

Anatomical Features of Some Bones of the Forelimbs of Lions (*Panthera leo*)

Características Anatómicas de Algunos Huesos de los Miembros Torácicos de Leones (*Panthera leo*)

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SUMMARY: We studied the bones of forelimb of four adult lions (*Panthera leo*) of both sexes to record the gross anatomical and morphometrical features of the scapula, humerus, radius and ulna. We observed some unique anatomical features that will be helpful for radiographic interpretation and forensic investigations. The lateral surface of scapula was unequally divided into supraspinous (*fossa supraspinata*) and infraspinous fossa (*fossa infraspinata*) by a well developed spine (*spina scapulae*). The acromion process was subdivided into suprahamate process (*processus suprahamatus*) and hamate process (*processus hamatus*); the later one was over hanged the glenoid cavity (*cavitas glenoidalis*), but the supraglenoid tubercle (*tuberculum supraglenoidalis*) was absent. The shaft (*diaphysis*) of humerus was compressed craniocaudally in proximal part, rounded to oval in middle part and compressed mediolaterally in distal part. A long, narrow supracondyloid foramen was found at distal limb just above the medial epicondyle (*epicondylus medialis*) which didn't connect the radial fossa (*fossa radialis*) with the olecranon fossa (*fossa olecrani*). The radius and ulna were twin bones where radius was articulated craniolateral to the ulna proximally and craniomedial to the ulna distally. However, the ulna was the longest bone in the forelimb of lion. The olecranon tuberosity of this bone had three prominences - two were cranially, whereas the caudal one was the largest and rounded. Distally projected styloid processes (*processus styloideus*) were found in the distal limb of both radius and ulna.

KEY WORDS: Lion; Anatomy; Scapula; Humerus; Radius; Ulna.

INTRODUCTION

The lion (*Panthera leo*), popularly known as the “King of jungle” as possessing both beauty and strength. It is a member of the Felidae (cat) family and one of four big cats in the genus *Panthera* (Nowak & Walker, 1999). Both in structure and in kinematic patterns, the bones of the lion mainly the bones of forelimb reveals many peculiarities (Howell, 1944; Hildebrand & Hurley, 1985). Like other felines it is strongly muscular and contain very powerful muscles in their chests and forelimbs as well as their manus can be supinated. These unique characteristics allow them to capture large prey such as buffalo, zebra, etc. Furthermore, these allow them to reach speeds of over 80 kilometers per hour while chasing prey (Kirberger *et al.*, 2005; Lucky & Harshan, 2014). The bones of the forelimb are twisted in such a manner as to give a vast range of motion to the forelimb. The shoulder, elbow and radiocarpal joints of the lion are placed one above the other to hold up its heavy muscles

equivalent to an architectural column; the downward scapula is aligned with the humerus and ulna (Nzalak *et al.*, 2010).

Many scientists have been studied on the skeletal system of large animals, for example horse, cattle, small ruminants such as sheep, goat (Sisson *et al.*, 1975), carnivores such as dog (Miller *et al.*, 1964), wild carnivores such as tiger (Tomar *et al.*, 2018), leopard (Podhade, 2007), Asiatic cheetah (Nazem *et al.*, 2017) and Indian wild cat (Palanisamy *et al.*, 2018). Only few literatures are available on some bones of the Asiatic lion (Pandey *et al.*, 2004; Nzalak *et al.*), but the morphometrical study of the skeletal system of the lion has not been studied in details. Beside this, in the field of radiology and forensic studies, the osteomorphometrical features of the scapula, humerus, radius and ulna are very important. Therefore, considering the above facts the present study was conducted.

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MATERIAL AND METHOD

The scapula, humerus, radius and ulna of four adult lions of both sexes were examined at the Anatomy Museum of Chattogram Veterinary and Animal Sciences University, Bangladesh. Recently these four lions died in the Bangladesh National Zoo, Dhaka and buried in different isolated places of the zoo burial ground with aseptic measures. After six months the bones were collected and subsequently processed by removing the mud and boiled with water and hydrogen peroxide (H₂O₂) for one hour to remove the remaining muscular structure from the bones. After removing the muscular structures through knife all the bones were properly washed with fresh water and finally all the bones were dried under sunlight for a week. For the gross morphometric study, the length, width, height and circumference were measured by using a calibrated scale and were recorded in centimeter (cm). The weight was also measured by using a digital balance and recorded in gram (g). The data were statistically analyzed.

RESULTS AND DISCUSSION

Scapula. The scapula of lion was downward and forward directed triangular shape flat bone placed in the cranio-lateral aspect of thorax with the dorsal end being relatively wide and the ventral end being narrow. However, the quadrangular shaped scapula was found in tiger (Tomar *et al.*), Indian wild cat (Palanisamy *et al.*) and civet cat (Sarma *et al.*, 2017). It was slightly sloped that helped to adapt the form of the forelimb laterally. The morphometrical data for different parameters of scapula of the lions are illustrated in Table I.

The scapula possessed two surfaces, three margins and three angles. The lateral surface was divided by a well developed spine (*spina scapulae*) into two unequal fossae, i.e. supraspinous fossa (*fossa supraspinata*) and infraspinous fossa (*fossa infraspinata*) (Fig. 1) as studied previously in lion (Pandey *et al.*). However, the equal fossae were found in dog (Miller *et al.*; Sisson *et al.*) and Indian wild cat (Palanisamy *et al.*). The height of the spine gradually decreased towards the proximal limb, which was similar to the findings of Nzalak *et al.* and Pandey *et al.* The edge of spine was inclined towards the infraspinous fossa except in its distal 1/4th part, whereas the proximal 1/3rd was slightly rough and thickened as reported in tiger (Tomar *et al.*). The distal continuation of the spine namely acromion process was composed of hamate process (*processus hamatus*) and suprahamate process (*processus suprahamatus*) (Fig. 1).

Though, Nzalak *et al.* called them as acromion and metacromion process, respectively. The hamate process was triangular with thick blunted ends that over hanged the glenoid cavity (*cavitas glenoidalis*). At the tip of the end it was slightly backward directed (Fig. 1). This finding was consistent with the findings in lion (Nzalak *et al.*), although it was not over hanged to the glenoid cavity in cattle, sheep and goat (Sisson *et al.*). The suprahamate process was resembling thick triangular plate and backward directed (Fig. 1) as previously observed in lion (Nzalak *et al.*).

The supraglenoid tubercle (*tuberculum supraglenoidalis*) was absent in this study, which was agreed with lion (Pandey *et al.*; Nzalak *et al.*) but disagreed with the horse (Sisson *et al.*) and cattle (Budras & Habel, 2011). The surface of supraspinous fossa was centrally undulating, concave dorsally then became convex and finally concave towards the spine and the infraspinous fossa was almost similar but it was less undulating (Fig. 1). This result was strongly agreed with previous result of lion (Nzalak *et al.*) but partially agreed with tiger (Tomar *et al.*) and with Indian wild cat (Palanisamy *et al.*), where the authors pointed out that the infraspinous fossa was flattened.

The dorsal margin of scapula was extended from the level of the proximal limb of 1st rib to the middle of the 6th rib. The outline was rough for the attachment of scapular cartilage, but this cartilage was lost during the collection of specimens. The cranial margin of scapula was slightly convex which extended from scapular notch (*incisura scapulae*) to cranial angle (*angulus cranialis*) (Fig. 1). The outline of this margin was circular and smooth, however it was thin and strongly circular in Indian wild cat (Palanisamy *et al.*). The caudal (axillary) margin was straight with thick and smooth outline and extended from the caudal angle (*angulus caudalis*) to the glenoid cavity (Fig. 1), which was similar to the study of Indian lion (Nzalak *et al.*), tiger (Tomar *et al.*), leopard (Podhade) and Indian wild cat (Palanisamy *et al.*).

The cranial angle (*angulus cranialis*) was not well distinct but fused with the adjacent margins, whereas the caudal angle (*angulus caudalis*) was thick, rough and tuberos. Moreover, the ventral angle (*angulus ventralis*) of scapula was articulated with humerus by glenoid cavity (*cavitas glenoidalis*) of scapula and head of humerus. The glenoid cavity (*cavitas glenoidalis*) was elongated oval shaped (Fig. 2), which was variable in some other species such as it was elongated in elephant (Ahasan *et al.*, 2016), oval to quadrangular in tiger (Tomar *et al.*) and oval shape in Indian wild cat (Palanisamy *et al.*).

Table I. Morphometrical data for different parameters of scapula, humerus, radius and ulna (N=4).

Bone	Parameters	Mean ± SE	
		Right	Left
Scapula	Weight (g)	216.5 ± 22.70	217.5 ± 23.97
	Maximum length (Dorsal margin to glenoid cavity) (cm)	25.98 ± 0.94	25.85 ± 1.02
	Maximum width (Cranial margin to caudal angle) (cm)	20.55 ± 0.79	20.48 ± 0.88
	Length of cranial margin (cm)	22.20 ± 0.89	22.18 ± 0.94
	Length of caudal margin (cm)	21.43 ± 0.97	21.38 ± 1.05
	Length of dorsal margin (cm)	15.48 ± 0.95	15.63 ± 0.95
	Length of scapular spine (cm)	19.70 ± 0.79	19.53 ± 0.72
	Height of scapular spine from supraspinous fossa (cm)	3.55 ± 0.16	3.7 ± 0.16
	Height of scapular spine from infraspinous fossa (cm)	4.25 ± 0.23	4.33 ± 0.18
	Maximum width of supraspinous fossa (cm)	8.45 ± 0.48	8.65 ± 0.41
	Maximum width of infraspinous fossa (cm)	10.13 ± 0.45	10.23 ± 0.45
	Length of glenoid cavity (cm)	5.33 ± 0.33	5.45 ± 0.37
	Width of glenoid cavity (cm)	3.63 ± 0.24	3.75 ± 0.26
	Distance between glenoid cavity and acromion process (cm)	3.83 ± 0.24	3.75 ± 0.26
Humerus	Weight (g)	407 ± 56.48	400.7 ± 56.64
	Total length (cm)	31.23 ± 1.48	31.10 ± 1.47
	Shaft		
	Length (cm)	25.55 ± 1.22	25.45 ± 1.22
	Circumference of upper part (cm)	14.10 ± 0.66	13.92 ± 0.65
	Circumference of middle part (cm)	11.58 ± 0.85	11.45 ± 0.82
	Circumference of lower part (cm)	11.25 ± 0.47	11.20 ± 0.44
	Circumference of head (cm)	17.28 ± 1.21	17.22 ± 1.15
	Proximal limb		
	Circumference (cm)	18.4 ± 1.32	18.27 ± 1.32
	Width (cm)	9.20 ± 0.67	9.07 ± 0.67
	Distal limb		
	Circumference (cm)	15.05 ± 1.09	14.97 ± 1.06
	Width (cm)	8.08 ± 0.39	8.0 ± 0.35
Depth of olecranon fossa (cm)	2.20 ± 0.21	2.1 ± 0.20	
Radius	Total length (cm)	28.62 ± 1.23	28.57 ± 1.22
	Proximal limb		
	Circumference (cm)	13.97 ± 1.08	13.85 ± 1.06
	Width (cm)	3.97 ± 0.28	3.92 ± 0.30
	Distal limb		
	Circumference (cm)	14.1 ± 1.32	13.97 ± 1.33
	Width (cm)	4.2 ± 0.38	4.1 ± 0.38
Circumference at mid shaft (cm)	7.57 ± 0.52	7.47 ± 0.48	
Ulna	Total length (cm)	34.97 ± 1.59	35.0 ± 1.66
	Circumference		
	Proximal limb (cm)	10.92 ± 0.86	10.8 ± 0.84
	Distal limb (cm)	7.85 ± 0.78	7.72 ± 0.79
	Length of olecranon (cm)	9.17 ± 0.53	9.12 ± 0.52
Circumference at distal limb of olecranon (cm)	9.82 ± 0.56	9.77 ± 0.55	

On the medial surface, the subscapular fossa (*fossa subscapularis*) was deep (Fig. 3) and contain two prominent ridges namely the anterior ridge and posterior ridge. The anterior one was curved and started from the lower one third of the cranial margin, became prominent towards the distal limb. On the other hand, the posterior ridge was straight, started immediately below the caudal angle ran parallel to the caudal margin and became prominent towards the distal limb and ended at above the rim of the glenoid cavity (*cavitas glenoidalis*). However,

comparatively shallow subscapular fossa with two ridges were found in tiger (Tomar *et al.*), whereas four ridges were observed in civet cat (Sarma *et al.*). This discrepancy due to the species differences. In this study, an almost rounded tiny coracoid process (*processus coracoideus*) also observed that was directed medially backward and downward (Fig. 3). However, this result was partially analogous to the study in tiger (Tomar *et al.*) and civet cat (Sarma *et al.*), where they mentioned hook like prominent coracoid process.

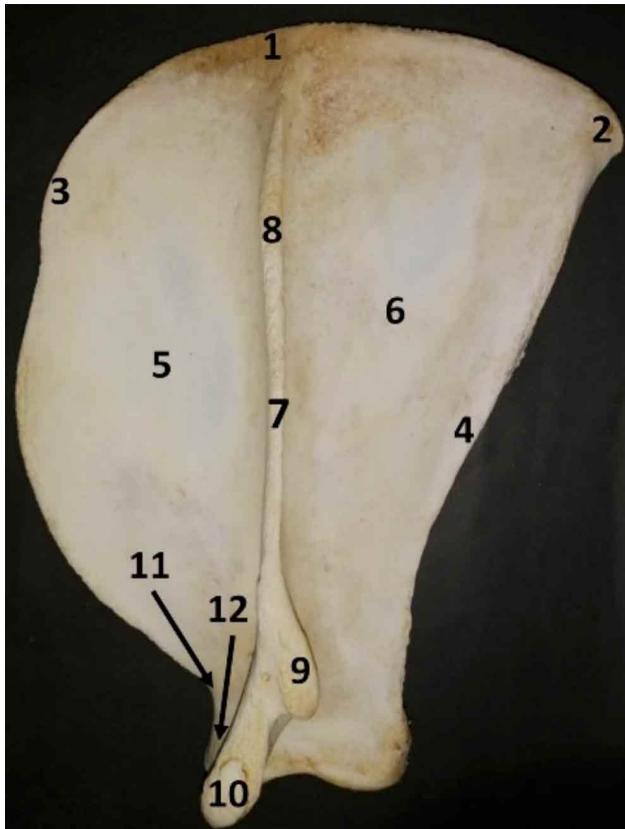


Fig. 1. Lateral view of left scapula of lion. 1= Cranial angle (*Angulus cranialis*), 2= Caudal angle (*Angulus caudalis*), 3= Cranial margin, 4= Caudal margin, 5= Supraspinous fossa (*Fossa supraspinata*), 6= Infraspinous fossa (*Fossa infraspinata*), 7= Scapular spine (*Spina scapulae*), 8= Tuberosity of spine, 9=Suprahamate process (*Processus suprahamatus*), 10= Hamate process (*Processus hamatus*), 11= Scapular notch (*Incisura scapulae*) and 12= Coracoids process (*Processus coracoideus*).

Humerus. The humerus is one of the major bones in the appendicular skeleton of lion to bear the total body weight. In the present study, it was a long bone with a spirally twisted shaft (*corpus humeri*), which was located obliquely downward and backward directed. It formed shoulder joint above by its head with the glenoid cavity of scapula and elbow joint below by its condyles with the proximal limbs of radius and ulna. The morphometrical data for different parameters of humerus of lions are presented in Table I.

It possessed a cylindrical shaft (*corpus humeri*) and two enlarged limbs (*epiphysis*) such as proximal limb and distal limb. The head (*caput humeri*) was rounded (Fig. 4) and had a large, undivided tubercle (*tuberculum*)- the greater or major (*tuberculum major*) and lesser tubercle (*tuberculum minus*) (Fig. 5). The greater tubercle was large and prominent on the cranial and lateral surface of proximal end of bone, whereas the later one was smaller, dorsally extended, non-

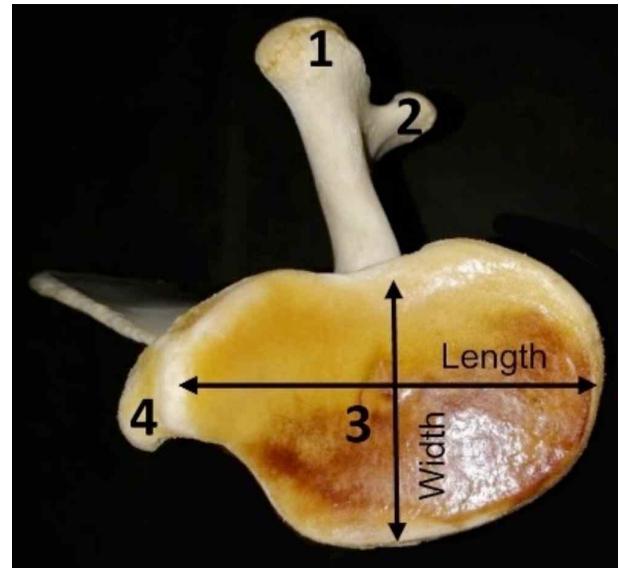


Fig. 2. Ventral view of left scapula of lion. 1= Hamate process (*Processus hamatus*), 2=Suprahamate process (*Processus suprahamatus*), 3= Glenoid cavity (*Cavitas glenoidalis*) and 4= Coracoid process (*Processus coracoideus*).

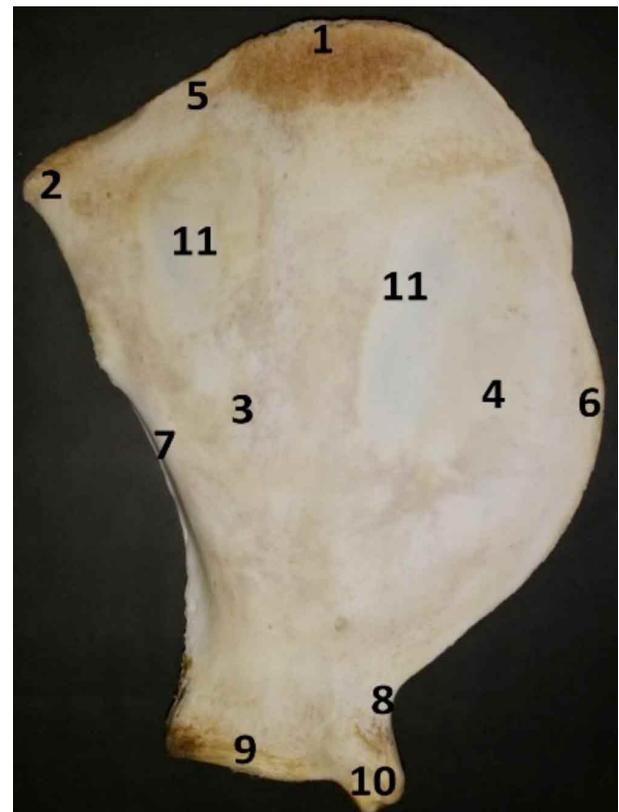


Fig. 3. Medial view of left scapula of lion. 1= Cranial angle (*Angulus cranialis*), 2= Caudal angle (*Angulus caudalis*), 3= Caudal ridge, 4= Cranial ridge, 5= Dorsal margin, 6= Cranial margin, 7= Caudal margin, 8= Scapular notch (*Incisura scapulae*), 9= Glenoid cavity (*Cavitas glenoidalis*), 10= Coracoid process (*Processus coracoideus*) and 11= Subscapular fossa (*Fossa subscapularis*).

articulated just under the head on the medial surface (Fig. 5). Similar findings were observed in Asiatic cheetah (Nazem *et al.*), but mostly prominent major tubercle was found in dog (Sisson *et al.*).

The shaft (*corpus humeri*) was compressed craniocaudally in proximal part, rounded to oval in middle part and compressed mediolaterally in distal part (Fig. 6) as described in lion (Kirberger *et al.*). This bone had four surfaces- the lateral, medial, cranial and caudal surface, but only two surfaces- lateral and medial were observed in Asiatic cheetah (Nazem *et al.*). The lateral surface was spirally twisted and smooth, whereas the medial one was compressed in the proximal part and almost rounded in the distal part. A shallow, convex musculospiral groove or brachial groove (*sulcus muscui brachialis*) was present on the lateral surface, which continued until the proximal half of this bone. The less developed deltoid tuberosity (*tuberositas deltoidei*) was noticed at the edge between the lateral and medial surfaces (Fig. 5), whereas well developed deltoid tuberosity was noticed in dog (Miller *et al.*; Sisson *et al.*). On the lateral surface, there is another obliquely crest like structure known as tricipital line or deltoid crest was found, which ended in the deltoid tuberosity. On the cranio-lateral aspect of humerus, another crest like structure was started from the distal part of lateral (greater) tuberosity, continued as slightly oblique line and finally terminated at teres major tuberosity (*tuberositas teres major*). On the distal part of the shaft, a supracondyloid crest or ridge (*crista supracondylaris lateralis*) started just above the lateral epicondyle (*epicondylus lateralis*), continued obliquely and then ended on its caudal surface (Fig. 4). The nutrient foramen was observed on the caudal surface of the proximal to the middle of the shaft, but Nzalak *et al.* observed this foramen on the distal half of the shaft. In contrast, two nutrient foramens were observed in Asiatic cheetah (Nazem *et al.*).

The distal limb of the humerus had two condyles (*condylus*), two epicondyles (*epicondylus*), a supracondyloid foramen, radial fossa (*fossa radialis*) and olecranon fossa (*fossa olecrani*). A small, shallow radial fossa (*fossa radialis*) was pointed out on the medial surface (Fig. 5). On the contrary, a large and deep olecranon fossa (*fossa olecrani*) was present on the other side (Fig. 4). Although these two fossae were shallow in tiger (Tomar *et al.*) and Asiatic cheetah (Nazem *et al.*). A long, narrow open type supracondyloid foramen was found on the medial surface of the distal limb just above the medial epicondyle (*epicondylus medialis*) (Fig. 6). This foramen didn't connect the radial fossa with the olecranon fossa as found in dog (Sisson *et al.*).

Radius and Ulna. The radius and ulna were twin bones of the skeleton of antebrachium which formed elbow joint proximally incorporated with the humerus and carpal joint distally with the carpal bones. In lion, the radius bone was articulated cranio-lateral to the ulna proximally and craniomedial to the ulna distally. The morphometrical data for different parameters of scapula of the lions are illustrated in Table I.

The radius has a long shaft (*corpus radii*) and two limbs- the proximal one was smaller and distal one was larger and expanded. The head of the radius (*caput radii*) was very well defined. On the proximal surface of head, the concave fovea capitis radii- a triangular articular surface was seen which articulated with the lateral condyle of humerus (Fig. 7). This was in agreement with the previous report of Nzalak *et al.*

Immediately below the head, the neck (*collum radii*) has an irregular surface for the articulation with ulna in its caudal part. A rough, prominent eminence- the radial tuberosity (*tuberositas radii*) was present on the medial surface of the proximal limb (Fig. 7) as seen in tiger (Tomar *et al.*).

The shaft of radius (*corpus radii*) was craniocaudally compressed, which was similar with Asiatic cheetah (Nazem *et al.*), but dissimilar with Asian elephant (Ahasan *et al.*). It had four surfaces- anterior, posterior, lateral and medial. The anterior surface was rough for the attachment of tendons of muscles, while the posterior surface was somewhat concave as reported in dog and cat (Sisson *et al.*). The lateral and medial surfaces were a bit rounded and comparatively smooth. The distal limb was the largest part of this bone. It had a medial elongated projection called styloid process of radius (*processus styloideus radii*) (Fig. 8) as reported in tiger (Lucky & Harshan). An articular surface- ulnar notch for the attachment of radius with ulna was also present.

The ulna was the longest bone in the forelimb of lion. The olecranon of ulna was projected farther than the radius at the proximal limb (Fig. 7), which was similar to the cattle (Budras & Habel) and sheep (Sisson *et al.*), but different from the horse (Sisson *et al.*). The free end of this olecranon was extended caudolaterally to form olecranon tuber (*tuber olecrani*) as observed in dog (Sisson *et al.*), Asiatic cheetah (Nazem *et al.*) and tiger (Lucky & Harshan). It had three prominences- two were cranial and the caudal one was the largest and rounded (Fig. 8) as reported in dog (Sisson *et al.*) and tiger (Lucky & Harshan). The trochlear (*semilunar*) notch (*incisura trochlearis*) was large and articulated with the trochlea



Fig. 4. Caudal view of left humerus of lion. 1= Head of humerus (*Caput humerus*), 2= Greater or major tubercle (*Tuberculum majus*), 3= Lesser tubercle (*Tuberculum minus*), 4= Neck of humerus (*Collum humeri*), 5= Deltoid tuberosity (*Tuberositas deltoidea*), 6=Supracondyloid crest or ridge (*Crista supracondylaris lateralis*), 7=Supracondyloid foramen, 8= Olecranon fossa (*Fossa olecrani*), 9= Lateral epicondyle (*Epicondylus lateralis*) and 10= Medial epicondyle (*Epicondylus medialis*).

Fig. 5. Cranial view of left humerus of lion. 1= Greater or major tubercle (*Tuberculum majus*), 2= Lesser tubercle (*Tuberculum minus*), 3= Intertubercular groove, 4= Teres major tuberosity (*Tuberositas teres majus*), 5= Deltoid tuberosity (*Tuberositas deltoidea*), 6= Shaft of humerus (*Corpus humeri*), 7= Radial fossa (*Fossa radialis*), 8= Capitulum (*Capitulum humeri*) and 9= Trochlea (*Trochlea humeri*).

Fig. 6. Medial view of left humerus of lion. 1= Lesser tubercle (*Tuberculum minus*), 2= Head of humerus (*Caput humerus*), 3= Neck of humerus (*Collum humeri*), 4= Crest of lesser tubercle, 5= Shaft of humerus (*Corpus humeri*) and 6= Medial epicondyle (*Epicondylus medialis*).

of humerus. It was continued distally by the medial and lateral coronoid processes (*processus coronoideus*) to form a concave surface for articulation, whereas proximally it was continued with the anconeal process (*processus anconeus*).

As like as radius, the shaft of ulna (*corpus ulnae*) was triangular in section and slightly convex cranially. This similar findings were observed in Asiatic cheetah (Nazem *et al.*). The proximal half of the shaft was thick as resembling to the distal part of caudal view. At the



Fig. 7. Caudomedial view of right radius and ulna of lion. 1= Olecranon tuber (*Tuber olecrani*), 2= Olecranon process (*Processus olecrani*), 3= Anconeal process (*Processus anconeus*), 4= Trochlear notch (*Incisura trochlearis*), 5= Capitular fovea of radius, 6= Radial tuberosity (*Tuberositas radii*), 7= Shaft of ulna (*Corpus ulnae*), 8= Shaft of radius (*Corpus radii*), 9= Interosseous space, 10= Styloid process of ulna (*Processus styloideus ulnae*) and 11= Styloid process of radius (*Processus styloideus radii*).



Fig. 8. Craniomedial view of right radius and ulna of lion. 1= Olecranon tuber (*Tuber olecrani*), 2= Olecranon process (*Processus olecrani*), 3= Anconeal process (*Processus anconeus*), 4= Trochlear notch (*Incisura trochlearis*), 5= Coronoid process (*Processus coronoideus*), 6= Capitular fovea of radius, 7= Interosseous space, 8= Styloid process of radius (*Processus styloideus radii*) and 9= Styloid process of ulna (*Processus styloideus ulnae*).

distal limb, a distally projected styloid process (*processus styloideus ulnae*) (Fig. 8) was seen which articulated with the carpal bones as observed previously by Nzalak *et al.* Medially it had a convex facet that articulated with the radius.

CONCLUSION

The above mentioned information regarding some unique anatomical features and their morphometric measurements can be helpful for identification, radiographic interpretation and forensic investigation of the forelimb bones of lion. These will also provide the pathway and guideline for better understanding the appropriate anatomical parameters.

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RESUMEN: Estudiamos los huesos de las miembros torácicos de cuatro leones adultos (*Panthera leo*) de ambos sexos para registrar las características anatómicas y morfométricas macroscópicas de la escápula, el húmero, el radio y la ulna. Se observaron algunas características anatómicas únicas que serán útiles para la interpretación radiográfica y las investigaciones forenses. La superficie lateral de la escápula se dividió de manera desigual en fosa supraespinosa y fosa infraespinosa por una columna bien desarrollada (espinosa de la escápula). El proceso del acromion se subdividió en proceso suprahumero (*processus suprahumatus*) y proceso humero (*processus humatus*); el tubérculo supraglenoideo (*tuberculum supraglenoidalis*) estaba ausente. La diáfisis (*diáfisis*) del húmero estaba comprimida craneocaudalmente en la parte proximal, redondeada a ovalada en la parte media y comprimida mediolateralmente en la parte distal. Se encontró un foramen supracondileo largo y estrecho en la ex-

tremidad distal, por encima del epicóndilo medial (*epicondylus medialis*) que no conectaba la fosa radial (*fosa radial*) con la fosa olecraneana (*fossa olecrani*). El radio y la ulna eran huesos idénticos en los que el radio se articulaba craneolateral a la ulna proximalmente, y craneomedial a la ulna distalmente. Sin embargo, la ulna era el hueso más largo del miembro torácico del león. La tuberosidad del olécranon de este hueso tenía tres prominencias: dos eran craneales, mientras que la caudal era la más grande y redondeada. Se encontraron procesos estiloides proyectados distalmente (*processus styloideus*) en la extremidades distales del radio y la ulna.

PALABRAS CLAVE: León; Anatomía; Escápula; Húmero; Radio; Ulna.

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