

Macro-anatomical investigations on the hind limb skeleton of mole-rat (*Spalax leucodon* Nordmann)

Zait Ender Özkan*

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

ÖZKAN, Z. E.: Macro-anatomical investigations on the hind limb skeleton of mole-rat (*Spalax leucodon* Nordmann). Vet. arhiv 72, 159-166, 2002.

ABSTRACT

In this study, five mole-rats (*Spalax leucodon* Nordmann) were used to investigate the bones of hind limb. Almost the whole area of the sacropelvic surface (facies sacropelvina) was formed by the iliac tuberosity (tuberositas iliaca). Average distance between the midacetabulum and tuber coxae was 16.7 mm, and average distance between the midacetabulum and tuber ischiadicum was 7.9 mm. There were three prominent trochanters on the femur. Eight distinct tarsal bones and five distinct metatarsal bones were present. The shortest metatarsal bone was os metatarsale I and the longest was os metatarsale III. The pedis was complete with five digits. There were two phalanges in the first digit and the other four digits were composed of three phalanges.

Key words: mole-rat, *Spalax leucodon* Nordmann, ossa membri pelvini, anatomy

Introduction

Mole-rats *Spalax leucodon* Nordmann are subterranean rodents which live in their own tunnel system. They are mainly phytophagous animals and make their habitats by burrowing in soft and productive agricultural plantations, steppes and gardens (DEMÝRSOY, 1997). Mole-rats belong to

* Contact address:

Dr. Zait Ender Özkan, Department of Anatomy, Faculty of Veterinary Medicine, Fýrat University, 23159, Elazýd, Turkey, Phone: 90 424 237 00 00; Fax: 90 424 238 81 73; E-mail: volkanozk@e-kolay.net

the Spalacidae family, order Rodentia (KURU, 1987; DEMÝRSOY, 1996). These animals use their extremities for burrowing and shovelling and they are often confused with moles (*Talpa europea* Linnaeus, order Insectivora) (DEMÝRSOY, 1997; 1998).

Some macro-anatomical investigations have been carried out on the skeletal systems of wild carnivores such as the mink (DURŞUN and TIPIRDAMAZ, 1989) and from the order Rodentia such as guinea pig and rat (ÖZKAN et al., 1997), porcupine (YILMAZ et al., 1998) and from the order Lagomorpha, such as rabbit (ÖZKAN et al., 1997) but the skeletal systems of the mole-rats from the order Rodentia have not been investigated in detail.

The literature on the macro-anatomical features of the skeletal system in mole-rats is meagre and the aim of the present study is to investigate the ossa membri pelvini part of the skeletal systems in mole-rats and to contribute to the present dearth of information.

Materials and methods

Examined bones were obtained from 5 adult male mole-rats (*Spalax leucodon* Nordmann) inhabiting their own tunnels in plantations in Elazýđ-Turkey. Maceration of bones was carried out by the method of BARTELS and MEYER (1991), TAĐBAĐ and TECÝRLÝOĐLU (1966).

For terminology, Nomina Anatomica Veterinaria 4th ed. (1994) was used and was further supplemented using the textbooks of WELLS (1964), COOK (1965) and GREENE (1968).

Results

Os coxae. Ala ossis ilii was concave. Spina iliaca dorsalis cranialis, spina iliaca dorsalis caudalis, spina iliaca ventralis cranialis, spina iliaca ventralis caudalis and spina ischiadica were prominent (Fig. 1). The great sciatic notch (incisura ischiadica major) was deep and wide; the lesser sciatic notch (incisura ischiadica minor) was deep and narrow, (Fig. 1). The wing (ala ossis ilii) and the body (corpus ossis ilii) of the ilium were wide and narrow respectively. Almost the whole area of the sacropelvic surface (facies sacropelvina) was formed by the iliac tuberosity (tuberositas iliaca) (Fig. 1).

The ischial spine (spina ischiadica) was a great eminence directed caudodorsally and there was a line lying from the tip of the ischial spine to the acetabulum. Ramus ossis ischii was convex and there was a wide pit on the medial surface of the tabula ossis ischii.

Ramus cranialis ossis pubis (acetabular branch of the pubis) was slender. The acetabulum was deep and there was no acetabular notch, but a little foramen was present instead of the notch. Average distance between the midacetabulum and tuber coxae was 16.7 mm, while the average distance between the midacetabulum and ischial tuberosity (tuber ischiadicum) was 7.9 mm. The average sagittal length and width of the foramen obturatum were 5.9 mm and 2.8 mm, respectively.

Femur. There was a small fovea (fovea capitis). The greater trochanter (trochanter major), the lesser trochanter (trochanter minor) and the third trochanter (trochanter tertius) were prominent (Fig. 2). The trochanteric



Fig 1. Medial (i) and lateral (ii) aspect of os coxae (scale is in mm). a) ala ossis ilii, b) facies sacropelvina, c) tabula ossis ischii, d) acetabular branch of os pubis, e) foramen obturatum, f) the foramen instead of the incisura acetabuli, g) tuber ischiadicum, h) spina ischiadica, j) incisura ischiadica major, k) incisura ischiadica minor, l) spina iliaca dorsalis cranialis, m) spina iliaca dorsalis caudalis, n) spina iliaca ventralis cranialis, o) spina iliaca ventralis caudalis

fossa (fossa trochanterica) was deep and the intertrochanteric ridge (crista intertrochanterica) was present between the lesser and greater trochanter. Trochanter major was separated from the caput ossis femoris by a notch. Condylus lateralis, condylus medialis, epicondylus lateralis, epicondylus medialis, linea and fossa intercondylaris were prominent.

Tibia and fibula. The tibia and fibula were fused in the distal 1/3 portion on average. The fibula was a very slender bone. There were two facets at the proximal end at the proximal end for articulation with the femur. Tuberositas tibiae was prominent, cochlea tibiae was concave. A prominent groove on the proximal half of the facies lateralis of the corpus tibiae was observed (Fig. 2).

Ossa tarsi. There were eight distinct tarsal bones. From medial to lateral the proximal tarsal bones consist of os tibiale mediale tarsi s. prehallux, talus and calcaneus. Os tibiale mediale tarsi s. prehallux was a small oval-



Fig 2. The femur (i) and the joints of femur, tibia and fibula (ii) (Scale is in mm). a) caput ossis femoris, b) trochanter major, c) trochanter minor, d) trochanter tertius, e) linea intertrochanterica, f) fossa trochanterica, g) condylus lateralis, h) condylus medialis, j) epicondylus lateralis, k) epicondylus medialis, l) linea intercondylaris, m) patella, n) a deep groove on the proximal half of the facies lateralis of the corpus tibiae, o) fibula

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

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shaped proximal tarsal bone articulating laterally with the talus, distally from medial to lateral with os tarsale I and os tarsi centrale. In the distal row, os tarsale I, os tarsale II, os tarsale III, os tarsale IV were distinct and there was os tarsi centrale in the distal of the talus. Os tarsale IV was larger than the other distal row bones (Fig. 3).

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 shortest was os metatarsale I and the longest was os metatarsale III (Fig. 3).

Ossa digitorum pedis. There were two phalanges in the first digit, while the other four digits were composed of three phalanges. The distal phalanges had the form of claws.

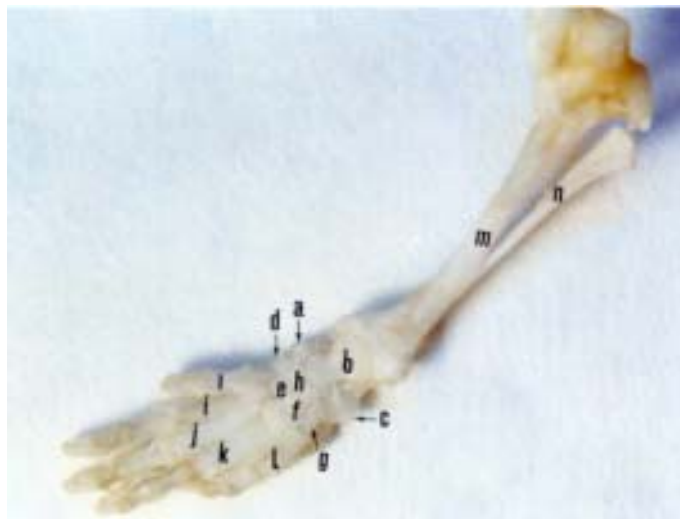


Fig 3. Dorsal aspect of the pedis. a) the small proximal tarsal bone, os tibiale mediale tarsi s. prehallux, b) talus, c) calcaneus, d) os tarsale I, e) os tarsale II, f) os tarsale III, g) os tarsale IV, h) os tarsi centrale, i) os metatarsale I, j) os metatarsale II, k) os metatarsale III, l) os metatarsale IV, m) tibia, n) fibula.

Discussion

Ramus cranialis ossis pubis (acetabular branch) is very thin in some rodents (in the *Spalacidae* and *Heteromyidae* families) (LESSERTISSEUR and SABAN, 1967). Similarly, in the present study a thin ramus cranialis ossis pubis was observed in mole-rats.

Foramen obturatum is large in rats (ÇALIŞLAR, 1978) and the presence of a large obturator foramen bounded by pubis and ischium is characteristic of mammals (WEICHERT, 1970). In mole-rats, this foramen was also large, average sagittal length and width of the foramen obturatum being 5.9 mm and 2.8 mm respectively.

In the hind limb of the Rodentia the femur possesses a third trochanter (SAUNDERS and MANTON, 1969). Similarly, in our study, a prominent third trochanter (trochanter tertius) was observed on the proximal 1/3 of the length of the femur in mole-rats.

DEMÝRSOY (1998) mentioned that in the Rodentia, tibia and fibula may fuse or may be distinct. In mole-rats the tibia and fibula were fused in the distal 1/3 portion on average as in rats (ÇALIŞLAR, 1978).

Eight irregular bones, varying greatly in size, and arranged in two parallel rows, comprise the tarsus in rats (GREENE, 1968). Similarly, there were eight distinct tarsal bones. Three and four tarsal bones were present in the proximal and distal row respectively and os tarsi centrale was in the distal of the talus in mole-rats. Os tibiale mediale tarsi s. prehallux in the proximal row is a distinct bone in the genus *Mus* (order Rodentia) (ÖKTAY, 1988). In the present study, this bone was a small proximal tarsal bone articulating laterally with the talus, distally from medial to lateral with os tarsale I and os tarsi centrale and is distinct in mole-rats also.

The foot in most Rodentia tends to be much longer than the hand and a reduction in the digits occurs in some forms (SAUNDERS and MANTON, 1969), also, mammals have reduced the phalangeal count in the pes, as in the manus to 2.3.3.3.3 (ROMER and PARSONS, 1978). In our study, the foot was longer than the hand and five digits were observed. There were two phalanges in the first digit, and the other four digits were composed of three phalanges.

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References

- BARTELS, T. H., W. MEYER (1991): Eine schnelle und effektive Methode zur Mazeration von Wilbertieren. Dtsch. Tierärztl. Wschr. 98, 407-409.
- COOK, M. J. (1965): The anatomy of the laboratory mouse. Academic Press., London and New York.
- ÇALIŞLAR, T. (1978): Laboratuvar Hayvanları Anatomisi. Fırat Üniv. Vet. Fak. Yay. 14, Ankara Üniv. Basımevi, Ankara.
- DEMİRSOY, A. (1996): Genel ve Türkiye Zoocoğrafyası, Hayvan Coğrafyası, Meteksan A. T., Ankara.
- DEMİRSOY, A. (1997): Türkiye Omurgalıları. Memeliler, Meteksan A. T., Ankara.
- DEMİRSOY, A. (1998): Yaşamın Temel Kuralları. Meteksan A. T., Ankara.
- DURSUN, N., S. TİPİRDAMAZ (1989): Etudes macro-anatomiquement sur les os du squelette du vison (*Mustela vison*). J. Fac. Vet. Med. Univ. Selçuk 5, 13-27.
- GREENE, C. E. (1968): The anatomy of the rat. Hafner Publishing Company, New York, London.
- KURU, M. (1987): Omurgalı Hayvanlar. Atatürk Üniv. Basımevi, Erzurum.
- LESSERTISSEUR, J., R. SABAN (1967): Généralités sur le Squelette. Traité de Zoologie, Anatomie, Systematique, Biologie. Publié Sous la Direction de Grassé, P. P. Masson et Cie, Paris.
- ÖKTAY, M. (1988): Omurgalı Hayvanların Kartıllaştırılmalı Anatomisi. Ýst. Üniv. Fen Fak. Basımevi, Ýstanbul.
- ÖZKAN, Z. E., G. DÝNÇ, A. AYDIN (1997): Investigations on the comparative gross anatomy of scapula, clavícula, skeleton brachii and skeleton antebrachii in rabbits (*Oryctolagus cuniculus*), guinea pigs (*Cavia porcellus*) and rats (*Rattus norvegicus*). Fırat Univ. J. Health Sci. 11, 171-175.
- ROMER, A. S., T. S. PARSONS (1978): 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.
- TATBAŞ, M., S. TECÝRLÝOĐLU (1966): Maserasyon teknidi üzerinde araştırmalar. J. Fac. Vet. Med. Univ. Ankara. 12, 324-330.
- WEICHERT, C. K. (1970): Anatomy of the Chordates. Mc Graw-Hill Book Company. New York, London.
- WELLS, T. A. G. (1964): The rat, a practical guide, Dover Publications, New York.
- YILMAZ, S., Z. E. ÖZKAN, D. ÖZDEMİR (1998): Macro-anatomical investigations on the skeletons of porcupine (*Hystrix cristata*). 1. Ossa membri thoracici. Tr. J. Vet. Anim. Sci. 22, 389-392.

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(*Spalax leucodon* Nordmann)

Received: 3 June 2002
Accepted: 28 June 2002

**ÖZKAN, Z. E.: Makroanatomska istraživanja kostiju stražnje noge bijelozubog
sljepaša (*Spalax leucodon* Nordmann). Vet. arhiv 72, 159-166, 2002.**

SAŽETAK

Istraživanje je provedeno na pet bijelozubih sljepaša (*Spalax leucodon* Nordmann). Gotovo čitavo područje križnozdelične površine (facies sacropelvina) bilo je oblikovano od ilijačne kvrge (tuberositas iliaca). Prosječna udaljenost između središta acetabuluma i bočne kvrge bila je 16,7 mm, a prosječna udaljenost između središta acetabuluma i sjedne kvrge iznosila je 7,9 mm. Na bedrenoj kosti ustanovljena su tri trochantera. Utvrđeno je osam odvojenih tarzalnih kostiju i pet metatarzalnih. Najkraća metatarzalna kost bila je os metatarsale I, a najduža os metatarsale III. Stopalo je bilo potpuno s 5 prstiju. Prvi prst se sastojao od dva prstna članka, a ostala četiri prsta bila su sastavljena od tri falange.

Ključne riječi: bijelozubi sljepaš, *Spalax leucodon* Nordmann, kosti stražnje noge, anatomija
