

Morphology of the Pelvic Limb Bones of the Southern Hairy-nosed Wombat (*Lasiorhinus latifrons*, Owen, 1845)

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With figures 6

received January, accepted January 2023

Abstract

The wombat is a nocturnal marsupial that digs burrows and be active at night. One hind limb skeleton of a hairy-nosed wombat is used for the morphometry and morphological description of this study.

The pelvic bone is 17 cm long and 14 cm wide. The wings of the ilium are parallel to the median plane. The gluteal surface is divided by a ridge into dorsal and lateral parts. The iliac crest is straight. The caput femoris is lower than the trochanter major. The fovea capitis is very shallow and the third trochanter is feeble. The tibia and fibula were two individual bones separated by an interosseous space. There were six ossi tarsi and the pedis was complete with five digits, the hallux (first digit) of which is reduced. The rest four digits each with three phalanges. The distal phalanges were protected with long arched claws. The results were discussed with its relevant in other domestic and wild animals and were supported by six figures. This study provides a basic research data that will be

useful for comparative anatomical studies.

Introduction

The wombat is a nocturnal marsupial that digs burrows and be active at night (Beatty, 1972). It is about 1 meter long from nose to tail, the tail being only a couple of centimeters long. An adult weigh about 25-35 kilograms. Wombats are the largest burrowing mammals. They belong to the Order: Diprotodontia, Suborder: vombati-formes, Family: Vombatidae. They are stocky animals with short, stout limbs, a short neck, a massive broad, dorso-ventrally flattened skull and a large broad sacrum. They are plantigrade with short fore- and hind limbs of approximately equal length (Wells, 1984). The hind legs are week and are rotated inward (pigeon-toed) (San Diego Zoo, Wildlife Alliance Library, 2021)

As there is no precise anatomical description of the musculoskeletal system of the wombat in general and its skeleton in special could be found in the available literatures, this study was

carried out, trying to fill this gap in studying the anatomy of the wombat hind limb skeleton.

Keywords: Hairy-nosed wombat, pelvic limb skeleton, bones

Material and Methods

specimen

A male Southern Hairy-Nosed Wombat (*Lasiorhinus latifrons*) kept in the freezing room in the Discipline of Anatomy and Pathology, School of Veterinary and Biomedical Sciences, James Cook University (JCU), Townsville, Australia was used in this study. After evisceration and dissection for the comparative practical anatomy, the animal bones were cleaned by boiling, de-fattened, bleached and air dried. Then after, the bones of the pelvic limb were described, photographed with a Samsung digital camera (WB700). The results were compared with the relevant other small-sized, domestic and wild animals.

Measurements

The measurements of the different bones of the hind limb were taken using Vernier calipers.

1) Pelvic bone

- a. Length, from proximal surface of the iliac crest to the distal surface of the ischial tuberosity. (17 cm)
- b. Breadth, from the medial surface of the iliac tuberosity to the lateral surface of the iliac process. (14 cm)

2) Femur

- a. Length, from the proximal surface of the head to the distal surface of the medial condyle. (13.3 cm)
- b. Shaft width, at the middle of the femur shaft. (1.5 cm)

3) Tibia

- a. Length, from the proximal surface of the intercondylar eminence to the distal surface of the medial malleolus. (11 cm)
- b. Shaft width, at the middle of the shaft. (14 mm)

4) Fibula

- a. Length, from the proximal surface of the lateral condyle to the distal surface of the lateral malleolus. (11cm)
- b. Shaft width, at the middle of the shaft. (6 mm)

5) Bones of the distal hind limb

Phalanges: Length from proximal to distal extremities.

Terminology used based on Nomina Anatomica Veterinaria published in 2005.

Results and Discussion

Many studies on wild animals were carried out describing the pelvic limbs (on marten by Atalar and Ozdemir, 2002; on otter by Dinc *et al.*, 1999; on wolf and fox by Gyrgyn *et al.*, 1988; on red fox and Golden jackal by Gültekin and Uçar, 1980; on feral pig by Karan, 2012; on badger by Özdemir and Karan, 2001; on squirrel Özdemir and Atalar, 2003 and on Bobcat by Ozgel and Aykut, 2015) however, a study on

the wombat pelvic limb skeleton could not be found in the available literature.

The pelvic bone (Os coxae)

The pelvic bone is 17 cm long and 14 cm wide. The pelvic symphysis is 3.5 cm long. The acetabulum is 3.5 long and 2 cm wide, acetabular fossa is deep and acetabular notch is 1 cm in length. This description is in line of Atalar and Ozdemir, in marten, 2002; Evans and Christensen in dog, (1979); Getty, in domestic animals, (1975). Karan (2012) reported that acetabular notch (incisura acetabuli) was narrow in pigs. Scott and Richardson (1988) mentioned that the mean length of the pelvic bone of wombat is 184.5 mm long and 56.7 mm breadth.

The wings of the ilium are parallel to the median plane. The gluteal surface is divided by a ridge into dorsal part and lateral part. The iliac crest is straight bearing a thick coxal tuberosity (1.8 cm long) and sacral tuberosity which is thin in the middle and thicker at both ends. Ischial tuberosity (2.5 cm long) is low and continues with the straight lesser ischiatic notch, which agrees with Atalar and Ozdemir (2002); Dinç *et al.* (1999) and Özdemir and Atalar (2003). The iliopubic eminences were prominent (project for about 5 mm) as reported by Gültekin and Uçar (1980) and Girgin *et al.* (1988). The cranial border of the pubis bears two facets (1.8 cm long) for articulation with the epipubic bones (fig.1). Scott and Richardson (1988)

mentioned that in the hairy-nosed wombat the iliac crest points laterally and forms sharp angle with body of ilium, the iliopectineal eminence is large and the surface area of the ischiatic table nearly same as obturator foramen. They added that the ischial tuberosity is 20 mm wide.

The epipubic bones of wombat are long is 68 mm long and the articular surface with the pubic bone is 45 mm long and 28 mm wide at its base (fig 2). Scott and Richardson (1988) said that the proximal ventral surface of the epipubic bone is cocave while, Wells (2021) described the epipubic bones of wombat as long and broad.

The femur (Os femoris)

The femur is 13.3 cm long and 1.5 cm wide. The head of the femur is 4 mm lower than the major trochanter. Ozgel and Aykut (2015) reported that the head of the femur was aligned with trochanter major in lynx. On the other hand, Atalar and Ozdemir (2002); Dyce *et al.* (2002); Evans and Christensen (1979); Getty (1975); Gültekin and Uçar (1980); Karan (2012); Özdemir and Atalar, (2003); Özdemir and Karan (2001) and Dinç *et al.* (1999) reported that the head of the femur is located higher than the major trochanter level. The fovea capitis is very shallow. Yilmaz *et al.* (1999) confirmed the absence of the fovea capitis in porcupine. The lesser trochanter (trochanter minor) is a prominent ridge housing a deep elongated trochanteric

fossa (about 3 cm long) on the proximal part of the medial surface of the femur (Fig 3). Medial epicondyle is more prominent than the lateral one. The third trochanter is a feeble projection below the greater trochanter. The third trochanter could not be observed in tree kangaroo (Saber and Kamal, 2019), in porcupine (Özdemir and Yilmaz et al, 1999), in badger (Karan, 2001), in chinchilla (Çevik-Demirkan et. al. 2007), in feral pigs (Karan, 2012), in Bobcat (Ozgel and Aykut, 2015) and in grasscutter (Onwuama, 2017). Moreover, Onwuama et al., (2018) argued the absence of the third trochanter of the grasscutter may confess greater ability to leap (hop), climb and run, escaping predators and other dangers, thereby enhancing survival in the wild. However, the third trochanter was described in rodents (de Araújo et al, 2013 and Brombini et al., 2018) and in hedgehogs (Girgiri et al., 2016 and Özkan, 2002).

The lateral and medial articular surfaces for the sesamoid bones, which is found proximal to the caudal end of lateral condyle in domestic animals (Getty, 1975) was not detected in this study. Similar to the observations of Özdemir and Karan (2001) in badger and Karan (2012) in feral pigs.

Tibia and fibula (Ossa cruris)

Tibia and fibula were fully formed separate bones, articulate with each other through their proximal ends and distal ends leaving a long interosseous

space (spatium interosseum) between them. (Atalar and Özdemir, 2002 in marten; Evans and Christensen, 1979 in dog; Getty, 1975 in domestic animals; Karan, 2012 in feral pig; Özdemir and Karan, 2001 in badger; Özdemir and Atalar, 2003 in squirrel).

The Tibia

The tibia is 11cm long and 14 mm wide (fig 4). Intercondyloid eminence (eminentia intercondylaris) is ill developed. The medial eminence is a little bit higher than the lateral one. Similar to the studies of Dinç *et al.* (1999) in otter, Atalar and Özdemir (2002) in marten, and könig and Liebich in domestic animals (2009). The medial condyle is large and nearly double the area of the lateral one. The cranial border presents a prominent tuberosity above the level of the tibial shaft. The cochlea tibiae is sagittal oriented, which agrees the findings of Evans and Christensen (1979) in dog; Getty (1975) in domestic animals; Karan (2012) in feral pig; Özdemir and Atalar (2003) in squirrel and könig and Liebich (2009) in domestic animals except in horse which is oblique as well as in Bobcat as reported by Ozgel and Aykut, (2015).

The Fibula

The fibula is a long bone (11 cm long, 6 mm wide) consists of Caput fibulae, collum fibulae, corpus fibulae and distal end (malleolus lateralis). The head of the fibula articulates with the lateral condyle of the tibia. The distal end is

larger and articulates with the tibia as well as with the os malleolare (Fig 5).

The fibula of the pig and carnivores has retained its whole length but is reduced in strength and function (König and Liebich, 2009). The same authors mentioned that in ruminants the shaft of the fibula is completely reduced.

Tarsal bones (*Ossa tarsi*)

The proximal row consisted of the calcaneus, the talus. The intermediate row, the central tarsal bone was seen at the distal aspect of the talus and articulates with all tarsal bones except for the calcaneus. The distal row of tarsal bones is in the order of IV, III, I, II according to their sizes (from the biggest to the smallest). Scott and Richardson (1988) compared between two genera of wombats and affirmed considerable variances within each genus and added that there is no diagnostic differences found for the tibiotarsal, fibular tarsal, central tarsal, or for the 1st, 2nd, 3rd, 4th tarsal bones.

Metatarsals

The metatarsals are 8, 20, 23, 24 17 mm long for the first to the fifth one respectively. The fifth metatarsal have a wide proximal end reaching 15 mm in length (Fig 5).

Digits

Wombat have five digits, the first is very small and without claw followed in length by the fifth digit. Its proximal phalanx is 5mm long and the distal one

is 7mm long. The second and third digits are united together in the living animal. The length of the three phalanges of the second digit is 15, 11, 12 mm respectively. While, the length in the third digit is 12, 10, 9 mm and in the fourth digit is 12, 9, 12 mm and in the fifth digit is 11, 7, 12 mm respectively (Fig 6). Each of the digits, except the first one is enclosed in a long-arched claw.

Scott and Richardson (1988) who compared between two wombat genera cleared that there is no morphological differences were observed for the metatarsals and phalanges.

The pes is narrow, slightly rotated inward to give a pigeon-toed stance and the hallux, or first toe (used for grasping in arboreal marsupials), is poorly developed, clawless and is reduced to a small nubbin (Wells, 1984). Digits II and III are syndactylous. (Jones, 1924 and Triggs, 2009).

The pes as well as the manus are plantigrade and bear long flat claws (Wells, 1984). Barbara Triggs (2009) mentioned that the hind feet are longer and narrower, the first, or inner, toe is clawless nub. The other four toes have long sickle-shaped claws, from which the second and third are fused together. Girgiri et al. (2016) mentioned that the first digit (hallux) was absent in the Four-Toed African Hedgehogs while the distal phalanges were equipped with claws.

Acknowledgement

I would like to thank Mrs. Kerry Johns, the technician of the Discipline of Anatomy and Pathology, School of Veterinary and Biomedical Sciences, JCU for her fine work done for preparing the limb skeleton used in this study.

Ethical Standards

The study was conducted in accordance with the Ethics Committee of Jams Cook University, Australia.

Conflict of Interest

The author declare that he has no competing interests.

Financial Support

The current study has not any fund from any organization or institutions.

References

Atalar, O. and Özdemir, D. (2002): Macro-anatomical investigations on the skeletons of Marten (*Martes foina*). II. Ossa membri pelvini. Fırat Univ. Vet. J. Hlth. Sci., 16: 233-236.

Beaty, B. (1972): Unique to Australia. Ure Smith, Sydney.

Brombini, G.C., Rahal, S.C., Schimming, B.C., Santos, I.F.C., Tsunemi, M.H., Mamprim, M.J., Alves, L.S., Filadelpho, A.L. and Teixeira, C.R. (2018): Radio-logical and osteological study of the pelvic limbs in free-ranging

capybaras (*Hydrochoerus hydrochaeris*). Anat. Histol. Embryol.:1-11.

Çalıtılar, T. (1978): Laboratuvar Hayvanları Anatomisi. Fırat Üniv. Vet. Fak. Yay. 14, Ankara Ün. Basyımevi, Ankara, pp. 106- 123.

Cevik-Demirkan, A.; V. Özdemir; I. türkmenoglu; I. Demirkan (2007): Anatomy of the Hind Limb Skeleton of the Chinchilla (*Chinchilla lanigera*). ACTA VET. BRNO 2007, 76: 501-507.

de Araujo F.A.P.; Sesko, N.F.; Rahal, S.C.; et al. (2013): Bone morphology of the hind limbs in two cavio-morph rodents. Anat Histol Embryol. 42,114–123.

Dinç, G.; Aydın, A.; Atalar, Ö. (1999): Macro-anatomical investigations on the skeletons of otter (*Lutra lutra*) II. Ossa membri pelvini. Fırat Üniv. J Health Sci 13: 229-232

Dyce, K.M.; Sack, W.O.; Wensing, C.J.G. (2002): Veterinary Anatomy. WB Saunders Company, Philadelphia, 3: 76-81.

Evans, H.E. and Christensen, G.C., (1979): Miller's anatomy of the dog. Second Edition, W.B. Saunders Company, Philadelphia, pp. 197-222.

Getty, R., (1975): Sisson and Grossman's the anatomy of the domestic animals. Volume 2, Fifth Edition, W.B.

Saunders Company, Philadelphia, pp. 1452-1467.

Girgiri, I.A.; Yahaya, A.; Gambo, B.G.; Majama, Y.B. and Sule, A (2016): Osteomorphology of the Appendicular Skeleton of Four-Toed African Hedgehogs (*Atelerix albiventris*) Part (2): Pelvic Limb. *Global Veterinaria* 16 (5): 413-418, 2016

Gültekin, M. and Uçar, Y. (1980): Yerli tilki (*Canis vulpes*) ve çakal (*Canis sureus*) iskelet kemiklerinin yerli köpeğinkilerine (*Canis familiaris*) göre gösterdikleri makro-anatomik ayrımlar üzerinde araştırmalar. Bölüm 1: Truncus ve membra. *AÜ Vet Fak Dergisi*, 27, 1-2, 201-214.

Gýrgýn, A.; H. Karadad; S. Býlgýç; A. Temýzer (1988): A study on the macro-anatomical differences of the skeletons of wolf and fox as compared with the skeleton of dog. *J. Fac. Vet. Med. Univ. Selçuk*. 4, 169-182.

Jones, F. Wood (1924): The Mammals of South Australia. Part II Government Printer: Adelaide pp. 133-270

Karan, M. (2012): Macro-anatomical study of ossa membri pelvini in the feral pigs (*Sus scrofa*). *Firat Univ Vet J Hlth Sci*. 2012; 26: 31–34.

König, H.E. and Liebich, H-G.(2009): Veterinary anatomy of domestic

mammals. Schattauer GmbH, Stuttgart, Germany

Nomina Anatomica Veterinaria (2005): International Committee on Veterinary Gross Anatomical Nomenclature “, 5th ed., Hannover

Olude M.A.; Olopade J.O.; Mustapha, O.A. (2009): Macro-anatomical investigations of the skeletons of the African giant rat (*Cricetomys gambianus Water-house*): Pelvic limb. *Eur. J. Anat.*, 13: 127-131.

Onwuama, K.T.; Ojo, S.A.; Hambolu, J.O.; Dzenda, T.; Zakari, F.O. and Salami, S.O. (2018): Macro-anatomical and morphometric studies of the hind limb of grasscutter (*Thryonomys swinderianus*, Temminck-1827). *Anat. Histol. Embryol.*; 47: 21-27.

Saber, A.S and Basma, M.K. (2019): Some Morphological and Radiological Studies on The Pelvic Limb Skeleton of Lumholtz Tree-Kangaroo (*Dendrolagus lumholtzii*). *J. Vet. Anat.*, Vol. 12, No.1: 19 - 34.

Scott, G.G. and Richardson, N.C. (1988): Appendicular osteological differences between *Lasiorhinus Latiferons* (Owen, 1845) and *Vombatus ursinus* (Shaw, 1800) (Marsupialia : Vombatidae). *Res.S.Aust.Mus.* 22 (2): 95-102

Triggs, B. (2009): Wombats, 2nd ed., CSIRO publishing, Collingwood VIC 3066, Australia.

Özkan, Z. E. (2002): Macro-anatomical investigations on the skeletons of hedgehog (*Erinaceus europaeus* L.). II. ossa membri pelvini . VETERINARSKI ARHIV 72 (4), 213-220

Özdemir, D. and Atalar Ö. (2003): Macro-anatomical investigations of the skeletons of squirrel (*Sciurus vulgaris*). II. Ossa membri pelvini. Firat Univ. J. Health Sci. 17: 151-154.

Özdemir, D., Karan, M. (2001): Macro-anatomical investigations on the skeletons of badger (*Meles meles*). II. Ossa membri pelvini. Firat Üniv. J Health Sci **15**: 397-400

Ozgel, O. and Aykut, M. (2015): Macro-anatomical Investigation on the Ossa Membri Pelvini of Anatolian Bobcat, *Lynx lynx*. Pakistan J. Zool., vol. 47(5), pp. 1492-1494.

Wells, R.T. (1984): Southern Hairy-nosed Wombat *Lasiorhinus krefftii*. P.120 in Strahan, R. (ed.) The Australian Museum Complete Book of Australian Mammals. The National Photographic Index of Australian Wildlife. Angus & Robertson: Sydney.

Yilmaz S., Dýnç G., Aydin A. (1999): Macro-anatomical investigations on the skeletons of porcupine (*Hystrix cristata*) II. Ossa membri pelvini. Tr. J. Vet. Anim. Sci. 23: 297-300.

<https://ielc.libguides.com/sdzg/fact-sheets/wombats/characteristics>

Wombats (*Vombatus* and *Lasiorhinus* spp.) Fact Sheet: Physical Characteristics

San Diego Zoo, Wildlife Alliance Library (Retrieved on 03/03/2022)

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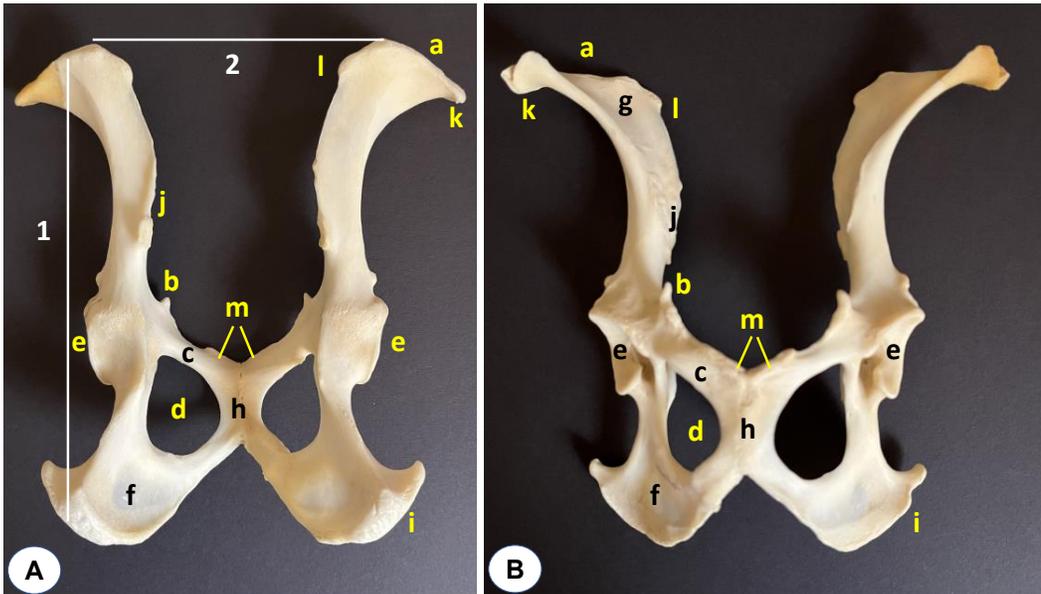


Fig (1): Dorsal view of the os choecosa of wombat (A) and ventral view (B).
 a crista iliaca, b iliopectineal eminence, c os pubis, d foramen obturatum, e Fossa acetabuli, f os ischii, g facies glutea, h symphysis pelvina, i tuber ischiadicum, j auricular surface, k tuber coxae. l tuber sacral. M surfaces for pre-pubic bones. 1 length of pelvis, 2 width of pelvis.

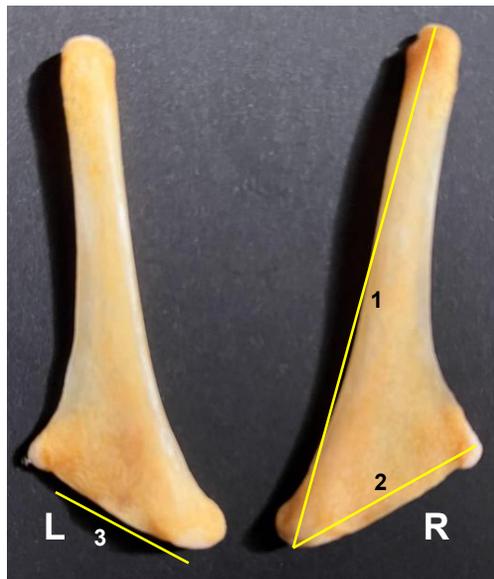


Fig (2): Dorsal view of the epipubic bone of the hairy-nose wombat.
 R right epipubic, L left epipubic. 1 length, 2 width, 3 articular area with the pubic bone.

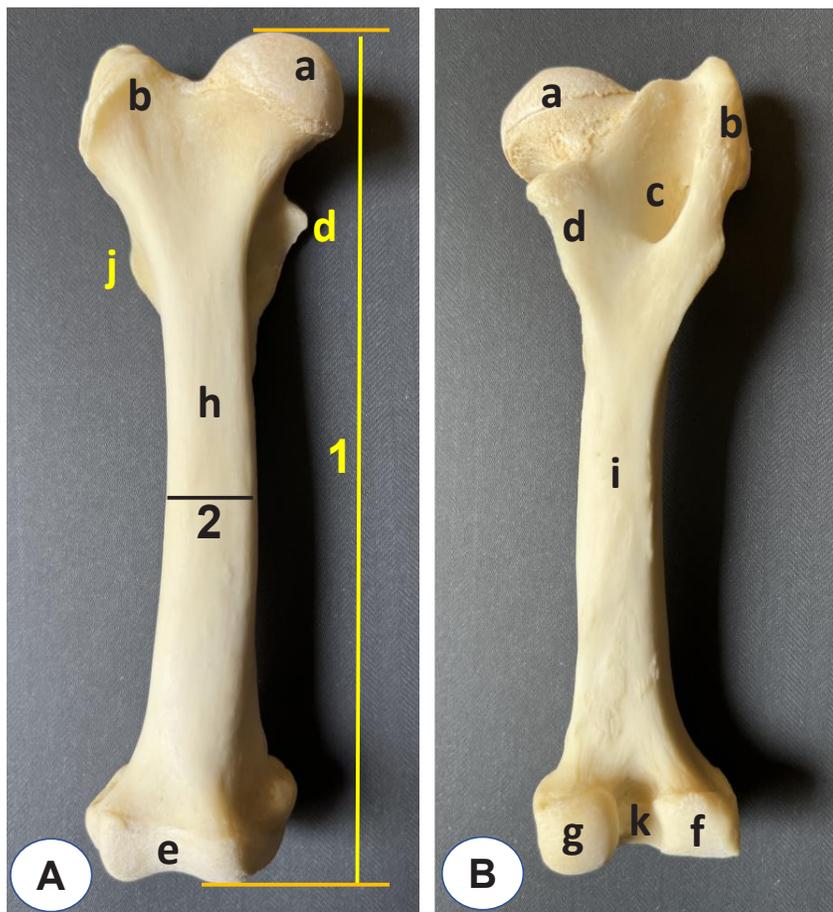


Fig (3): Cranial view of the right femur of wombat (A) and caudal view (B).
 a Caput ossis femoris, b trochanter major c fossa trochantrica, d trochanter minor, e trochlea ossis femoris, f condylus lateralis, f condylus medialis. h facies cranialis, i facies caudalis, j third trochanter, k intercondyloid fossa. 1 length of femur, 2 Width of femur shaft.

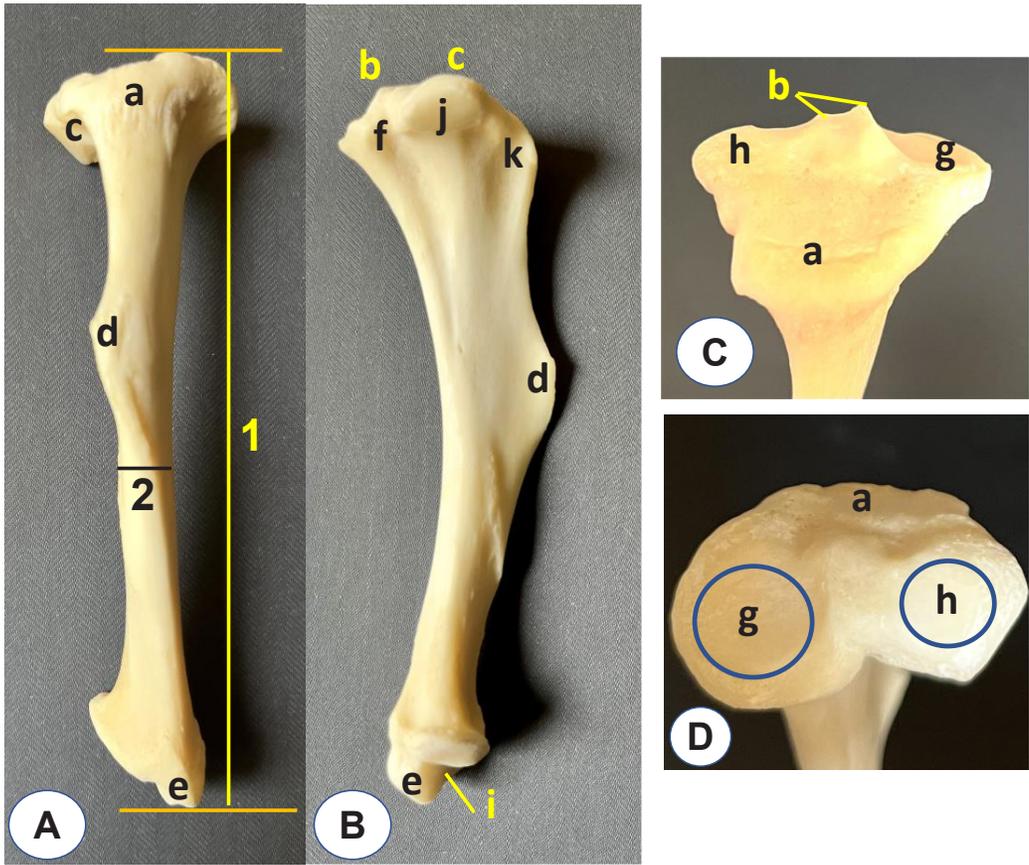


Fig (4): Tibia (A) Cranial view of right tibia; (B) lateral view of right tibia; (C) Dorso-cranial view of the proximal end of tibia, (D) Dorso-caudal view of the proximal end of tibia.

a tibial tuberosity, b intercondylar eminences, c lateral condyle, d tuberosity of the cranial border, e medial malleolus, f popliteal notch, g medial condyle, h lateral condyle, i cochlea, j extensor sulcus, k extensor groove.

1 tibial length, 2 width of tibia.

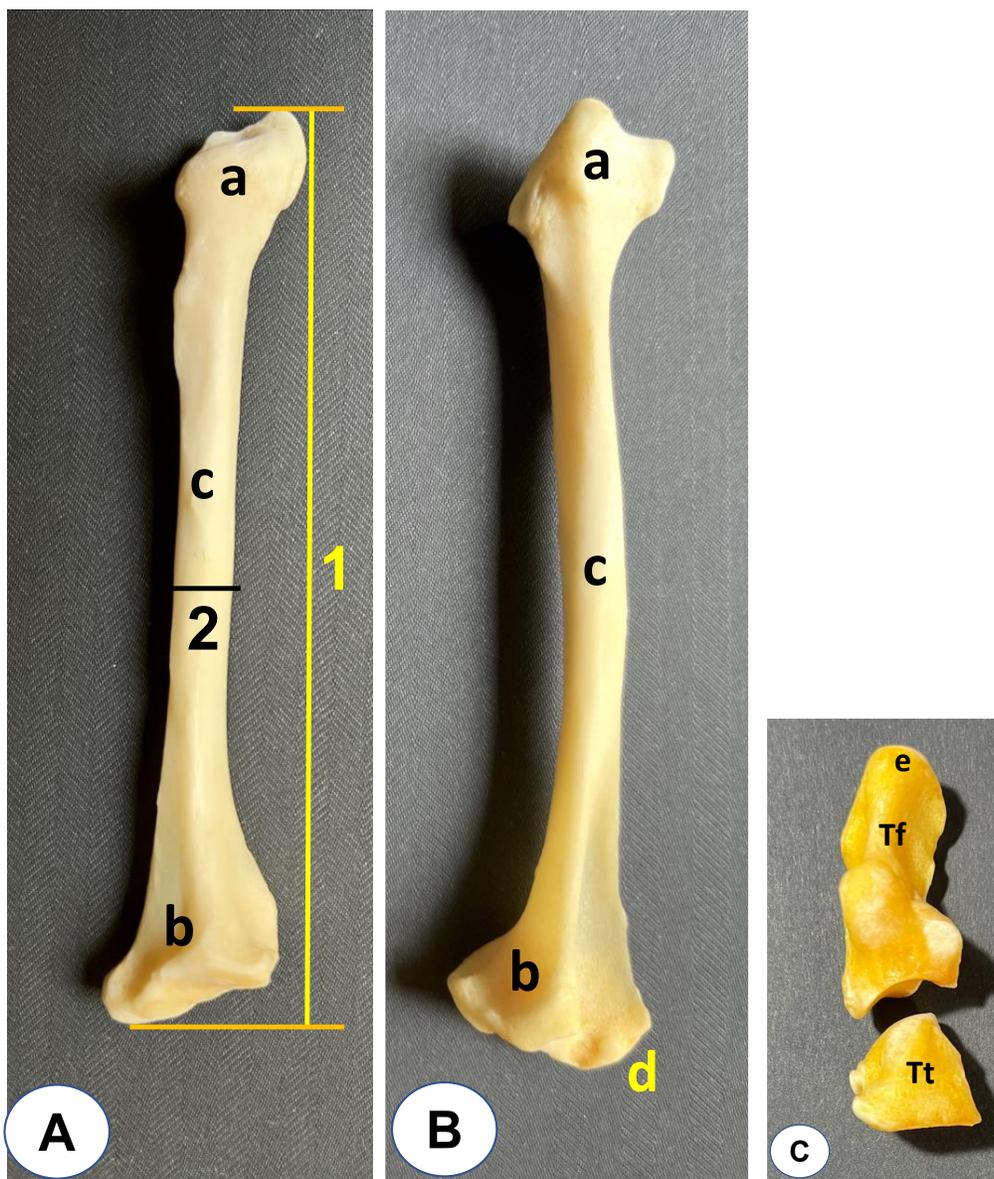


Fig (5): Fibula (Os fibulare) (A) cranial view of right fibula; (B) lateral view of right fibula; (C) proximal row of the tarsal bones.

a proximal end, b distal end, c shaft, d lateral malleolus. 1 length of fibula, 2 width of fibular shaft.

Tt tibial tarsal bone, Tf Fibular tarsal bone, e calcanean tuberosity.

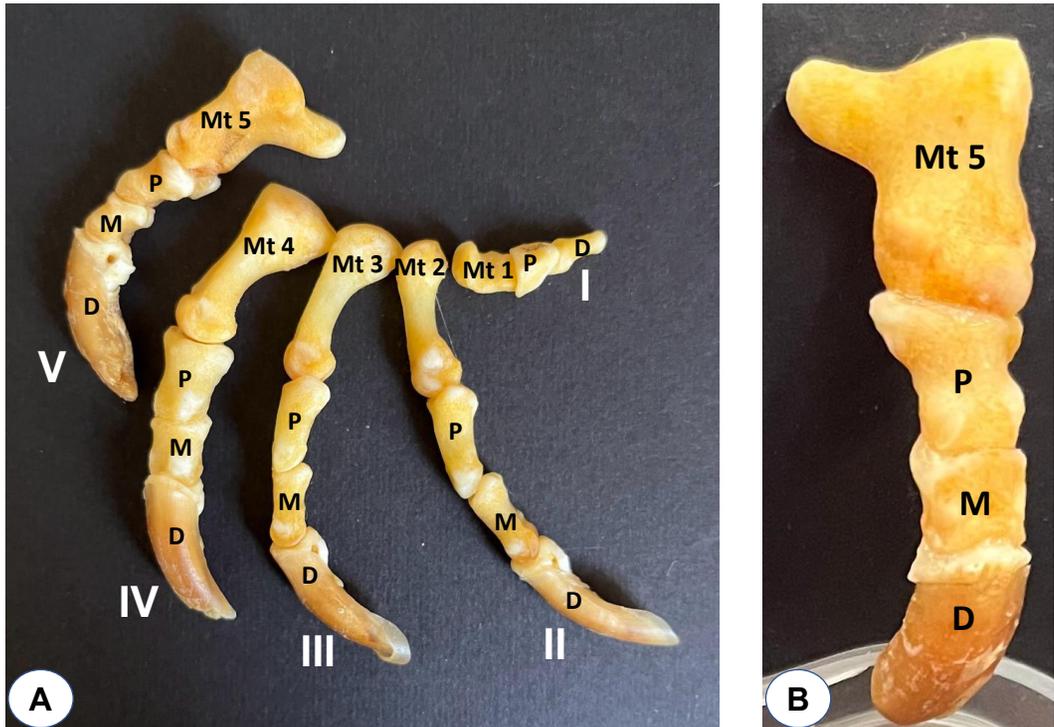


Fig (6): Digits of the right pelvic limb of the wombat, lateral view (A) and the fifth digit, dorsolateral view (B).

Mt metatarsal bone, P proximal phalanx, M middle phalanx, D distal phalanx inside the claws, I, II, III, IV, V number of digits

Animal species in this Issue

Wombat (*Lasiorhinus latifrons*, Owen, 1845)



Kingdom: Animalia & Phylum: Chordata & Class: Mammalia & Infraclass: Marsupialia & Order: Diprotodontia & Superfamily: Vombatoidea & Family: Vombatidae & Genus: *Vombatus* & Species: *V. Lasiorhinus latifrons*,

Wombats are short-legged, muscular quadrupedal marsupials that are native to Australia and are approximately 1 meter (40 in) in length, with short, stubby tails. All are members of the family **Vombatidae**. They are adaptable in habitat tolerance, and are found in forested, mountainous, and heathland areas of south-eastern Australia, including Tasmania, as well as an isolated patch of about 740 acres in Epping Forest National Park in central Queensland.

Wombats are herbivores; their diets consist mostly of grasses, sedges, herbs, bark, and roots. Their incisor teeth somewhat resemble those of rodents (rats, mice, etc.), being adapted for gnawing tough vegetation.

Wombats' fur can vary from a sandy colour to brown, or from grey to black. All three known extant species average around 1 meter in length and weigh between 20 and 35 kg

Female wombats give birth to single young after a gestation period of roughly 20–30 days, which varies between species. All species have well-developed pouches, which the young leave after about six to seven months. Wombats are weaned after 15 months, and are sexually mature at 18 months

Source: Wikipedia, the free encyclopaedia