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Macro-anatomical investigations of the skeletons of the African giant rat (*Cricetomys gambianus* Waterhouse): Pelvic limb

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SUMMARY

In this study, the hind limb bones of adult African giant rats (*Cricetomys gambianus* Waterhouse) were used to investigate their gross morphology. The ventrocaudal iliac spine was absent in the animals while the pelvic symphysis was fused. The average distance between the mid-acetabulum and the tuber coxae was 41.00 mm, and the average distance between the mid-acetabulum and the ischial tuberosity (tuber ischiadicum) was 26.00 mm. The average sagittal length and width of the foramen obturatum were 20.00 mm and 14.00 mm, respectively. Sexual differences were observed in the Os coxae. There were three trochanters on the femur while the fovea capitis was absent and replaced by an indistinct depression. The tibia and fibula were almost fused in the distal half before dividing distally to form the medial and lateral malleolus. The tibia has a distal depression not reported in literature. There were 8 tarsal bones and the pedis was complete with five digits.

Key words: *Cricetomys gambianus* Waterhouse – Macroscopic anatomy – Pelvic limb – Bones

INTRODUCTION

African giant rats (*Cricetomys gambianus* Waterhouse) belong to the family Cricetidae and order Rodentia. It is a wild rat widely distributed in Sub Saharan Africa (Rosevear, 1969).These animals inhabit a variety of habitats, ranging from arid areas to temperate areas, but need some form of shelter to survive (Ajayi, 1977a; 1977b). Their value as a delicacy among rural populations and increasing demand for animal protein, among other considerations make this rodent a good candidate for domestication (Ajayi, 1974). These animals use their extremities for burrowing and shoveling. The literature about the macro anatomical features of the skeletal system in African giant rat is meager. Many macro-anatomical investigations have been performed on the skeletal system of mammals, including the rabbit, the guinea pig (Özkan et al., 1997), the mink (Dursun and Tipirdamaz,

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1989), the badger (Dinç, 2001; Hidaka et al., 1998), the porcupine (Yilmaz, 1998), the hedgehog (Özkan, 2005), and the mole rat (Özkan et. al., 2007), but the skeletal system of African giant rats has not been thoroughly investigated. Therefore, the aim of the present study was to investigate the skeletal structure of the pelvic limb in the African giant rat with a view to providing basic information that could be useful in further orthopaedic research.

Materials and methods

The bones examined were obtained from 7 adult African giant rats (4 males and 3 females) caught in the wild. They were euthanized using chloroform inhalation; the limbs were dissected away from the supporting tissues using a scalpel blade and holder. Hot water maceration was carried out based on the methods of Onar (2001), Özkan (2002) and Olopade (2006) to remove muscles, ligaments and tendons for clear gross observations of the bony parts. Morphological descriptions were documented and measurements were taken using metric instruments.

Results

Os coxae (Fig. 1)

The tuber coxae were observed on the wing of the ilium where it grooved medially. From the tuber sacrale, the sharp iliac spine ran caudally until it terminated in a hook-like projection. The iliosacral surface bore the articular part ventromedial to the caudal half of the ilium. A distinct muscular tubercle was observed cranial to the acetabulum, having a less prominent gluteal line. There was a prominent iliopectineal eminence, while the ischiadic spine was not well developed. The great sciatic notch (incisura ischiadica major) was deeper and wider than the lesser sciatic notch (incisura ischiadica minor). The 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 connecting the two caudal branches of the pubic bones (ramus caudalis ossis pubis) and was fused in all the rats observed.

The symphysis pelvis was longer in males than in females and terminated cranially at level of sacral 4-5 (Coccygeal 1-2 in females). The male pelvis also appeared larger. The average distance between the mid acetabulum and tuber coxae was 41.00 mm, and the average distance between the mid acetabulum and ischial tuberosity (tuber ischiadicum) was 26.00 mm. The average sagittal length and width of the foramen obturatum were 20.00 mm and 14.00 mm, respectively.

Femur (Fig. 2)

The head of the femur was supported by a distinct neck. Laterally, the greater trochanter arose dorsal to the level of the head. The fovea capitis was absent but was replaced by an indistinct depression. There were three trochanters on the femur: the greater trochanter (trochanter major), the lesser trochanter (trochanter minor) and a prominent trochanteric tertius, which formed a solid crest running from the greater trochanter to the mid-femoral shaft. The

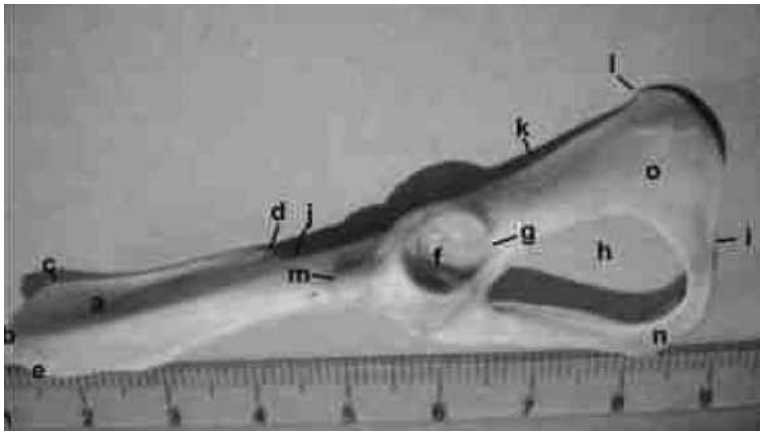

Figure 1. Ventrolateral aspect of the *left* ossa coxarum of the African giant rat (*Cricetomys gambianus* Waterhouse). a) wing of the ilium, b) tuber coxae, c) dorsocranial iliac spine, d) dorsocaudal iliac spine, e) tuber sacrale, f) acetabulum, g) acetabular notch, h) obturator foramen, i) a small notch on the caudal aspect of the ischium, j) major ischiadic notch, k) minor ischiadic notch l) tuber ischiadicum, m) muscular tubercle, n) pubic bone, o) ischium.

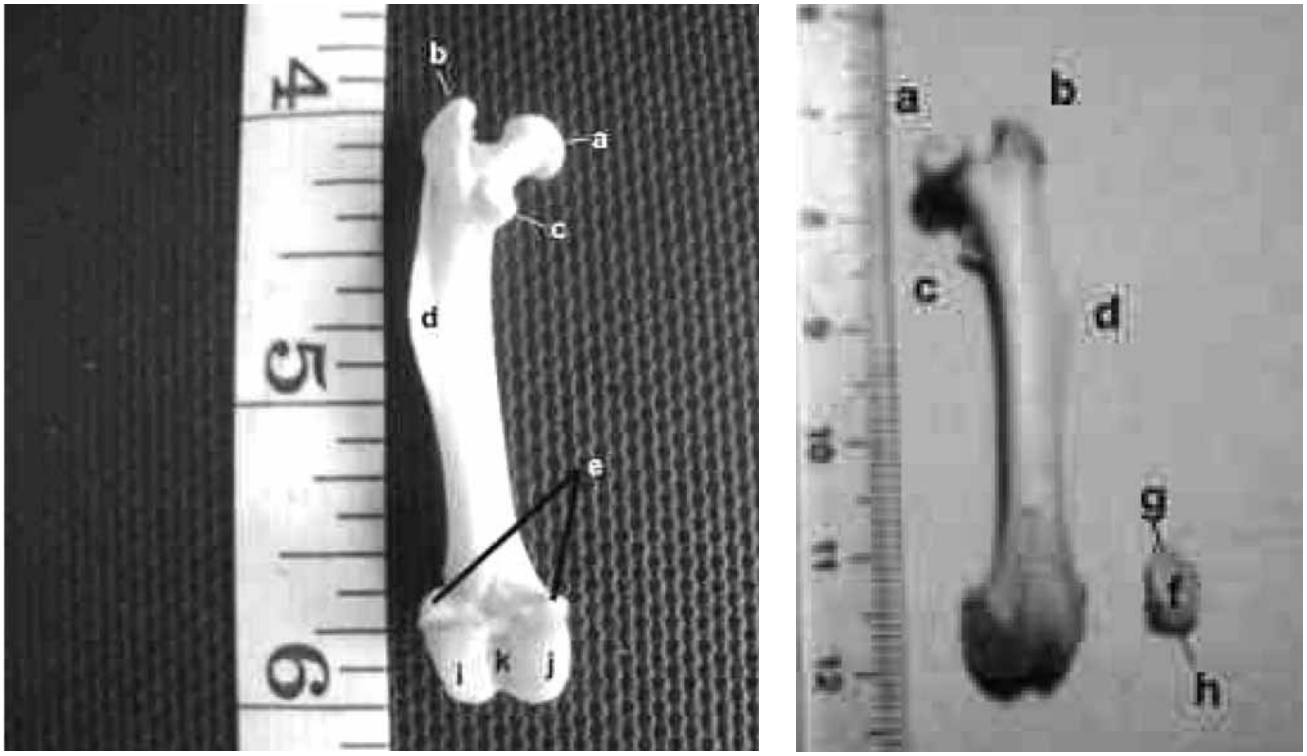

Figure 2. A: the caudal surface of the femur. **B:** cranial surface of the femur and the patella.
a) head, b) trochanter major, c) trochanter minor, d) trochanter tertius, e) Sessamoid bones of Vesal, f) patella, g) apex patellae, h) basis patellae, i) lateral condyle, j) medial condyle, k) intercondylar fossa.

Figure 3. Tibia and fibula bones of the African giant rats. a) tibia, b) fibula, c) tibial tuberosity, d) distal depression in the tibia bone, e) tendon overlying the tibial depression.

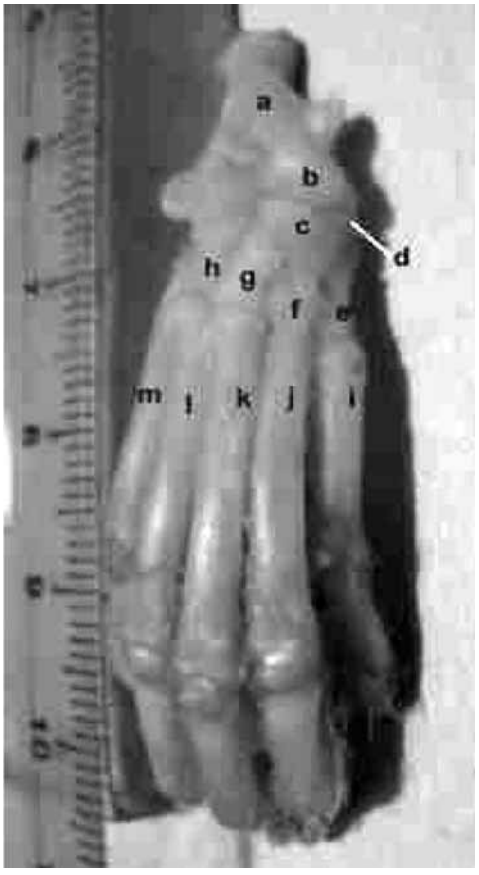

Figure 4. Dorsal aspect of the tarsal and metatarsal bones of the African giant rat. a) calcaneus, b) talus, c) distal central, d) tibial tarsal, e) tarsal I, f) tarsal II, g) tarsal III, h) tarsal IV, i) metatarsal I, j) metatarsal II, k) metatarsal III, l) metatarsal IV, m) metatarsal V.

trochanteric fossa (fossa trochanterica) was wide and deep. The trochanteric ridge (crista intertrochanterica) was present between the lesser and the greater trochanters. The lateral condyle, medial condyle and lateral epicondyle as well as the medial epicondyle, intercondylar line and fossa were prominent. Caudal to each condlyle were two sessamoid bones (Sessamoid bones of Vesal) embedded in the tendons of origin of the gastrocnemius muscle. The cranial surface of the patella was convex while the apex patella was pointed.

Tibia and Fibula (Fig. 3)

The tibia and fibula were separated by a wide cleft at their proximal two-thirds but were fused in the distal third. They diverged distally to form the medial and lateral malleolus. The distal portion of the tibia bore a distinct depression, which in the fresh state was crossed by a thick tendon, turning it into a foramen.

Ossa tarsi (Fig. 4)

There were 8 tarsal bones. The proximal row consisted of the talus and calcaneus bones, and the tibial tarsal bone occurred medial to the talus while the central tarsal bone was in the distal part of the talus. 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: I>IV>III>II.

Ossa metatarsalia (Fig. 4)

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: III>IV>II>V>I. There were two plantar located sesamoid bones in pairs at each of the metatarsophalangeal joints.

Ossa digitorum pedis (Fig. 4)

There were two phalanges in the first digit and the other four digits had three phalanges. The distal phalanges were arched and pointed to accommodate the curved nails.

Discussion

The symphysis was fused in all rats studied. In the hedgehog, it is formed by an interpubic ligament (Lessertisseur and Saban, 1967; Özkan, 2002). The presence of a large obturator foramen bounded by the pubis and ischium is characteristic of mammals (Weichert, 1970). In the African giant rat, this foramen was also large and had an almost hemicyclic form.

Romer (1970) reported that the fourth trochanter in the femur is absent in mammals, while the third trochanter is particularly well developed in Erinaceus and Centetes (Saunders and Manton, 1969). In this study, the three trochanters on the femur of African giant rats were well developed while the fovea capitis was absent and reduced to an indistinct depression. Yilmaz et al. (1999) reported that the fovea capitis on the femoral head (caput ossis femoris) and the supracondylar fossa are absent in porcupines. The fibula of the African giant rat is a slender bone and is usually separated from the tibia; it is, however, fused at the distal end in Erinaceus (Saunders and Manton, 1969), and in porcupines the fibula is fused with the tibia at the proximal portion (Yilmaz et al., 1999). The depression on the distal portion of the tibia has not been reported in literature and the authors propose the term *tibial depression of Olude.*

The tarsal bones were typical, as in the Wistar rat (Hebel and Stromberg, 1976). The medial tibial tarsal bone has not been reported in the hedgehog (Özkan, 2002). In some species of the Erinaceidae family the pedis comprises four digits (Kuru, 1999). However, in our study, the pedis was complete with all five digits.

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