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Morphology of Femur, Tibiotarsus and Fibula of Local Hill Fowl of Uttarakhand

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Abstract

This study was conducted on femur, tibiotarsus and fibula from six adult local hill fowl of Uttarakhand. The femur of the local hill fowl was a long cylindrical bone consisted of a shaft and two extremities. The shaft was curved and twisted in appearance. The proximal extremity had spherical head separated from shaft by neck. The trochanter minor was indistinct. The distal extremity had posteriorly medial and lateral condyles and anteriorly trochlea. The tibiotarsus was the longest bone among the leg bones. The shaft was anteriorly curved in its proximal half and posteriorly curved in its distal half. The fibular crest was well developed and on posterior-lateral aspect of it's mid-shaft very small nutrient foramen was observed. The cnemial crest was originates from cranial border of transverse ridge and extended ventro-medially. The distal extremity showed large medial and small lateral condyles separated by the deep intercondyler fossa. The fibula was a reduced long bone with distinct head and rudimentary shaft. The shaft of fibula extended up to the distal one third of the shaft of tibiotarsus.

Keywords: Morphology, Femur, Fibula,Local hill fowl, Tibiotarsus

Introduction

Local hill fowl is an indigenous fowl of Kumaon region of uttarakhand, which is considered to be descended from the Red jungle fowl.These birds adapt to adverse environment like poor housing, poor management and poor feeding (Kaur *et al.,* 2010). The femur, tibiotarsus and fibula are major part of the pelvic limb in birds, which is more important because of their bipedal standing and walking when compared with mammals. The femur articulates with synsacrum dorsally to form hip joint and distally with tibiotarsus to form stifle joint. Since its evolution is from jungle fowl, so this study was conducted to elucidate the gross morphological features peculiar to bones of local hill fowl,.

Materials and methods

This study was conducted on femur, tibiotarsus and fibula from carcass of six adult local hill fowl. The bones were collected and their muscles were removed manually and then the bones were boiled in domestic pressure cooker at 100°C for three hours. The muscles and cartilage were removed and the bones were separated by using blunt scalpel without damaging the periosteum. Afterwards, the disarticulated bones were boiled with 10 % bleaching powder solution in domestic pressure cooker for thirty minutes to remove the minor tissue debris. The dried bones were

immersed in acetone solution for overnight to remove the fat (Tompsett, 1970). Finally the bones were studied for its peculiar gross anatomical features and results were recorded.

Results and Discussion

The femur of the local hill fowl was long cylindrical bone consisted of a shaft and two extremities (Sreeranjini *et al.*, 2013). The shaft was long, wider at proximal and distal end and narrow in mid-shaft, slightly curved and twisted in appearance (Figure 1). It had four surfaces i.e anterior, posterior, medial and lateral surfaces. The anterior surface was smooth, having a muscular line called linea aspera which was running disto-proximally from medial condyle to trochanter major. The posterior surface was rough, wider having two linea aspera running from each condyles upto 2/3rd of the shaft. The lateral surface was smooth distally and continuous with anterior surface proximally. At the level of mid-shaft between those two linea aspera small nutrient foramen was observed. The medial surface was rough wider distally and continuous with anterior surface proximally. The proximal extremity was smaller than distal extremity.

Fig.1: Left and Right Femur of Local hill fowl- Anterior view**.** TM-Trochanter major, H-Head, N-Neck, S-Shaft, MC- Medial condyle and LC- Local condyle.

The proximal extremity was a distinct, spherical head situated on the medial aspect but fovea capitis was not evident like in emu (Shanthilakshmi *et al.*, 2007) and unlike in other domestic birds (Nickel *et at.,* 1977). The head was separated from shaft by a distinct neck as in Columbia livia (Cracraft, 1971). The long axis of the neck was parallel to the long axis of the shaft. The trochanter minor was indistinct situated just below the neck and trochanter major extended above the level of the head with a facet for articulation of antitrochanter of ilium. Proximal extremity was convex, rough, bearing number of small ridges and furrows for muscular attachment at lateral side. The distal extremity consisted of medial and lateral condyles. The lateral condyle was larger thanmedial condyle as reported by Shanthilakshmi *et al*. (2007) in emu. In anterior surface between condyles deep trochlea was present for articulation with patella. There was a distinct groove on lateral condyle. Caudolateral part of lateral condyle also had a facet for articulation with fibula.

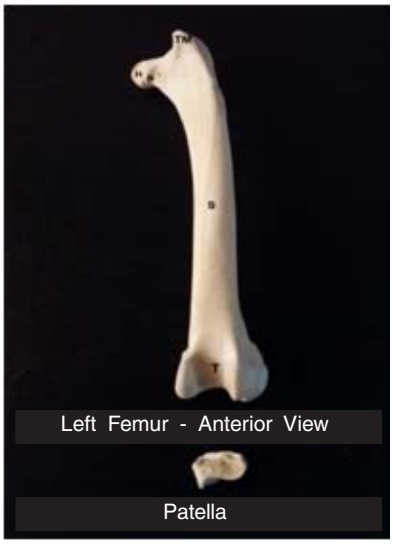

Figure 2: Femur and Patella of Local hill fowl. TM-Trochanter Major, H-Head, N-Neck, S-Shaft and T-Trochlea.

In the present study, the patella is a small, ovoid sesamoid bone (Figure 2), which glides over the anterior distal extremity of femoral trochlea as observed by Nickel *et al.* (1977).

The tibiotarsus was the longest of the leg bones. It measured about one third time longer than femur as like that in fowl and pigeon (Nickel *et al*., 1977). The tibiotarsus, formed by the fusion of tibia and proximal row of tarsal bones and consisted a long shaft and two extremities (Figure 3). The shaft was slight anteriorly curved in its proximal half and posteriorly curved in its distal half. Just below the proximal extremity, the lateral surface of the shaft furnished a 2 cm long fibular crest for attachment of the fibula. The fibular crest was well developed unlike that of fowl and quail (Mc Lelland, 1990 and Fitzgerald, 1969). Just behind the fibular crest on posterio-lateral aspect of mid-shaft very small nutrient foramen was observed. The medial surface of the tibiotarsus was smooth in its entire length. Dorsal surface of the shaft near its distal extremity furnished shallow extensor canal for the passage of the tendon of extensor muscles of the toes. The same was reported in

fowl (Mc Lelland, 1990) and in coturnix quail (Fitzgerald, 1969). Proximal to the extensor canal and on the bony bridge, a nutrient foramen was noticed in peahen by Sreeranjini *et al*. (2013) which was not observed in local hill fowl.

The proximal extremity was larger with larger medial and smaller lateral condyles separated by a ridge as in fowl and coturnix quail. The condyles articulated with menisci and condyles of femur. The lateral border of lateral condyle furnished a facet for articulation with the head of fibula. The convexities of the condyles along with menisci provided an extensive undulated area that permits some degree of rotation in addition to flexion and extension of the stifle (Fitzgerald, 1969). The cranial border of the articular surface presented a transverse ridge for attachment of the broad patellar ligament as in coturnix quail. From the centre of the ridge, the cnemial crest extended ventrally and medially. The crest was short and stump compared to that of the domestic fowl. The cnemial crest provides attachment for the main extensor muscle of the knee joint (Mc Lelland, 1990). In fowl, the cnemial crest faded on the shaft, but in peahen it ended abruptly in the proximal extremity itself. Al-Sadi (2012) reported the presence of two cnemial crests- cranial larger and caudal smaller in Turkey.

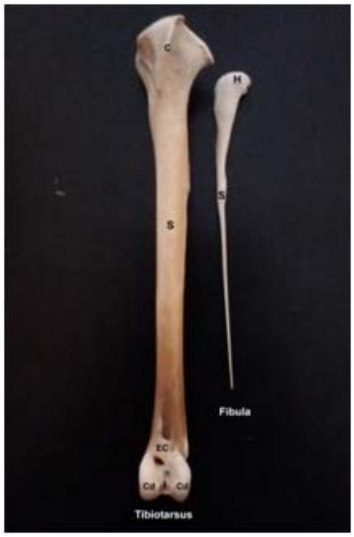

Fig. 3: Tibiotarsus and fibula of Local hill fowl.C-Cnemial crest, S- Shaft, H- Head, EC-Extensor canal and Cd-Condyle.

The distal extremity of local hill fowl showed large medial and small lateral condyles separated by the deep intercondyloid fossa. This is contrary to Sreeranjini *et al*. (2013) in peahen, where large lateral and small medial condyles were observed. The extensor canal was seen immediately proximal to the condyles. The condyles continued caudally to constitute a shallow wide grooved trochlea. On both sides of the distal extremity, depressions for the attachments of collateral ligaments were present as in fowl (Getty, 1975). The extensive articular surface provided by condyles and trochlea permit great deal of movement of the hock joint (Fitzgerald, 1969).

The fibula was a reduced long bone with distinct head and rudimentary shaft. The head articulated with the lateral condyle of tibiotarsus and femur. The shaft of fibula extended up to the distal one third of the shaft of tibiotarsus as in fowl (Mc Lelland, 1990). The distal shaft was tapering, thin and pointed. Proximal part of the shaft of the fibula showed attachment to the fibular crest of tibiotarsus.

The long tibiotarsus of Local hill fowl indicated adaptive features for bipedalism and running whereas the highly reduced fibula and fusion of tibia with proximal row of tarsals to form tibiotarsus were indicative of adaptations for flight.

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