# Morphological and Morphometrical Studies on the Radius and Ulna of Himalayan Mongoose

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**SUMMARY**

The present study was carried out on the radius and ulna of Himalayan mongoose, a brown mongoose species which is native to the Himalayan region of Indian subcontinent. The specimen under study was collected from an animal that was hit by a moving car in Palampur. The specimen was preserved and the dissection was done to record the gross anatomical observations on the radius and ulna of Himalayan mongoose. The radius and ulna were long bones of the forearm region and were straight. The interosseous space extended along the length of the bone. The shaft of the radius was slightly curved. Proximal extremity had an ovoid articular surface. The bicipital tuberosity was present on the proximal part towards the lateral border. Distally it had a styloid process on the medial side. Ulna was longer and heavier than radius. Proximal extremity had olecranon process, anconeus process and a trochlear notch.

**Key words:** Mongoose, Himalayan, Radius, Ulna, Gross Anatomy

The Indian mongoose is a member of family *Herpestidae* from the order carnivora. Eight different species of mongoose occur in the Indo – Malayan region, all belonging to the same genus *Herpestes* (Corbet and Hill, 1992).The mongoose has been put under IUCN (International Union for Conservation of Nature's) Red List of threatened species (Mudappa and Choudhary, 2016). Mongoose are protected under Schedule II (Part II) of the Indian Wildlife (Protection) Act, 1972, which prohibits all trade of animals listed in it. In the field of radiology and forensic studies, the osteo-morphometric features of the scapula, humerus, radius and ulna are very important. Some morphometric studies have been reported on scapula (Rajput *et al.,* 2022), humerus (Shunmugam and Sundaram, 2022) and femur (Rao *et al.,* 2023) of mongoose but the scientific literature available on the radius and ulna of the Himalayan mongoose is scanty, hence, the present study was conducted.

The cadaver of mongoose was collected from Palampur after it was hit by a car and was found dead on the spot. The cadaver was taken to the Department of Veterinary Anatomy and was fixed as per the standard protocol of animal fixation post death. Permission to conduct the scientific study on the mongoose was sought and was granted by the Department of Forest (H.P.). The radius and ulna of the mongoose were dissected out and macerated as per standard procedure. The morphometric parameters were recorded with digital Vernier's caliper and non- stretchable cotton thread (Table – 1 and 2).

Radius and ulna, the two long bones formed the skeleton of the forearm and were straight in the mongoose (Fig. 1). They were articulated at the proximal and distal extremities and separated by the interosseous space which extended along the length of the bone in mongoose (Fig. 1) as observed by El-Ghazali and El-behery (2018) in cat and Tomar *et al.*, (2018) in royal Bengal tiger. The combined weight of radius and ulna was 1.38 gm.

Radius was composed of shaft, proximal and distal extremities. The shaft of the radius was slightly curved and flattened in its proximal half but distally the body was roughly triangular as reported by El-Ghazali and El- behery (2018) in cat and Goodarzi (2018) in hedgehog (*Paraechinus Hypomelas)*. The anterior surface was convex and the posterior surface was flattened (Fig. 2). The anterior surface was wide in the middle. It articulated with ulna proximally at the medial side and distally at lateral side. The findings were similar to that observed by Lucky and Harshan (2014) in tiger, Sundaram *et al.* (2015) in orange rumped Agouti (*D. leporina*), Tomar *et al.* (2018) in royal

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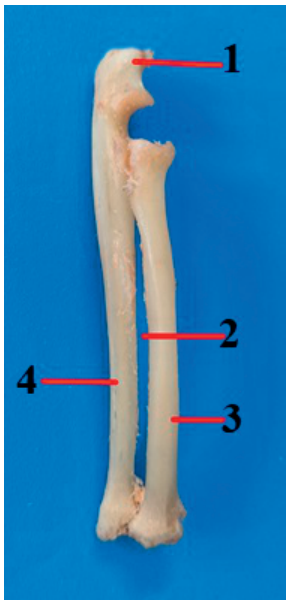


**Fig.1.** Skeleton of forearm of mongoose showing 1 – olecranon tuber, 2 – interosseous space, 3 – radius and 4 – ulna.

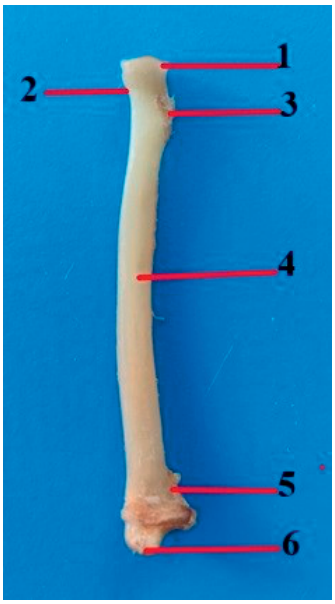


**Fig.2.** Anterior view of radius of mongoose showing 1 – head, 2 – neck, 3 – bicipital tuberosity, 4 – shaft, 5 – ulnar notch, 6 – styloid process.

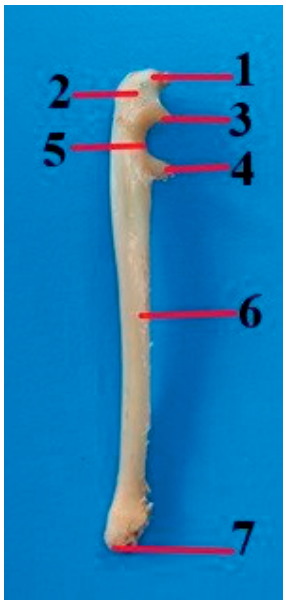


**Fig.3.** Medial view of ulna of mongoose showing
1– olecranon tuber,
2– olecranon process,
3– anconeal process,
4– coronoid process,
5– trochlear notch,
6 – body and
7 – styloid process.

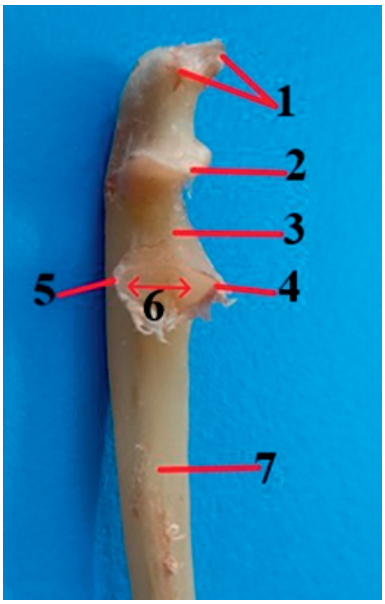


**Fig. 4.** Proximal extremity of the ulna of mongoose showing 1 – olecranon tubercles, 2 – anconeal process, 3 – trochlear notch, 4 & 5 – lateral and medial coronoid process, 6 – radial notch and 7 –body of ulna.

Bengal tiger, Palanisamy & *et al.* (2018) in Indian wild cat.

At the proximal extremity, the head of radius (radial head) presented an ovoid articular surface with groove in the middle to articulate with humerus (Fig. 2). Similar findings have been reported by Lucky and Harshan (2014) in tiger, Sundaram *et al.* 2015 in orange rumped Agouti, Goodarzi (2018) in hedgehog and Tomar *et al.* (2018) in royal Bengal tiger. It was distinctly separated from the body by a marked radial neck (Fig. 2).The bicipital tuberosity was rough and tubercular and was located on proximal part of the posterior surface towards the lateral border (Fig. 2) as in Indian wild cat (Palanisamy, 2018). However, it was presented as a small tubercle dorso-medially in hedgehog (Goodarzi, 2018), in the form of small rough area or semilunar / kidney shaped / quadrangular in royal Bengal tiger (Tomar *et al.,* 2018), a 2.5 cm long roughened prominence in tiger (Lucky and Harshan, 2014) and was indistinct in orange rumped Agouti ( D. leporina) (Sundaram *et al.,* 2015).

Distal extremity of radius was expanded and the articular surface was concave and somewhat ovoid in shape. On the lateral side of this extremity there was a transversely elongated facet that articulated with the distal extremity of ulna. On the medial side there was a prominent styloid process which had a rough tuberous medial surface (Fig. 2). These observations were found similar to the findings of Sreeranjini *et al.*, (2014) in leopard, Palanisamy (2018) in Indian wild cat and Tomar *et al.*, (2018) in royal Bengal tiger. Just above the styloid process, there was a thin flattened projection (Fig. 2) and there was as a tubercle at the middle of anterior aspect of the distal extremity as reported by Tomar *et al.* (2018) in royal Bengal tiger.

Ulna was longer and heavier than radius. It was located medio-laterally to radius. Proximally ulna was extended 1.3 cm above the radius. It consisted of a shaft and two extremities. The shaft was flattened along its length but distally the body was three sided with three surfaces and three borders. The proximal part of the shaft was laterally compressed whereas it was medially compressed in the distal part as reported by Palanisamy *et al.* (2018) in wild cat. The surface facing the radius or cranial surface presented a rough, elongated and elevated interosseous border and served as a surface for the fibrous interosseous membrane which connects ulna

**Table: 1. Morphometry of the radius of Himalayan mongoose**

| Parameters | Left Radius | Right Radius |
|---|---|---|
| Weight (gm) | 0.58 | 0.59 |
| Total length (cm) | 4.5 | 4.5 |
| **Proximal extremit** | | |
| Circumference (cm) | 1.6 | 1.7 |
| Width (cm) | 0.3 | 0.4 |
| **Distal extremit** | | |
| Circumference (cm) | 1.8 | 1.9 |
| Width (cm) | 0.4 | 0.4 |
| **Shaft** | | |
| Length (cm) | 3.6 | 3.6 |
| Pro imal circumference (cm) | 1.1 | 1.1 |
| Middle circumference (cm) | 1.0 | 1.1 |
| Distal circumference (cm) | 1.2 | 1.3 |

**Table: 2. Morphometry of the ulna of Himalayan mongoose**

| Parameters | Left Radius | Right Radius |
|---|---|---|
| Weight (gm) | 0.76 | 0.78 |
| Total length (cm) | 5.7 | 5.7 |
| **Proximal extremit** | | |
| Circumference (cm) | 1.4 | 1.5 |
| Width (cm) | 0.8 | 0.8 |
| **Distal extremit** | | |
| Circumference (cm) | 1.1 | 1.1 |
| Width (cm) | 0.3 | 0.4 |
| **Shaft** | | |
| Length (cm) | 3.7 | 3.7 |
| Pro imal circumference (cm) | 1.4 | 1.4 |
| Middle circumference (cm) | 1.1 | 1.2 |
| Distal circumference (cm) | 1.0 | 1.0 |

to radius, similar to that reported in tiger (Lucky and Harshan, 2014).

The proximal extremity had olecranon process, an anconeal process and trochlear notch (Figs. 3 & 4) for trochlea of humerus. The olecranon process possessed three tubercles (Fig. 4). The caudal one was large and rounded as observed in tiger (Lucky and Harshan, 2014), royal Bengal tiger (Tomar *et al.,* 2018), cat (El-Ghazali and El- behery, 2018) and wild cat (Palanisamy *et al.*, 2018). The lateral tubercle was smooth and prominent and the medial tubercle was rough. The lateral surface of the olecranon process was rough and elevated whereas, the medial surface was smooth and concave, this was in agreement to that observed by Tomar *et al.* (2018) in royal Bengal tiger. The anconeus process was large saddle shaped, located immediately proximal to the trochlear notch (Fig. 4). The trochlear notch was smooth, semilunar in shape and rough in the middle. It was wider distally and contained medial and lateral projections called medial and lateral coronoid process of ulna on either side of the notch (Fig. 4). This was in agreement to that observed by Lucky and Harshan (2014) in tiger, Sreeranjini *et al.* (2014) in leopard, Tomar *et al.* (2018) in royal Bengal tiger and Palanisamy *et al.* (2018) in Indian wild cat. The radial notch was a concave surface (Fig.4) present between these two processes articulated with the head of the radius as also reported by Lucky and Harshan (2014) in tiger, Tomar *et al.* (2018) in royal Bengal tiger, Palanisamy *et al.* (2018) in Indian wild cat and Goodarzi, (2018) in hedgehog *Paraechinus Hypomelas*.

The distal extremity was smaller than the proximal extremity. On the lateral side, a blunt projection, the styloid process (Fig. 3) was present and directed ventrally. On the medial side there was a round facet which articulated with the distal extremity of radius. This was similar to that reported by Lucky and Harshan (2014) in tiger, Sreeranjini*et al.* (2014)in leopard, Tomar *et al.* (2018) in royal Bengal tiger, Palanisamy *et al.* (2018) in Indian wild cat and Goodarzi, (2018) in hedgehog *Paraechinus Hypomelas*.

## REFERENCES

Corbet, G.B. and Hill, J. E. 1992. *The mammals of Indo- Malayan region: A systematic review*. Oxford University Press. Oxford, U.K, pp. 488.

El - Ghazali, H.M. and El- behery, E. I. 2018. Comparative macro-anatomical observations of the appendicular skeleton of New Zealand Rabbit (*Oryctolagus Cuniculus*) and domestic cat (*Felis Domestica*) thoracic limb. *International Journal of Veterinary Science* 7 : 127 – 133.

Goodarzi, N. 2018. Skeletal morphology of forelimb of hedgehog (*Paraechinus Hypomelas)* (Brandt, 1836); a radiographic and 3D computed tomographic study. *Online Journal of Veterinary Research 22* : 1003-1013.

Lucky, K.M. and Harshan, K.R. 2014. Gross anatomy of skeleton antebrachii of a tiger (*Panthera Tigris*). *Indian Journal of Animal Research* 48 : 298 – 300.

Mudappa, D. and Choudhary, A. 2016. Herpestes Edwardsii. The IUCN Red List of threatened species 2016 : e.T41611A45206787.

Palanisamy, D., Tomar, M.P.S, Ankem, P.B, Rao, D. and Ulakula, R.S. 2018. Macro anatomy of radius and ulna in Indian wildcat (*Felis Libyca Ornata*). *Indian Journal of Veterinary Anatomy* 30 : 72 – 74.

Rajput, R., Pathak, V., Shukla, P. and Gupta, D. 2022. Morphological and morphometrical studies on the scapula of Himalayan mongoose. *Indian Journal of Veterinary Anatomy* 34 : 43-45

Rao Arjun Kumar, Pathak. V, Rajput. R, Gupta. D and Shukla. P. 2023. Morphological and Morphometrical Studies on the femur of Himalayan Mongoose. *Indian Journal of Veterinary Anatomy* 35 : 53-55

Shunmugam, R., N Sundaram, M. 2022. Comparative morphology of the humerus of rabbit, guinea pig and mongoose. *Indian Journal of Veterinary Sciences and Biotechnology*. 18 : 59-63.

Sreeranjini, A.R., Ashok, N., Rajani, C.V., Indu, V.R., Maya, S., Lucy, K.M and Chungath, J.J. 2014. Gross anatomical studies on the radius and ulna of leopard (*Panthera Pardus*). *Indian Veterinary Journal* 91 : 24 – 26.

Sundaram, V., Dumar, N., Adogwa, A., Rao, S. and Nayak, S.B. 2015. Morphological studies of the forelimb skeleton of the orange rumped agouti (*Dasyprocta leporine Linnaeus*, 1758). *Annual Research and Review in Biology* 8 : 1 – 9.

Tomar, M.P.S., Taluja, J.S., Vaish, Rakhi, Shrivastav, A.B. and Sumbria, Deepak. 2018. Gross anatomy of radius and ulna in Royal Bengal tiger (*Panthera Tigris*). *Applied Biological Research* 20 : 171 – 176.