

**Macro-anatomical investigations on the skeletons of hedgehog
(*Erinaceus europaeus* L.). II. ossa membri pelvini**

Zait Ender Özkan*

Department of Anatomy, Faculty of Veterinary Medicine, Fýrat University, Elazýg, Turkey

**ÖZKAN, Z. E.: Macro-anatomical investigations on the skeletons of hedgehog
(*Erinaceus europaeus* L.). II. ossa membri pelvini. Vet. arhiv 72, 213-220, 2002.**

ABSTRACT

In this study, three adult male hedgehogs (*Erinaceus europaeus* Linnaeus) were used to investigate the bones of hind limb. The spina iliaca ventralis caudalis was absent. The symphysis pelvis was formed by symphysis pubis and it was an interpubic ligamentous tissue in hedgehogs. The average Vialleton angle was measured as (8°). Average distance between the midacetabulum and tuber coxae was 39.2 mm and average distance between the midacetabulum and ischial tuberosity (tuber ischiadicum) was 13.8 mm. There were three trochanters on the femur. The tibia and fibula were fused almost in the distal half. There were 7 tarsal bones and the pedis was complete with five digits.

Key words: hedgehog, *Erinaceus europaeus* L., ossa membri pelvini

Introduction

Hedgehogs (*Erinaceus europaeus* L.) belong to the Erinaceidae family, order Insectivora (VAUGHAN, 1972; DEMÝRSOY, 1996; 1997; 1998). The most important features of hedgehogs are the bristles transformed to spine form on the dorsal and lateral sides of the body, forming a quite round body

* Contact address:

Dr. Zait Ender Özkan, Department of Anatomy, Faculty of Veterinary Medicine, Fýrat University, 23159, Elazýd, Turkey. Phone: +90 424 237 0000, Fax: +90 424 238 8173

when threatened and in order to sleep in winter under a 4 °C environmental temperature (DEMÝRSOY, 1997; 1998). The literature on the macro-anatomical features of the skeletal system in hedgehogs is very meagre.

There have been some macro-anatomical investigations carried out on the skeletal systems of wild animals such as lagomorphs (DUBRUL, 1950), African rhinoceros (GOMERČIĆ and HUBER, 1982), hyena (TECÝRLÝOÐLU, 1983), wolf and fox (GÝRGÝN et al., 1988), mink (DURSUN and TIPIRDAMAZ, 1989), raccoon dogs and badgers (HIDAKA et al., 1998), porcupine (YILMAZ et al., 1998; 1999), otter (DÝNÇ et al., 1999), but the skeletal systems of hedgehogs of the order Insectivora have not been investigated in detail.

The aim of this study is to investigate the ossa membri pelvini part of the skeletal system in hedgehogs and to contribute to the fund of information.

Materials and methods

The bones examined were obtained from three adult male hedgehogs caught by the villagers in Elazýd. Maceration of bones was carried out by the method of BARTELS and MEYER (1991), and TAÐBAÐ and TECÝRLÝOÐLU (1966).

For terminology, Nomina anatomica veterinaria (ANONYMOUS, 1994) was used.

Vialleton angle (LESSERTISSEUR and SABAN, 1967) was measured as an angle between the line lying from the midacetabulum to the midpoint of the crista iliaca and the line lying from the midacetabulum to the centre of the facies auricularis.

Results

Os coxae. Linae glutae were not prominent. Spina iliaca dorsalis cranialis, spina iliaca dorsalis caudalis, spina iliaca ventralis cranialis were prominent; spina iliaca ventralis caudalis was not present. The spina ischiadica was not well developed. The great sciatic notch (incisura ischiadica major) was deeper and wider than the lesser sciatic notch (incisura ischiadica minor). The iliac tuberosity (tuberositas iliaca) on the sacropelvic

surface (facies sacropelvina) was prominent, and facies auricularis was formed as a small area.

Tuber ischiadicum was prominent and had a single process. There was a small notch on the caudal side of the tabula ossis ischii. The symphysis pelvis was formed by symphysis pubis and was in the form of a ligament connecting the two caudal branch of the pubic bones (ramus caudalis ossis pubis) (Fig. 1).



Fig. 1. Vento-lateral aspect of os coxae of hedgehog (*Erinaceus europaeus* L.)
a) ala ossis ilii, b) crista iliaca, c) spina iliaca dorsalis cranialis, d) spina iliaca dorsalis caudalis, e) spina iliaca ventralis cranialis, f) acetabulum, g) incisura acetabuli, h) for. obturatum, ý) tabula ossis ischii, i) a small notch on the caudal side of the tabula ossis ischii, j) incisura ischiadica major, k) incisura ischiadica minor, l) tuber ischiadicum, m) interpubic ligamentous tissue.

The Vialleton angle was measured as (8ş). Average distance between the midacetabulum and tuber coxae was 39.2 mm, and the average distance between the midacetabulum and ischial tuberosity (tuber ischiadicum) was 13.8 mm. The average sagittal length and width of the foramen obturatum were 11.4 mm and 6.6 mm, respectively.

Femur. There were three trochanters on the femur: the greater trochanter (trochanter major), the lesser trochanter (trochanter minor) and the third trochanter (trochanter tertius). The trochanteric fossa (fossa trochanterica) was wide and deep and the trochanteric ridge (crista intertrochanterica) was present between the lesser and the greater trochanters. Condylus lateralis, condylus medialis, epicondylus lateralis, epicondylus medialis, linea and fossa intercondylaris were prominent (Fig. 2).



Fig. 2. The femur, ossa cruris and the patella in hedgehog (*Erinaceus europaeus* L.)
i- caudal aspect of the femur; ii- cranio-lateral aspect of the tibia and fibula
a) caput ossis femoris, b) trochanter major, c) trochanter minor, d) trochanter tertius, e) crista intertrochanterica, f) fossa trochanterica, g) condylus lateralis, h) condylus medialis, i) epicondylus lateralis, j) epicondylus medialis, k) linea intercondylaris, l) fossa intercondylaris, m) tibia, n) fibula, o) tuberositas tibiae, p) patella, r) facies cranialis, s) basis patellae, t) apex patellae

Patella. The cranial surface of the patella was convex; apex patellae was pointed.

Skeleton cruris. The tibia and fibula were fused almost in the distal half and there was a wide spatium between the tibia and fibula in the

Table 1. Specification of myomorphus mammals examined by renoculture and microscopic agglutination according to the trapping area with corresponding results

Z. E. Özkan: Macro-anatomical investigations on the skeletons of hedgehog (*Erinaceus europaeus* L.). II. ossa membri pelvini

proximal half. Tuberositas tibiae was prominent. There was a prominence near the lateral malleolus and the cochlea tibiae was sagittal (Fig. 2).

Ossa tarsi. There were 7 tarsal bones. The proximal row consisted of the talus and calcaneus. Os tarsi centrale was in the distal of the talus. Facies articularis navicularis of the talus was convex and there was a small pit on the trochlea tali. The distal row bones from medial to lateral were os tarsale I, os tarsale II, os tarsale III, and os tarsale IV. The comparative sizes of the distal tarsal bones were: IV>I>III>II.

Ossa metatarsalia I-V. The pedis was complete with five digits and there were five distinct metatarsal bones lying between the tarsal bones and phalanges. The comparative lengths of the metatarsal bones were: IV>III>II>V>I.

There were two plantar located sesamoid bones in pairs at each of the metatarsophalangeal joints.

Ossa digitorum pedis. There were two phalanges in the first and fifth digit and the other three digits comprised three phalanges. The distal



Fig. 3. Dorsal aspect of the tarsal and metatarsal bones of hedgehog (*Erinaceus europaeus* L.). a) talus, b) calcaneus, c) os tarsi centrale, d) os tarsale I, e) os tarsale II, f) os tarsale III, g) os tarsale IV, h) os metatarsale I, ý) os metatarsale II, i) os metatarsale III, j) os metatarsale IV, k) os metatarsale V

phalanges were arched and pointed to accommodate the curved nails. The comparative lengths of nails were: II>III> IV>V>I.

Discussion

Any sexually dimorphic character can be used to distinguish males from females, including differences in genitalia, body size, pelage, ornamentation, behaviour. In practice, males are 20% larger than females on average (KUNZ et al., 1996). In the present study, certain measurements were taken in male hedgehogs.

In the Erinaceidae family, symphysis was formed by a cartilage or interpubic ligament (LESSERTISSEUR and SABAN, 1967) and in the order Insectivora the symphysis is sometimes non-existent, and always weak, as in *Erinaceus* for example, where it is confined to the pubis (SAUNDERS and MANTON, 1969). In the present study, an interpubic ligamentous form was observed in hedgehogs.

The presence of a large obturator foramen bounded by the pubis and ischium is characteristics of mammals (WEICHERT, 1970). In hedgehogs, this foramen was also large and had an almost hemicycle form. Average sagittal length and width of the foramen obturatum were 11.4 mm and 6.6 mm, respectively.

ROMER (1970) reported that the fourth trochanter in the femur is absent in mammals, and SAUNDERS and MANTON (1969) mentioned that the femur of the Insectivora has a third trochanter which is particularly well developed in *Erinaceus* and *Centetes*. In this study, three trochanter in the femur in hedgehogs were observed: the greater (trochanter major), the lesser (trochanter minor) and the third (trochanter tertius).

The fovea capitis on the caput ossis femoris and fossa supracondylaris are absent in porcupines (YILMAZ et al., 1999). The fovea capitis on the caput ossis femoris is absent in the African rhinocerus (*Diceros bicornis* L.), too (GOMERČIĆ and HUBER, 1982). Similar findings were observed in this study.

The fibula is a slender bone and is usually separated from the tibia but is, however, fused at the distal end in *Erinaceus* (SAUNDERS and MANTON, 1969; DEMÝRSOY, 1998). In porcupines the fibula is fused with the tibia at the

Z. E. Özkan: Macro-anatomical investigations on the skeletons of hedgehog (*Erinaceus europaeus* L.). II. ossa membri pelvini

proximal portion (YILMAZ et al., 1999). In our study the slender fibula was fused only at the distal half of the tibia in hedgehogs.

In some species of the Erinaceidae family the pedis is comprises four digits (KURU, 1999). In our study, the pedis was complete with five digits.

References

- ANONYMOUS (1994): Nomina anatomica veterinaria. 4th ed. By the World Association of Veterinary Anatomists.
- BARTELS, T. H., W. MEYER (1991): Eine schnelle und effektive Methode zur Mazeration von Wirbeltieren. Dtsch. Tierärztl. Wschr. 98, 407-409.
- DEMÝRSOY, A. (1996): Genel ve Türkiye Zoocodrafyasý, Hayvan Codrafyasý, Meteksan A. ̇., Ankara.
- DEMÝRSOY, A. (1997): Türkiye Omurgalýlarý. Memeliler, Meteksan A. ̇., Ankara.
- DEMÝRSOY, A. (1998): Yaşamýn Temel Kurallarý. Meteksan A. ̇., Ankara.
- DÝNÇ, G., A. AYDIN, Ö. ATALAR (1999): Macro-anatomical investigations on the skeletons of otter (*Lutra lutra*) II. ossa membri pelvini. Fýrat Univ. J. Health Sci. 13, 229-232.
- DUBRUL, E. L. (1950): Posture, locomotion and the skull in Lagomorpha. Am. J. Anat. 87, 277-314.
- DURSUN, N., S. TIPIRDAMAZ (1989): Etudes macro-anatomiquement sur les os du squelete du vison (*Mustela vison*). J. Fac. Vet. Med. Univ. Selçuk. 5, 13-27.
- GÝRGÝN, A., H. KARADAĐ, S. BÝLGÝÇ, A. TEMÝZER (1988): A study on the macro-anatomical differences of the skeletons of wolf and fox as compared with the skeleton of dog. J. Fac. Vet. Med. Univ. Selçuk. 4, 169-182.
- GOMERČIĆ, H., Đ. HUBER (1982): Articuluss coxae u Africkog nosoroga. XIX th. Congress of Yugoslav Association of Anatomists. Abstracts. Prishtine, 13-15. 09. 1982. p. 34.
- HIDAKA, S., M. MATSUMOTO, H. HIJI, S. OHSAKO, H. NISHINAKAGAWA (1998): Morphology and morphometry of skulls of raccoon dogs, *Nyctereutes procyonoides* and badgers, *Meles meles*. J. Vet. Med. Sci. 60, 161-167.
- KUNZ, T. H., C. WEMMER, V. HAYSEN (1996): Standard Methods for Mammals. Measuring and Monitoring Biological Diversity. (D. E. Wilson, F. R. Cole, J. D. Nichols, R. Rudran, M. S. Foster, Eds.). Smithsonian Institution Press, Washington, London.
- KURU, M. (1999): Omurgalý Hayvanlar. Palme Yayýncýlýk, Feryal Matbaacýlýk San. Ltd. ̇ti., Ankara.
- LESSERTISSEUR, J., R. SABAN (1967): Generalites sur le Squelette. Traite' de Zoologie, Anatomie, Systematique, Biologie. Publie' Sous la Direction de Grasse', P. P. Masson et Cie, Paris.

Z. E. Özkan: Macro-anatomical investigations on the skeletons of hedgehog (*Erinaceus europaeus* L.). II. ossa membri pelvini

- ROMER, A. S. (1970): The Vertebrate Body. W. B. Saunders Company, Philadelphia, London, Toronto.
- SAUNDERS, J. T., S. M. MANTON (1969): A manual of practical vertebrate morphology, 4th ed., Clarendon Press. Oxford.
- TATBAŦ, M., S. TECÝRLÝOGLU (1966): Maserasyon teknidi üzerinde arařtırmalar. J. Fac. Vet. Med. Univ. Ankara 12, 324-330.
- TECÝRLÝOGLU, S. (1983): Makro-anatomische Untersuchungen über die Skelettknochen von Hunden der Hyäne. I: Truncus. J. Fac. Vet. Med. Univ. Ankara. 30, 149-166.
- VAUGHAN, T. A. (1972): Mammalogy. W. B. Saunders Company, Philadelphia, London, Toronto.
- YILMAZ, S., Z. E. ÖZKAN, D. ÖZDEMÝR (1998): Macro-anatomical investigations on the skeletons of porcupine (*Hystrix cristata*) I. ossa membri thoracici. Tr. J. Vet. Anim. Sci. 22, 389-392.
- YILMAZ, S., G. DÝNÇ, A. AYDIN (1999): Macro-anatomical investigations on the skeletons of porcupine (*Hystrix cristata*) II. ossa membri pelvini. Tr. J. Vet. Anim. Sci. 23, 297-300.
- WEICHERT, C. K. (1970): Anatomy of the Chordates. Mc Graw-Hill Book Company. New York

Received: 5 July 2002
Accepted: 29 August 2002

ÖZKAN, Z. E.: Makroanatomiska istraživanja kostura ježa (*Erinaceus europaeus* L.). II. ossa membri pelvini. Vet. arhiv 72, 213-220, 2002.

SAŽETAK

Istražena je anatomska građa kostiju stražnje noge u tri odrasla ježa (*Erinaceus europaeus* L.). Nedostajala je spina iliaca ventralis caudalis. Symphysis pelvis je bila oblikovana od symphysis pubis, a ustanovljen je interpubični ligament. Prosječni Vialleton kut iznosio je 8°. Prosječna udaljenost između središta acetabuluma i bočne kvrge iznosila je 39,2 mm, a prosječna udaljenost između središta acetabuluma i sjedne kvrge bila je 13,8 mm. Na bedrenoj kosti su ustanovljena tri trochantera. Goljenica i lisnjača su bile spojene u distalnoj polovici. Utvrđeno je 7 tarzalnih kostiju, a stopalo je bilo potpuno s pet prstiju.

Ključne riječi: jež, *Erinaceus europaeus* L., kosti stražnje noge
