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Full Length Research Paper

Morphological studies of the appendicular skeleton of the African giant pouched rat (*Cricetomys gambianus)* part (ii) pelvic limb

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The pelvic limb of the African giant pouched rat (*Cricetomys gambianus)* was studied using 12 adult rats of both sexes. Characteristics of the bones were studied by gross observation after preparation. Measurement of different segments of the Pelvic limb (articulated) was also taken. The bones of the pelvic limb were found to be generally similar in both structure and number to other rodent species that has been studied. Variation came only in the size of the bones and in the number of coccygeal bones. The ossa coxarum came (check) together through the pubic symphysis. The pelvis also presented a relatively wide obturator foramen. The femur presented three trochanters (major, minor and tertious) and fabellae on the medial and lateral condyles. The fibula runs down the length of the tibia, with an attachment proximally and fusion at the distal third thereby presenting an extensive interosseous space. The pes presented 8 tarsal and 5 metatarsal bones. Each of the metatarsal presented 3 phalanges except the first metatarsal which presented 2 phalanges. The number of bones on each pelvic limb was found to be 34 plus 19 sessamoid bones making a total number of 106 bones in the two hind limbs of this rat.

Key words: African giant rat, pelvic limb, pes.

INTRODUCTION

The African giant pouched rat (*Cricetomys gambianus)* belonged to the order Rodentia, family Muridae and subfamily Cricetidae (Perry et al., 2006). It is a wild rat wildly distributed in Sub-Saharan Africa (Rosevear, 1969). They inhabit a variety of habitats, but prefer a burrow being a nocturnal animal (Nowak, 1997). They made use of their appendages for burrowing and shovelling (Happold, 1987). Their teeth and forepaws are used to loosen substrate and their hind feet to push excavated soil away (Ewer, 1967). It can also stand on its hind limbs, raising the forelimb from the ground. This animal is currently being domesticated in Nigeria (Ajayi et al., 1978). This is not unconnected with its value as a delicacy among rural populations as well as the threat posed by the excessive and uncontrolled decimation of this rat for consumption (Ajayi, 1975). The rat has also been found to be useful in sniffing out landmines on fields and tuberculosis in infected patients (Moth, 2004; Mekee, 2003).

Broadly speaking, the skeleton of any animal present two sets of characters, Morphological/ structural character which is connected with an animal's position in the class of vertebrates and teleological or secondary character which is connected with an animal's habit or mode of living acquired during the development of the animal species (Peter and Roger, 1980). Olude et al. (2009) were able to do some preliminary work on the appendicular skeleton of this rat without an elaborate exposition of the numerical strength, pictoral clarity and thorough identification of the specific bones. The aim of this study therefore, was to bring to a proper perspective

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Table 1. Number of bones that make up the pelvic limb of the African giant rat.

Bone	Number per limb
Oscoxae	1
Femur	1
Patella	1
Fabellar	2
Tibia	1
Fibula	1
Tarsals	8
Metatarsal	5
1st Phalanx	5
2nd Phalanx	4
3rd Phalanx	5
Sessamoid bones	19
Total per limb	53

*Total bones on both limbs = 53 x 2= 106 which is 36% of the body bones.

Table 2. Lengths of Pes and pelvic limb (articulated) of the African giant rat.

Skeletal parts	Length	
	Range (cm)	Mean (cm)
Pes	6.3-7.0	6.5±0.2
Pelvic limb	17.5-19.0	18.3±0.3

the gross anatomical features as well as the number of bones that made up the appendicular skeleton of this rat. This study will add to the body of information building up on this potentially important wild rat.

MATERIALS AND METHODS

A total of 12 adult African giant pouched rats (*Cricetomys gambianus*) (six males and six females) were used for this study. These rats were captured alive in the wild around Samaru villages in Zaria, Kaduna state, Nigeria, using metal cage traps. They were then housed in customized laboratory rat cages in the Department of Veterinary Anatomy, Faculty of Veterinary Medicine, Ahmadu Bello University, Zaria, Nigeria and fed with fruits, groundnut pellets and water given *ad libitum* for a week prior to commencement of study.

The rats were euthanized using gaseous chloroform in a confined container and weighed using a balance (EMPEROR model p.1210) with a sensitivity of 0.1 g. They were then dissected to remove skin, thoracic, abdominal and pelvic contents. The muscles were carefully dissected and teased from the bones to leave the bones with minimal soft tissue attachments, then submerged into different plastic buckets containing 3% sodium hydroxide. The plastic buckets were then covered and placed under the sun and checked every 30 minutes to carefully remove the bones freed of flesh. The bones were then rinsed in running water and then air dried. Photographs of the long bones were taken individually while that of the pes was taken together. The total number of bones recovered were counted and recorded. Measurements of pes and pelvic limb (articulated) were taken.

RESULTS

The pelvic limb bones of the African giant pouched rat (*Cricetomys gambianus*) were found to be generally similar to other members of the rat family with some differences in the morphology and number of some of the bones.

Table 1 showed the number of bones on one of the pelvic limb as well as the total for the two limbs and percentage of the pelvic limb in relation to the skeleton. The pelvic limb has a total of 106 bones which form 36% of the total number of bones that make up the skeleton of this species of rat.

Table 2 presented the length of the pelvic limb (articulated). No sexual dimorphism was observed in the length of the pelvic limb. However, the weights of the rats positively affect the size of each bone.

Pelvic girdle

Figure 1 showed the pelvis of the African giant rat where the sacrum had attachment with the ilium and the ossacoxarum presented only pubic symphysis. Figure 2 presented an oscoxa with relatively large obturator foramen formed by the shaft of the ischium and ramus of the pubis and prominent superior and inferior ventral

Figure 1. Pelvis - dorsal view. 1, Wing of ilium; 2, Point of sacrum articulaton with ossacoxarum; 3, Acetabulum; 4, Shaft of ilium; 5, Shaft of ischium; 6, 6', Ascending and descending ramus of pubis; 7, Ischial tuber; 8, Pubis symphysis.

Figure 2. Right OS COXAE - lateral view. 1, Crest of ilium; 2, Superior ventral spine; 3, Nutrient foramen; 4, Inferior ventral spine; 5, Iliopectineal eminence; 6, Acetabular surface; 7, Acetabulum; 8, Acetabula notch; 9, Shaft of ischium; 10, Obturator foramen; 11, 11', Ascending and descending ramus of pubis; 12, Angle of pubis; 13, Ramus of ischium; 14, Ischial tuber.

spines. The ilium fuses distally with the proximal aspects of the ischium and pubis to form the acetabulum for articulation with the head of the femur. The ascending ramus of the pubis meets with the ileopectinal eminence while the descending ramus meets the ramus of the ischium. The ischium presented caudolaterally the ischial tuber.

Femur

Figure 3 present a prominent head with defined neck. It also presented three trochanters (greater trochanter, lesser trochanter and trochanter tertious). The shaft presented the aspera line connecting the greater trochanter to the trochanter tertious which is also on the lateral aspect of the shaft. The distal extremity presented the internal and external condylar ridge, articular surface for fabella articulation, intercondyloid fossa, medial and lateral condyle all located caudally. The trochlea for articulation with the patella is on the cranial aspect.

Tibia and Fibula

Figure 4 showed the fibula as a slender bone running down the length of tibia with proximal head attachment and distal third fusion. This arrangement of the bones presented an extensive interrosseous space between them. The distal ends of the two bones ended in medial and lateral malleolus respectively.

Tarsal bones

Figure 5a and 5b presented 8 tarsal arranged in two rows of four proximal and four distal. The calcaneus and 3rd tarsal became conspicuous on the plantar aspect.

Figure 3. Left femur - cranial (R) and caudal (L) views. 1, Greater trochanter; 2, Trochanteric crest; 3, Head; 4, Neck; 5, Intertrochanteric fossa; 6, Lesser trochanter; 7, Aspera line; 8, Trochanter tertious 9, Internal condylar ridge; 10, External condylar ridge; 11, Articular surface for lateral labella; 12, Articular surface for medial fabella; 13, Intercondyloid fossa; 14, lateral condyle; 15, Medial condyle; 16, Articular surface for Patella.

Figure 4. Tibia and fibula - cranial (R) and caudal (L) views. 1, Lateral condyle; 2, Medial condyle; 3, Head of fibula; 4, Interosseus crest; 5, Dorso-medial ridge; 6, Interosseus space; 7, Medial malleolus; 8, Lateral malleolus; 9, Intercondyloid fossa; 10, Tuberosity; 11, Crest.

Metatarsal and phalangeal bones

Figure 6 presented 5 metatarsal bones with each of the metatarsal having 3 phalanges except the first digit which has 2 phalanges. The distal phalanx showed appointed curved end.

DISCUSSION AND CONCLUSION

The pelvic limb study of the African giant pouched rat *(Cricetomys gambianus*) revealed a lot of similarity and some differences in the skeletal morphology with other species of rodents reported in literature (Greene, 1963; Ozkan, 2007; Yilmaz et al., 1999).The presence of three trochanters on the femur of this rat agreed with what was reported in Erinaceus and Centetes by Saunders and Manton (1969). Romer (1970) also reported that mammals generally lacked the fourth trochanter. The presence of the fabella on both the medial and lateral condyles of the femur was similar to what was reported in canines (Sisson and Grossman 1975).

The fibula of the African giant pouched rat has proximal attachment and distal 3rd fusion with the tibia. This observation was contrary to Olude et al. (2009) who reported that the two bones are separated but agreed with and similar to what Saunders and Manton (1969) reported in Erinaceus where the two bones were fused distally. In porcupines *(Hystrix cristata*) the two bones got fused proximally (Yilmaz et al., 1999). That the fibula has the same length with the tibia is also characteristic of rodents (Rudolf, 1969) except in Beavers where they are in close contact distally (ABC Encyclopedia Britannica 2000). The tarsal bones were typical of the other rodent species such as the Wistar rat (Hebel and Stromberg, 1976), but differed from that of Hedgehog where the medial tibial tarsal was reported absent (Ozkan, 2002).The sessamoid bones are also located on the plantar surface. This arrangement also applied to all rodents except in the beaver which has web like digits and the guinea pig which has only 3 digits (Animal corner 2007).

The observation of complete number of digits (that is 5) agreed with what was reported in Wistar rat (Hebel and

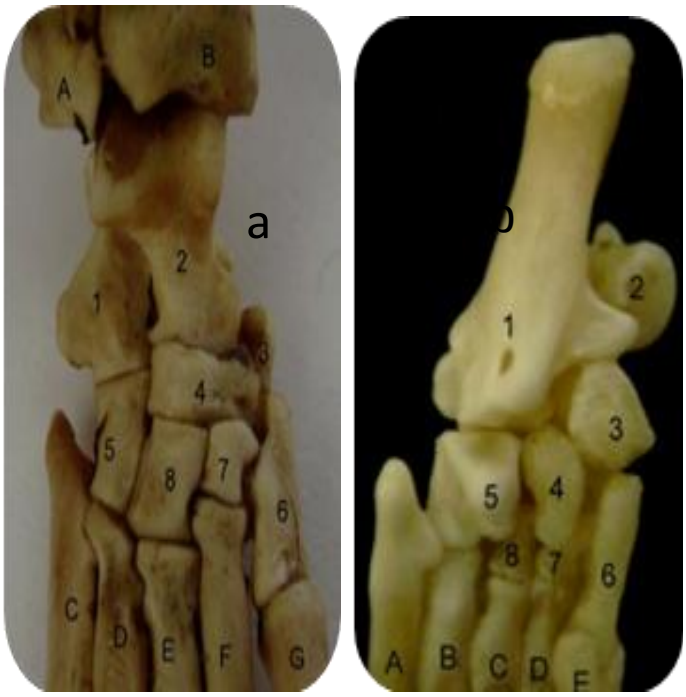

Figure 5. a) Tarsals - dorsal view. A-Lateral malleollus; B-Medial malleolus; C-G, Metatarsals; 1, Calcaneus; 2, Talus; 3, Tibiale; 4, Navicular; 5, Cuboid; 6, First cuneiform; 7, Second cuneiform; 8, Third cuneiform and b) Tarsals - volar view. 8 Tarsal bones (4 proximal and 4 distal rows) with 5 metatarsals.

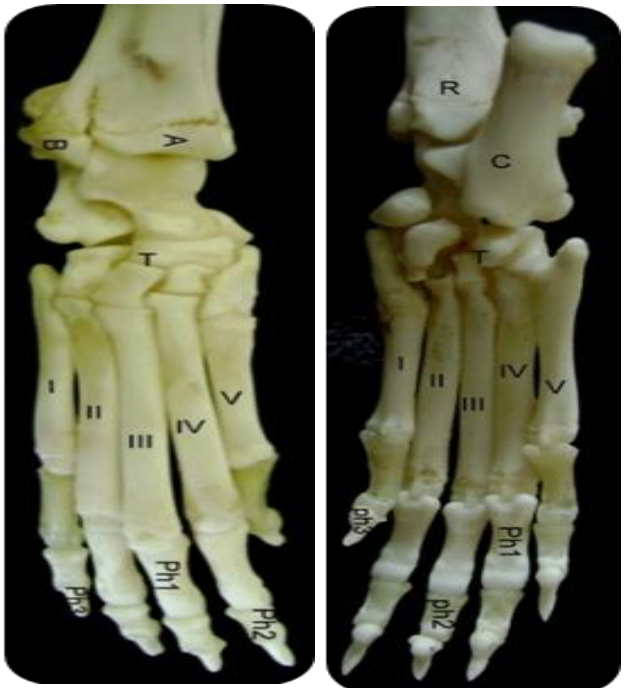

Figure 6. PES - dorsal (L) and plantar views. A-Medial malleolus; B-Lateral malleolus; C-Calcaneus; R-Tibia; T-Tarsus; I to V, Metatarsals; Ph1, Phalanx; Ph2, Phalanx; Ph3, Phalanx.

Stromberg, 1976); laboratory rat (Rudolf and Stromberg, 1976); Rabbit (Ozkan et al., 1997); Mink (*Mustelavison*) (Dursum and Tipidamaz, 1989); Porcupine*(Hystrixcristata*) (Yilmaz et al., 1998); Badger (*Melesmeles*) (Dinc, 2001) and Mole rat (*Spalaxleucodon*Nordmann) (Ozkan, 2007). Kuru (1999) however, reported that in some species of the Ernaceidae family the pedis comprises four digits. The guinea pig on the other hand has three digits only (Animal Corner, 2007). The shape of the distal phalanx as observed in this study was attributable to the rat's burrowing habit (Olude et al., 2009). This study was an addition to the body of information that is gradually building up to enhance the domestication of this valuable Rat.

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