes, os lenticulare was found as a processus lenticularis on os incus. The presence of processus lateralis, processus rostralis, and processus muscularis was observed on os malleus. The length of os malleus, os incus and os stapes were measured as right/left $7.00 \pm 0.76 / 6.58 \pm 0.085$ mm, $2.89 \pm 0.3 / 2.83 \pm 0.68$ mm and $1.76 \pm 0.13 / 1.88 \pm 0.17$ mm respectively. The width of the corpus incudis was measured as right/left $2.39 \pm 0.40, 2.16 \pm 0.40$ mm, and the width of the base stapedis was $1.25 \pm 0.17 / 1.28 \pm 0.15$ mm, respectively. Statistical analysis showed no significant difference between right and left ossicula auditus ($P > 0.05$). As a result, a macro anatomical and morphometric study was performed on ossicula auditus of male Hemshin sheep which is not included in the literature. The findings obtained from the study were included in the literature.

Keywords: Anatomy, Ear Ossicles, Sheep.

Erkek Hemşin Koyununda Ossicula Auditus Üzerinde Makroanatomik ve Morfometrik Bir Çalışma

Öz: Bu çalışma, erkek Hemşin koyunlarının ossicula auditus morfometrisini ve makro anatomisini belirlemek için yapıldı. Bu amaçla 10 adet yetişkin erkek Hemşin koyunu başı kullanıldı. Koyun başları Artvin ili Ardanuç ilçesi belediye mezbahanesinden temin edildi. Çalışma için ilk önce kafatasları deri ve kaba etlerinden temizlendi. Daha sonra dış kulak yolu (meatus acusticus externus) takip edilerek cavum tympani de yer alan kulak kemikçikleri diseksiyonla çıkartıldı. Kulak kemikçikleri üzerinde toplamda 14 farklı nokta arasında ölçümler yapıldı. Erkek Hemşin koyununda ossicula auditus'un malleus, incus ve stapes olmak üzere üç kemikten oluştuğu görüldü. Os lenticulare'nin incus üzerinde processus lenticularis şeklinde bulunduğu gözlemlendi. Malleus üzerinde procesus lateralis, procesus rostralis ve procesus muscularis'in varlığı görüldü. Incus'un gövdesinden crus longum ve crus breve'nin ayrıldığı görüldü. Malleus uzunluğu sırasıyla sağ/sol $7.00 \pm 0.76 / 6.58 \pm 0.085$ mm, incus uzunluğu $2.89 \pm 0.3 / 2.83 \pm 0.68$ mm, stapes uzunluğu $1.76 \pm 0.13 / 1.88 \pm 0.17$ mm olarak analiz edildi. Corpus incudis genişliği sırasıyla sağ/ sol $2.39 \pm 0.40, 2.16 \pm 0.40$ mm ve basis stapedis'in genişliği $1.25 \pm 0.17, 1.28 \pm 0.15$ mm olarak analiz edildi. İstatistiksel analiz sonucunda sağ ve sol kulak kemikçikleri arasında anlamlı bir fark olmadığı gözlemlendi ($P > 0.05$). Sonuç olarak literatürde yer edinmeyen erkek Hemşin koyunu ossicula auditus'u üzerinde makro anatomik ve morfometrik bir çalışma yapıldı. Çalışma sonucu elde edilen bulgular literatür'e kazandırıldı.

Anahtar Kelimeler: Anatomi, Koyun, Kulak Kemikçikleri.

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INTRODUCTION

Hemshin sheep have been adapting rainy climates in the Eastern Black Sea region. Hemshin sheep are widely grown for meat and milk in Artvin and Rize. It is mostly with no horns. (1). Ossicula auditus, known as os malleus, os incus and os stapes, are found in the cavum tympani. These bones are responsible for transferring vibrations from membrane tympani to the auris interna (2). The anatomical structure of ossicula auditus in different animal species are available in the literature (3-8). Although various bones of some animals have been investigated for morphometry (metapodium, cranium, mandible etc.) (9-15), no studies on the morphometric and macroanatomic features of Hemshin sheep ossicula auditus were found in the literature review.

Morphometry is a research method that examines the shape differences of an organism and its relation to other variables. This method is sometimes used in the development, sometimes in the analysis of the effects of any treatment. In addition, morphometry permits statistical analysis of numerical or graphical lay outs of specific widths, lengths or angles between two points (16). Morphological and morphometric studies reflect the contribution of environmental components and genetics to the developmental stage of the organism (17).

This study was aimed to the determine morphometric values and macroanatomical structures of ossicula auditus of male Hemshin sheep.

MATERIALS and METHODS

In this study, 10 adult male Hemshin sheep heads were used. The ethics committee of the local ethics committee of the Kafkas University dated 25.02.2016 and number 2016/027 was approved to use the sheep as material for the study. Firstly, pars petrosa of ossis temporalis was distinguished from skulls. Then, following meatus acusticus externus,

and ossicula auditus located in the cavum tympani was extracted with the dissection. The mean and standard deviation values of the morphometric parameters from the ossicula auditus were analyzed by SPSS (20.0 version) program and the right and left ossicula auditus were compared with the "Independent samples T" test. Pictures of ossicula auditus were taken with Canon 16X camera. Morphometric parameters of ossicula auditus were obtained from 14 different points (18). The research was based on the terms Nomina Anatomica Veterinaria 2012 (19).

RESULTS

The findings are shown in Table 1, Figure 1 and Figure 2.

Table 1. Morphometric values of ossicula auditus in Hemshin sheep (Mean \pm standard deviation).

Tablo 1. Hemşin koyununda ossicula auditus'a ait morfometrik veriler (Ortalama \pm standart sapma).

Parameter	Right (Mean \pm standart deviation)	Left (Mean \pm standart deviation)
IL	2.89 \pm 0.31	2.83 \pm 0.68
CBL	2.82 \pm 0.45	2.63 \pm 0.29
CLL	3.89 \pm 0.47	3.44 \pm 0.49
CIH	2.21 \pm 0.28	2.02 \pm 0.38
CIW	2.39 \pm 0.40	2.16 \pm 0.40
ML	7.00 \pm 0.76	6.58 \pm 0.85
CML	1.67 \pm 0.17	1.72 \pm 0.33
CMW	1.61 \pm 0.40	1.06 \pm 0.20
MML	5.24 \pm 0.47	5.15 \pm 0.61
SL	1.76 \pm 0.13	1.88 \pm 0.17
CSW	0.55 \pm 0.94	0.53 \pm 0.70
BSW	1.25 \pm 0.17	1.28 \pm 0.15
CPL	1.45 \pm 0.23	1.53 \pm 0.23
CAL	1.49 \pm 0.22	1.58 \pm 0.21

IL: Length of incus, CLL: Length of crus longum, CBL: Length of crus breve, CIW: Length of corpus incudis, CIH: Height of corpus incudis, ML: Length of malleus, CMW: Width of corpus mallei, CML: Length of corpus mallei, MML: Length of manubrium mallei, SL: Length of stapes, BSW: Width of basis stapedis, CSW: Width of caput stapedis, CAL: Length of crus anterior, CPL: Length of crus posterior.

In the male Hemshin sheep, ossicula auditus was consisted of os malleus, os incus and os stapes, and os malleus was the largest of these 3 bones. The

presence of processus lateralis, processus rostralis, and processus muscularis was observed on os malleus. The length of os malleus, os incus, os stapes were measured as right/left $7.00 \pm 0.76 / 6.58 \pm 0.085$ mm, $2.89 \pm 0.3 / 2.83 \pm 0.68$ mm, $1.76 \pm 0.13 / 1.88 \pm 0.17$ mm respectively. Despite the fact that macroanatomical findings, there was a numerical difference between the right and left ossicula auditus, but there was no statistically significant difference between the right and left ossicula auditus ($P > 0.05$).



Figure 1. The ossicula auditus in male Hemshin sheep.

Şekil 1. Erkek Hemşin koyununda kulak kemikçikleri. a. Os incus, a-1. Corpus incudis, a-2. Crus breve, a-3. Crus longum, a-4. Proc. Lenticularis b. Os malleus b-5. Caput mallei, b-6. Collum mallei, b-7. Manubrium mallei, b-8. Proc. rostralis, b-9. Proc. muscularis, b-10. Proc. lateralis. c. Os stapes c-1. Basis stapedis, c-2. Crus caudalis, c-3. Crus rostralis, c-4. Caput stapedis.

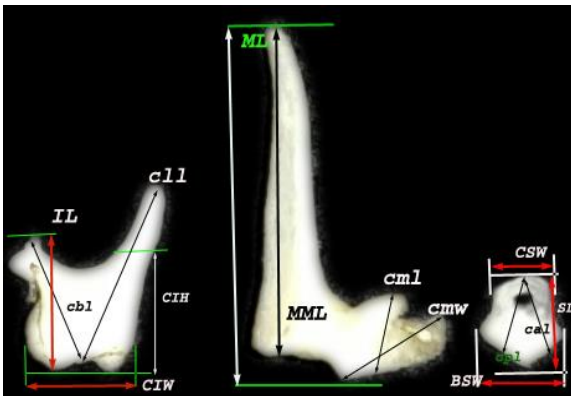


Figure 2. Morphometric measurements of ossicula auditus in male Hemshin sheep.

Şekil 2. Erkek Hemşin koyununda kulak kemikçiklerinin morfometrik ölçümleri. IL: Length of incus, CLL: Length of crus longum, CBL: Length of crus breve, CIW: Length of corpus incudis, CIH: Height of corpus incudis,

ML: Length of malleus, CMW: Width of corpus mallei, CML: Length of corpus mallei, MML: Length of manubrium mallei,

SL: Length of stapes, BSW: Width of basis stapedis, CSW: Width of caput stapedis, CAL: Length of crus anterior, CPL: Length of crus posterior.

DISCUSSION and CONCLUSION

Morphometric studies have been reported in the literature on ossicula auditus of various animals (14,18,20,21). In this study, ossicula auditus of male Hemshin sheep were examined in terms of direction, macroanatomic and morphometric.

The ossicle chain in Hemshin sheep has a similar topography in respect to the same chain in the ruminants, horse, donkey and New Zealand rabbit.

A study on a donkey ossicula auditus has been reported processus lateralis and processus muscularis were not evident on the malleus (21). Similarly, in the study of the ossicula auditus on Malakan horses was reported that processus lateralis and processus muscularis is not available on malleus (24). But in other studies that about ruminants, mouse and domestic animals of ossicula auditus, they were reported 3 process on os malleus its processus rostralis, processus muscularis and processus lateralis (3,7,23). In our study on male Hemshin sheep of ossicula auditus, we found the processus rostralis, processus lateralis and processus muscularis on malleus. This finding is similar to the findings reported in the literature (3,7,23)

It was reported that the os stapes was found to be triangles (2,22). In another literature, they were reported stapes was found to be rectangular (3). It is thought that the os stapes in Male Hemshin sheep look more like a rectangular pentagon whose side edges are not completely clear, that is, rather than rectangular.

Previous studies have reported that gender has no statistically significant effect on ossicula auditus morphometry (18,20,21). Considering the results of previous studies, it was not examined whether the gender factor was effective or not on ossicula auditus in Hemshin sheep.

In the literature (18), it was reported that the right ossicula auditus was significantly larger than the left ossicula auditus in terms of morphometric values in the New Zealand rabbit. Another literature (14) was reported that some morphometric parameters (IL, CBL, SL, BSW, CPL) of the right and left sides of incus and stapes were statistically different ($P<0.05$). But in our study there were no statistically significant difference between the right and left ossicula auditus.

As a result, although there are some studies about Hemshin sheep in the literature but there is no macroanatomical and morphometrical study was performed on the ossicula auditus of Hemshin sheep (15,25,26). With the help of this study data, the lack of information in the literature was eliminated.

Conflict of interest

The authors declare that they have no conflict of interest.

REFERENCES

1. Akçapınar H., 2000. Sheep Breeding. İsmat typography 2. Edition Ankara.
2. König HE., Liebich HG., 2007. Veterinary Anatomy of Domestic Mammals: Textbook and Color Atlas. 3rd ed., Schattauer Co, Stuttgart, Germany.
3. Botti M., Secci F., Ragionieri L., Dessole AA., Acone F., 2006. Auditory ossicles in the ruminants: Comparative morphological analysis with the analogues formations of horse. Ann. Fac. Medic. Vet. di Parma, 26, 91-96.
4. Hebel R., Stromberg MW., 1986. Anatomy and Embryology of Laboratory Rat, 1st ed. Biomed and Verlag, New York.
5. Huang GT., Rosowski JJ., Flandermeier DT., Lynch TJ., Peake WT., 1996. The middle ear of a lion: Comparison of the structure and function to domestic cat. J. Acoust. Soc. Am., 101, 1532-1549.
6. Kristensen F., Jacobsen JOG., Eriksen T., 1996. Otology in Cats and Dogs, 1st edition. LEO, Stockholm.
7. Masuda Y., Honjo H., Naito M., Ogura Y., 1986. Normal development of the middle ear in the mouse: a light microscopic study of serial sections. Acta Medica 40, 201-207.
8. Miller ME., 1964. Anatomy of the Dog, 1st edn. W. B. And Saunders, Philadelphia.
9. Onar V., Mutuş R., Kahvecioğlu KO., 1997. Morphometric analysis of the foramen magnum in German Shepherd dogs (Alsations). Ann Anat, 179, 563-568.
10. Bozkurt EU., Düzler A., Özgel Ö., Kürtül İ., 2002. Morphometric and morphological features of the bones of the wing in Bald Ibis. Indian Vet J, 79, 470-476.
11. Onar V., Belli O., Owen PR., 2005. Morphometric examination of Red Fox (*Vulpes vulpes*) from the Van-Yoncatepe necropolis in Eastern Anatolia. Int J Morphol, 23, 253-260.
12. Özcan S., Aksoy G., Kürtül İ., Aslan K., Özüdoğru Z., 2010. A comparative morphometric study on the skull of the Tuj and Morkaraman Sheep. Kafkas Univ Vet Fak Derg, 16, 111-114.
13. Demiraslan Y., Gülbaz F., Özcan S., Dayan MO., Akbulut Y., 2014. Morphometric analysis of the mandible of Tuj and Morkaraman sheep. J Vet Anat, 7, 75-86.
14. Gurbuz İ., Demiraslan Y., Aslan K., 2015. Morphometric analysis of the skull of New Zealand Rabbit (*Oryctolagus cuniculus* L.) according to gender. AJAVS, 1, 27-32.
15. Dalga S., Aslan K., 2017. The morphometric study on Hemshin sheep mandible. Atatürk Üniv Vet Bil Derg, 12, 22-27.
16. Rohlf FJ., Marcus LF., 1993. A revolution in morphometrics Trendsecol. Evol, 8, 129-132.
17. Wehausen JD., Ramey RR., 2000. Cranial morphometric and evolutionary relations in the northern range of *Ovis canadensis*. J Mammal, 81, 145-161.
18. Kürtül İ., Demirkan AÇ., Bozkurt EU., Dursun N., 2003. Detailed subgross morphometric study on the auditory ossicles of the New Zealand Rabbit.

- Anat Histol Embryol. 32, 249-252.
19. Nomina Anatomica Veterinaria 2012. International Committee on Veterinary Gross Anatomical Nomenclature: General Assembly of the World Association of Veterinary Anatomists., 5th ed, Gent, Published by the Editorial Committee Hannover (Germany), Columbia, MO (U.S.A.), Ghent (Belgium), Sapporo (Japan).
 20. Mohammadpour AA., 2011. Morphology and morphometrical study of hamster middle ear bones. *IJVR*, 12, 121-126.
 21. Demiraslan Y., Gurbuz I., Aslan K., 2015. A Macroanatomic and morphometric study on Auditory ossicles in Donkey (*Equus asinus*). *İstanbul Üniv., Vet. Fak. Derg*, 41(2), 151-154.
 22. Getty R., 1975. Sisson and Grossman's The Anatomy of the Domestic Animals. Volume 1, fifth edition, WB, Saunders Company, Philadelphia, USA.
 23. Nickel R., Schummer A., Seiferle E., 1986. The Anatomy of the Domestic Animals Volume 1. Verlag Paul Parey, Berlin, Germany.
 24. Gurbuz İ., Aykut M., Dayan MO., Aslan K., 2016. Morphometric analysis of ossicula auditus in Malakan horses. *Eurasian J Vet Sci*, 32, 204-207.
 25. Gurbuz İ., Demiraslan Y., Kırbaş G., Aslan K., 2018. The morphometric and stereologic investigation of metapodium in male Hemshin sheep. *MAKÜ Sağ Bil Enst Derg* 6, 1-14.
 26. Gurbuz İ., Demiraslan Y., Sarı EK., Aslan K., 2017. Morphologic and morphometric structure and arterial vascularization of glandula interdigitalis in Male Hemshin sheep. *Kafkas Univ Vet Fak Derg*, 23, 242-246.