



RESEARCH PAPER

Gross anatomical studies on the femur, tibio-tarsus and fibula of emu (*Dromaius novaehollandiae*)

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Abstract : The study was conducted on three adult emu birds of 2-3 years of age. The femur was a relatively short, but thick bone, measuring about 23 ± 0.43 cm in length. The fovea capitis was absent. The large trochanter major was at the same level as the head. A large pneumatic foramen was present on the caudal surface of the femur, medioventrally to the trochanter major. Distal extremity of femur showed a trochlea anteriorly and two condyles posteriorly. The tibio-tarsus was longest and formed by the fusion of the tibia and proximal row of tarsal bones. The average length was 43 ± 0.68 cm, was almost twice as long as the femur. The cranial part of the proximal end was greatly expanded which formed a large ridge, the proximal end of which was divided to form lateral and medial cranial ridges. The distal end showed lateral and medial condyles cranially and a trochlea with symmetrical ridges caudally. The fibula was shorter than the tibia, measuring about 29 ± 0.23 cm in length with a prominent head.

Key Words : Femur, Tibio-tarsus, Fibula, Emu, Gross morphology

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INTRODUCTION

Emu is the largest bipedal bird, native to Australia and is the second largest extant bird in the world by height, after ostrich. They are totally marketable birds and their feathers, eggs and toenails are being used as creative jewelry accents for fashion items and uniquely in craft goods such as backgrounds for fine artistic paintings. Therefore, emu farming is considered as a profitable in agriculture sector. The emu has heavily muscled pelvic limb allowing high speed running and defense against the enemies. The pelvic limbs are prone to fracture due to heavy weight, height, running and kicking habits. The present study will provide detail

knowledge of femur, tibio-tarsus and fibula for better treatment and ailment of clinical conditions. Deeming (1999) described the detailed anatomy of pelvic limb of ostrich but investigation on the emu is meager. Keeping the above view in fact the present study has been designed.

MATERIAL AND METHODS

Carcasses of three adult emu of 2-3 years of age were collected from Department of Veterinary Pathology, Ranchi Veterinary College, Kanke, Ranchi after postmortem examination. After maceration and proper cleaning (Raghvan, 1964) the femur, tibio-tarsus and fibula

were used for recording various morphological characterization and comparison with other domestic birds.

RESULTS AND DISCUSSION

The femur was a relatively short, but thick bone, measuring about 23 ± 0.43 cm in length directed downward and forward. However, Shanthi Lakshmi *et al.* (2007) reported that the average length of femur was 20 cm in emu. Proximal extremity consisted of a head and neck and trochanter major (Fig.1). The medially placed head of the femur was rounded for articulation with the acetabulum of os-coxae. The fovea capitis was absent in femur. This observation was similar to the findings of Shanthi Lakshmi *et al.* (2007) in emu. Whereas, Nickel *et al.* (1977) described that fovea capitis was present in the head of femur in domestic birds. The large trochanter major (Fig.1) was at the same level as the head and had an elongated articular surface along its dorsomedial border for articulation with the antetrochanter of the ilium. Similar findings were reported by Deeming (1999) in ostrich and Shanthi Lakshmi *et al.* (2007) in emu. The trochanter major was separated from the head by a shallow groove and showed rough areas laterally for muscular attachments. A large pneumatic foramen (Fig.2) was present on the caudal surface of the femur, medioventrally to the trochanter major. This observation was in accordance with the findings of Brett and Hopkins (1991) in emu, ostrich and rhea, Deeming (1999) in ostrich and Shanthi Lakshmi *et al.* (2007) in emu. The sharp cranial border of the trochanter major continued distally on the anterior surface of the shaft as faint bony ridge. Nickel *et al.* (2007) in domestic birds and Shanthi Lakshmi *et al.* (2007) in emu described presence of similar ridge. The ridge was continuous with the lateral ridge of trochlea (Fig.1) as reported by Shanthi Lakshmi *et al.* (2007) in emu. The shaft of the femur was slightly curved medially. Similar finding was reported by Shanthi Lakshmi *et al.* (2007) in emu. It showed four surfaces. Lateral surface was convex from side to side and smooth. Medial surface was also convex and smooth. Anterior surface was crossed by a faint ridge which continued from cranial border of trochanter major and ended on lateral trochlear ridge. Posterior surface showed a faint ridge extended from neck to medial condyle which had trochanter minor (Fig. 2) medially as a small protuberance at its dorsal third. Whereas, Shanthi Lakshmi *et al.* (2007) in emu reported that the trochanter minor was on the

medial aspect of the shaft away from the neck. However, Nickel *et al.* (1977) described that trochanter minor was present under the neck in domestic birds. A faint ridge also extended from thick posterior border of trochanter major which fused with preceding ridge. Distal extremity of femur was comparatively larger which showed a trochlea anteriorly and two condyles posteriorly (Fig.1 and 2). The lateral trochlear ridge was large and higher than medial ridge while the lateral condyle was larger and lower than medial condyle. The lateral condyle showed a triangular articular area for articulation with head of fibula. Unlike fowl the lateral surface of the lateral condyle showed a large tubercle (Fig.1 and 2). These findings were totally in agreement with the descriptions of Shanthi Lakshmi *et al.* (2007) in emu. Patella was absent as reported by Shanthi Lakshmi *et al.* (2007) in emu.

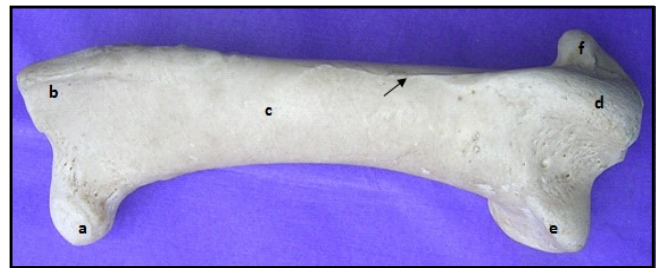


Fig.1: Anterior view of femur showing (a) head, (b) trochanter major, (c) shaft, (d) lateral ridge of trochlea, (e) medial ridge of trochlea, (f) tubercle on lateral condyle and (→) ridge from trochanter major ending in lateral ridge of trochlea



Fig.2: Posterior view of femur showing (a) lateral condyle, (b) medial condyle, (c) head, (d) trochanter major, (e) shaft, (→) pneumatic foramen, (→) trochanter minor and (→) tubercle on lateral condyle

The tibio-tarsus (Fig.3) was longest and formed by the fusion of the tibia and proximal row of tarsal bones as reported by Feduccia (1975) in fowl, Nickel *et al.* (1977) in domestic birds and Jagapathi Ramayya *et al.* (2007) and in emu. The average length was 43 ± 0.68 cm, was almost twice as long as the femur. This finding was

totally in accordance to the observations of Nickel *et al.* (1977) in duck and goose, Jagapathi Ramayya *et al.* (2007) in emu and Deeming (1999) in ostrich. The bone was comprised of a proximal extremity, shaft and distal extremity (Fig.3). Its proximal end was wide and flat showed lateral and medial condyles for articulation with the condyles of the femur as reported in ostrich by Deeming (1999). However, Jagapathi Ramayya *et al.* (2007) reported that condyles were indistinct in emu. Lateral face of the lateral condyle articulated with the head of fibula (Fig.3). The cranial part of the proximal end was greatly expanded which formed a large ridge, the proximal end of which was divided to form lateral and medial cranial ridges. The lateral ridge was lower and tuberos. The medial ridge was sharp and curved laterally (Fig.3). Similar findings were described by Nickel *et al.* (1977) in domestic birds, Deeming (1999) in ostrich and Jagapathi Ramayya *et al.* (2007) in emu. The shaft was straight and directed vertically downward which showed three surfaces three borders. The caudal surface of the tibiotarsal shaft was flattened, the cranial surface was rounded. The medial surface was flat and smooth. The lateral border showed a narrow rough area for the attachment of fibula (Fig.3) as reported by Jagapathi Ramayya *et al.* (2007) in emu. The distal end was expanded to form lateral and medial condyles cranially and a trochlea with symmetrical ridges caudally (Fig.3). The condyles were separated by a wide and shallow groove. These observations were similar to the descriptions of Chamberlain (1943) in fowl. The fibula (Fig.4) was shorter than the tibia, measuring about 29 ± 0.23 cm in length. As stated by Jagapathi Ramayya *et al.* (2007) in emu, the proximal, expanded head of the fibula (Fig.4) was attached to the lateral condyle of the tibiotarsus and distal part of lateral condyle of the femur. The greatest width of head was 3.70 ± 0.12 cm. and body tapered distally upto $3/4^{\text{th}}$ portion of tibio-tarsus. Brett and Hopkins (1991) and Jagapathi Ramayya *et al.* (2007) also reported that the fibula extended $3/4^{\text{th}}$ length of tibio-tarsus. The body of fibula (Fig.4) was rod like in shape which showed rough area in the middle of medial face for articulation with corresponding rough area of lateral face of shaft of tibio-tarsus. Distal to this attachment the body tapered to a free point with incomplete articulation with tibio-tarsus. These findings were in accordance with the descriptions of Jagapathi Ramayya *et al.* (2007) in emu.



Fig.3: Lateral view of tibio-tarsus showing (a) lateral condyle, (b) area for head of fibula, (c) lateral ridge, (d) medial ridge, (e) rough area for body of fibula, (f) shaft, (g) lateral condyle, (h) lateral trochlear ridge and (→) depression on distal extremity



Fig.4: Medial view of fibula showing (a) head and (b) body

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