



GROSS ANATOMICAL STUDIES ON THE HIND LIMB OF THE SITATUNGA (*Tragelaphus spekii*).

Kenechukwu Tobechukwu Onwuama, Sulaiman Olawoye Salami, Esther Solomon Kigir, Alhaji Zubair Jaji

Department of Veterinary Anatomy, University of Ilorin, Ilorin, Nigeria

Abbreviated title: Hind limb bones of the Sitatunga

Corresponding address: Kenechukwu Tobechukwu Onwuama. Telephone number: 08036425961. E-mail address: kenexcares@yahoo.com

ABSTRACT

The Sitatunga, *Tragelaphus spekii*, is a swamp dwelling antelope resident in West Africa. This study was carried out to document unique morphological and numerical information on the hind limb bones of this ruminant. Two (2) adults of both sexes were obtained as carcass at different times after post-mortem examination and prepared to extract the bones via cold water maceration for use in the study. The presence of a sharp pointed ilio-pubic eminence at the junction between the cranial border of the ilium and pubis; less prominent ischial tuber, inconspicuous ischiatic arch and a large oval obturator foramen were unique features of the Ossa coxarum that distinguished it from that of small ruminants. The Femur's medial condyle was obliquely orientated, the fibula was absent while the long Tibia was typical of ruminant presentation. It was observed that the morphological features of the tarsals and Pes were also typical. However, the last Phalanges presented characteristic long triangular shaped bones with sharp pointed ends. The total number of bones making up the forelimb was accounted to be 45. In conclusion, this study has provided a baseline data for further biological, archeological and comparative anatomical studies.

Keywords: Sitatunga, Bone, Femur, Antelope, Ruminant.

INTRODUCTION

The Sitatunga (*Tragelaphus spekii*), a member of the family Bovidae is a semi aquatic swamp dwelling antelope found in south western African rain forest and wet regions of southern savannah (Robinchaud, 2011). Though never been domesticated, they are kept in captivity as zoo animals in many parts of Africa (Rose and Robert, 2013). Its close relatives include the Nyala and bush buck (Estes, 2004) which show some indistinguishable characteristics (McDonald, 2001). They are slow and clumsy land runners and are known to move through swamp and soft grounds, plunge, ruminate and swim well in water than any other known ungulate (Liebenberg, 2000). These characteristic

relationship and behaviour in swampy areas presents a need for investigation into the appendicular skeleton of this animal to ascertain adaptive features and enumerate some peculiarities that may differentiate them from other studied ungulates such as the sheep, goat and cattle (Konig and Liebich, 2004).

Consequently, the aim of this study was to investigate and document the fore limb morphology of the Sitatunga thereby establishing a base line data which will help in future scientific and evolutionary studies. The objectives were to provide general, distinguishing features and number of bones making up the Hind limb.

MATERIALS AND METHODS

Two (2) adult male and female sitatunga carcasses weighing 62kg and 54kg

respectively were obtained at different times after post-mortem examination from

the department of Veterinary Pathology, Faculty of Veterinary Medicine, University of Ilorin, Nigeria for bone preparation by cold maceration at the Department of Veterinary Anatomy. The carcasses were dissected using scalpel blade with a blade holder to carefully remove skin, muscles and internal organs leaving the bones with minimal soft tissue attachments. They were then put in a large plastic container containing enough water to submerge the

bones after which it was covered airtight and placed out door. Water was changed after a week before being drained and bones recovered a week later. The recovered bones were then degreased using sodium bicarbonate and sundried. Photographs of recovered bones of the Hind limb were taken singly and segmentally after which they were then studied and described noting its distinguishing characteristics.

Table 1: Number of bones of the Hind limb of the Sitatunga (*Tragelaphus spekii*)

Bones	Number
Ossa coxarum	1
Femur	2
Patella	2
Tibia	2
Os Malleolus	2
Tarsals	10
Metatarsals	2
First phalanx	4
Second phalanx	4
Third phalanx	4
Sesamoid	12
Total average:	45

RESULTS

The Hind limb comprised bones of the Hip (Ossa coxarum), Thigh (Femur and patella), Leg (Tibia) and Pes (tarsals, metatarsals and phalanges). They exhibited general features like that of other domestic animals studied. The average number of bones of the hind limb was found to be 45 as given by the table below.

The **ossa coxarum** presented two halves joined at the pelvic symphysis (Figure 1). It consisted of 3 fused bones; ilium cranially, ischium caudally and pubis medially all presenting parts that formed the acetabulum for articulation with the head of femur. The *ilium* presented a wing cranially and a body caudally that extended to form the cranial part of the acetabulum. The wing presented a convex cranial border, convex lateral surface and a medial auricular surface for articulation with the sacrum. It formed a sacral tuber medially and the coxal tuber laterally. On the ventral

surface of the body cranial to the acetabulum, it presents a fossa. The *pubis* formed the craniomedial aspect of the bone extending laterally (to form the medial part of the acetabulum) and caudally (to join the ischium). Medial to the acetabulum, its cranial border presented a pointed iliopubic eminence. Its caudal border formed the craniomedial margin of the large obturator foramen. The *Ischium* formed the caudolateral aspect of the bone. Its craniolateral angle formed the caudal part of the acetabulum, its caudolateral angle formed the ischial tuber while the caudomedial aspect joined its fellow to form a very shallow ischiatic arch. The craniolateral border forms the caudal margin of the obturator foramen. The Acetabulum presented a double notched cotyloid cavity with a deep acetabular fossa.

The **Femur** presented a long shaft and two extremities (Proximal and distal) (Figure 2). The shaft had a convex cranial surface with no distinct structure while the concave caudal surface possessed the lesser trochanter on its proximal third with a muscular line extending from it and running along the lateral border of the shaft. The distal third of the caudolateral surface presented the supracondyloid fossa. The proximal extremity presented the head and neck medially, greater trochanter laterally.

A curved trochanteric crest connected the greater trochanter obliquely to the lesser trochanter while creating the trochanteric fossa. The distal extremity presented caudally, the larger lateral condyle and the smaller obliquely directed medial condyle separated by the intercondylar fossa. Cranially, it presented a trochlea with two ridges. The triangular **Patella** presented a convex dorsal base, ventral apex, concave inner articular surface and convex roughened external surface (Figure 3).



Figure 1: Sitatunga Ossa coxarum (Ventral and dorsal views). 1, Coxal tuber; 2, Sacral tuber; 3, Wing of ilium; 4, Body of Ilium; 5, Fossa; 6, Cotyloid cavity of acetabulum; 7, Acetabular fossa; 8, Iliopubic eminence; 9, Pubis; 10, Obturator foramen; 11, Ischium; 12, Ischial tuber; 13, Pubic symphysis; 13, Ischial symphysis.



Figure 2: Sitatunga Femur (cranial and caudal views). 1, Head; 2, Greater trochanter; 3, Neck; 4, Shaft; 5, Trochlea; 6, Medial condyle; 7, Lateral condyle; 8, Trochanteric fossa; 9, Lesser trochanter; 10, Muscular line; 11, Supracondyloid fossa; 12, Intercondyloid fossa.

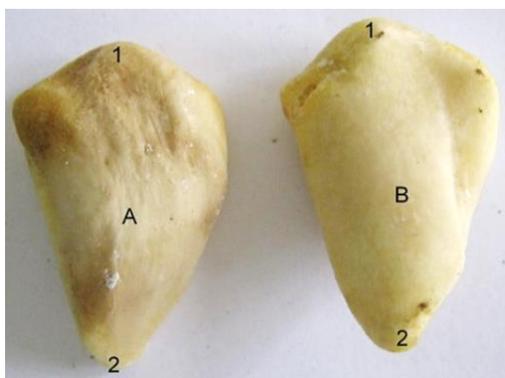


Figure 3: Sitatunga Patella. 1, Base; 2, Apex; A, Convex external surface; B, Concave internal surface.

The **Tibia** (Figure 4) was the longest bone having a shaft and two extremities (proximal and distal). The shaft presented a slight s-shaped conformation having three surfaces at the proximal third (due to the tibial tuberosity and spine on the cranial surface) and two surfaces on its distal third. Its caudal surface presented one popliteal line that started below the proximal extremity and ended at the mid shaft. The line was flanked by muscular line. The proximal extremity bore the lateral, medial condyles (separated by a fossa) and cranial tibia tuberosity. The medial condyle extended centrally to form the intercondyloid eminence. The distal extremity presented an articular surface marked with depressions for articulation with the tibia tarsal bone. It extended the lateral and medial malleolus. The fibula was absent in this species.

The **tarsals** (Figure 5) were five in number namely: Fibula tarsal, tibia tarsal, first tarsal, second and third tarsal fused and centriquartal.

The **Metatarsal** presented a long bone with a shaft and two extremities (Proximal and distal) (Figure 6). Evidence of fusion was seen by a deep longitudinal groove spanning the shaft length on the dorsal

surface. Its palmar surface presented a wide depression that also spanned the entire shaft length. The proximal extremity presented articular surfaces for tarsal articulation. The distal extremity comprised lateral and medial condyle separated by an intercondylar groove. Above and below the groove was the nutrient foramen and metatarsal canal respectively. Each condyle presented a median ridge.

Two **Digits** having three phalanges were seen on each foot (Figure 7). The first and second Phalanges were small cylindrical bones with shaft and extremities that presented concave proximal surface and convex distal surfaces for articulation. The second phalanx was the shortest of the three bones. The third phalanx of this animal was very unique presenting a long triangular shaped bone with a characteristic sharp pointed end. It presented four surfaces including a concave cranio-dorsal surface (for articulation with the second phalanx), lateral, medial and ground surfaces. Each foot presented six (6) sesamoid bones on their volar surface with two sesamoids placed at the metatarsophalangeal and one at the distal interphalangeal joint of each digit



Figure 4: Sitatunga tibia (cranial and caudal views). 1, Lateral condyle; 2, Medial condyle; 3, Tibia tuberosity; 4, Shaft; 5, lateral malleolus; 6, Medial malleolus; 7, Intercondyloid eminence; 8, Intercondyloid fossa; 9, Neck; 10, Popliteal line.



Figure 5: Sitatunga tarsals. 1, Fibula tarsal; 2, Tibia tarsal; 3, Centriquartal; 4, Second and third tarsal fused.



Figure 6: Sitatunga metatarsal (cranial and caudal views). 1, Proximal extremity; 2, Shaft; 3, Metatarsal groove; 4, Nutrient foramen; 5, Lateral condyle; 6, Medial condyle; 7, Intercondyloid groove.



Figure 7: Sitatunga Digits (Dorsal view). 1, First phalanx; 2, Second phalanx; 3, Third phalanx.

DISCUSSION

This Sitatunga (*Tragelaphus spekii*) presented morphological features of its hind limb that appeared very similar to that of other small ruminant species (Sheep and goat). The only peculiar features seen in the Ossa coxarum was the sharp pointed ilio-pubic eminence at the junction between the cranial border of the ilium and pubis; less prominent ischial tuber, inconspicuous ischiatic arch and a large oval obturator foramen.

The prominence of the muscular line (extending from the lesser trochanter, coursing the shaft length to the supracondyloid fossa) and the orientation of the medial condyle obliquely were the two distinguishing differences of the femur compared with what was reported for the domesticated small ruminants (Konig and Liebich, 2004; Dyce, 2010). It was also noted that the length of the animal's femur was longer than what was reported for the sheep and goat (Gamal, 2006).

The Tibia, except for its length was similar to what was found and reported for other species. The Fibula was absent but replaced by a separate Os malleolus distally. This finding was different from what was reported in some breeds of Ox (Budras and Habel, 2003; Ashdown and Done, 2010) and horse (Budras *et al.*, 2009) with rudimentary and incomplete fibula respectively.

The morphology, number and arrangement of the Pes bones with the exception of the distal phalanx were similar to the those reported other domesticated ruminants (Adams and Crabtree, 2012). The unique shape of the distal phalanx suggested its adaptation for locomotion and survival in the swampy rainforest region.

CONCLUSION

This study on the Gross anatomy of the hind limb of the Sitatunga (*Tragelagus spekii*) presented the numerical and morphological information on bones of this

region of this animal highlighting specific features, similarities and differences from other domesticated ruminants.

REFERENCES

1. Adams, B and Crabtree, P. 2012. Comparative Osteology: A laboratory and Field Guide of common North American Animals. Academic press. Oxford, U.K. pp. 156-214
2. Ashdown, R. R and Done, S.H. 2010. Color Atlas of Veterinary Anatomy Vol. 1: The Ruminants. 2nd edition. Mosby Elsevier. Pp. 3, 28.
3. Budras, K. and Habel, R.E. 2003. Bovine Anatomy: An Illustrated text. First edition. Schlutersche GmbH and Co. Hannover, Germany. Pp. 35.
4. Dyce, K.M., Sack, W.O and Wensing, C.J.G. 2010. Text book of Veterinary Anatomy. Saunders Elseviers, St. Lois Missouri. U.S.A. 4th edition. Pp 407-414.
5. Estes, R.D. 2004. The behavior guide to African Mammals: Including hoofed Mammals, Carnivores, and Primates. 4th edition. Berkeley. University of Carlifornia Press. Pp. 175-177.
6. Gamal, E.A. 2006. Atlas Anatomy of Sheep. The Academic Bookshop Egyptian joint stock co. Cairo. Pp. 10-17.
7. Gheorge, M.C. 2001. Guide to regional ruminant Anatomy based on the dissection of the Goat. 1st edition. Wiley-Blackwell.
8. Hussain, M.S. 2010. Essentials of Caprine Anatomy. 1st edition. Faculty of Veterinary Science, University of Agriculture, Faisalabad. Pp.10-22.
9. Konig, H.E and Liebich, H. 2004. Veterinary Anatomy of Domestic mammals: Textbook and colour Atlas. Schattauer, Stuttgart, Germany. Pp. 27-90
10. Liebenberg, L. 2000. A photographic guide to tracks and tracking in southern Africa. Cape town Struik. P.121.
11. McDonald, D. 2001). The new encyclopedia of mammals 2nd edition, Oxford, U.K: Oxford University Press.
12. Popesko, P. 2012. Atlas of Topographical anatomy of the Sheep (Atlas of Topographical anatomy of Domestic Animals). Vydavatelstvo Priroda, s.r.o. Slovakia.
13. Robinchaud, W.G. 2011. Family Bovidae (Sitatunga). In Wilson, D.E and Mittermeier, R.A (eds). Handbook of the Mammals of the world (vol.2). Barcelona, Spain: Lynx Edicions.
14. Rose, P and Robert, R. 2013. Evaluating the activity patterns and enclosure usage of a little studied zoo species, the Sitatunga (*Tragelaphus spekii*). *Journal of Zoo and Acquarium Research*. 1(1).