Introduction: Wild pigs (Sus scrofa), which are found throughout the Caribbean island of Trinidad and Tobago, are sometimes used experimentally, in the field of biomedical science, to model the human anatomy. In particular, the skull, which is very important as it houses vital organs and foramina, has clinical importance in applying regional anesthesia. 

Subjects and Methods: The present work was conducted on two skulls and mandibles of wild pigs to grossly describe their osteology and foramina. The information garnered can be used for comparative studies of the skulls and mandibles with other similar species. The skulls and mandibles were prepared and cleaned using standard method. All of the characteristic features of various standard views of the skulls bones, including dorsal, lateral, caudal, and the lateral, rostral and caudal views of the mandibles as well as the foramina of the skulls and mandibles were described and discussed.

Results: Each skull was divided into long facial and short cranial regions. The tympanic bulla was small. The supraorbital foramina and grooves were present. The zygomatic process of the zygomatic bone and the zygomatic process of the temporal bone formed the large zygomatic arch. The mandible was a paired bone with ossified mandibular symphysis. The dental formula was confirmed and it was 44 teeth.

Conclusion: The bones and foramina of the skull and mandible were homologue to that of other mammals.

Keywords: Anatomy, Skull, Mandible, Wild Pig, Caribbean.
The maxilla was an extensive bone, which formed a considerable part of the lateral wall of the nasal cavity. It consisted of nasal and facial parts. It contained all of the upper check teeth. The facial part had the infraorbital foramen for the transmission of the infraorbital vessels and nerve, the small maxilloincisive foramen and the facial crest which extended caudally onto the zygomatic process and it surrounded the fossa canina in which the muscles of the snout originate. The zygomatic processes of the zygomatic and temporal bones formed the massive zygomatic arch. The arch, which was prominent and projected laterally, gave rise to the frontal process of the zygomatic bone at the dorsal border. The alveolar process of the maxilla bone housed the upper check teeth. There was a projection for the canine tooth, eminentia canina, at the rostral extent of the alveolar process of the maxilla bone. The orbits were small and the caudal aspect of the orbit was open, as the zygomatic process of the frontal bone did not connect with that of the frontal process of the zygomatic bone (Figures 1, 2,3 and 4).

The basicranium was situated between palate, containing the teeth, the maxilla and premaxilla and the main body of the cranium containing the bulla tympanica, the posterior nares of the nasal aperture, the palatine bone, the basal part of the occipital and the root of the paramstoid. The bones of the basicranium were the frontal, parietal, sphenoid, temporal and occipital bones. The palatine bone formed articulated with the ethmoid bone distolaterally and with the vomer bone medially. It presented a horizontal and a perpendicular part. The horizontal lamina, along with the lamina of the opposite side formed the caudal one fourth of the hard palate when fused on the midline. The perpendicular lamina formed the lateral wall of the nasopharynx. It had the pterygoid process. The ethmoid bone continues onto the lateral face of the palatine bone forming the pterygopalatine fossa (Figures 1, 2,3 and 4).

The nuchal crest was broad and prominent. It was the highest part of the skull and formed a part of the occipital bone, which thins laterally and turns downwards to form part of the temporal crest. The temporal crest formed a concave depression caudal to the centre of the nuchal crest in which the foramen magnum with two diverge ridges were located at its base. The paramstoid processes of the wild pig were straight and very long with the hypoglossal foramen caudaoMedially to the root of the paramstoid. The ethmoid bone lay deep within the skull and situated between the cranial and facial parts of the skull (Figures 1, 2, 4 and 5). The dental formula of the upper arcade was 3-1-4-3, with long straight lower incisors and curved upper incisors which allowed a grasping action. The canine root does not close and continues to grow throughout the life. The lower canine rubs against the upper canine, a constant sharpening action that allows the canine to be used in self-defense. The mandible was the largest paired bone with fully ossified mandibular symphysis forming an immovable joint. The mandible was lack of mandibular tuberosity. Each part of the mandible had a ramus and a body. The dorsal border of the mandible housed the dental alveoli for six incisors, two canines, eight premolars and six molars. The ramus had the condylar and coronoid processes along with strongly excavated masseteric fossa. There were two mandibular foramina on the pair of rami of the mandible on the pterygoid fossae, while, laterally, there was a mental foramen on both sides of the body of the mandible (Figures 6, 7 and 8). The dental formula of the wild pig was 44 teeth; Incisor (I) 3/3, Canines (C) 1/1, Premolars (Pm) 4/4, Molar (M) 3/3x 2= 44.
Mohamed; Morphology of Wild Bear Skull

1. Premaxilla; 2. Rostral process of the nasal bone; 3. Nasal bone; 4. Eminentia canina; 5. Upper canine tooth; 6. Preorbital fossa; 7. Supraorbital foramina; 8. Supraorbital grooves; 9. Lacrimal foramina; 10. Frontal process of zygomatic bone; 11. Zygomatic process of frontal bone (Supraorbital process); 12. Zygomatic process of temporal bone; 13. Temporal line; 14. Temporal crest; 15. Nuchal crest; 16. Frontal fossa; 17. Frontal bone; 18. Facial crest; 19. Nasoincisive notch; A. Parietal bone; B. Occipital bone; C. Temporal bone; D. Incisive fissure.

Figure 2: Photograph showing the lateral view of the skull of the wild pig.

Figure 3: Photograph showing the lateral view of the skull of the wild pig.

Figure 4: Photograph showing the lateral view of the skull of the wild pig.

1. Premaxilla; 2. Rostral process of the nasal bone; 3. Nasal bone; 4. Eminentia canina; 5. Upper canine tooth; 6. Preorbital fossa; 10. Frontal process of zygomatic bone; 11. Zygomatic process of frontal bone (Supraorbital process); 17. Frontal bone; 19. Nasoincisive notch; 20. Maxilla; 21. Infraorbital foramen; 22. Lacrimal bone; 23. Lacrimal foramina; 24. Internal opening of supraorbital canal; 25. Zygomatic (Malar) bone; 29. Upper incisor teeth; 30. Upper premolar teeth; 31. Upper molar teeth; 34. Ethmoidal foramen; 35. Optic foramen; 36. Foramen orbitotrochlearis; E. Maxilloincisive foramen; 5. Upper canine tooth; 29. Upper incisor teeth; 30. Upper premolar teeth; 31. Upper molar teeth; 37. Foramen magnum; 38. Occipital condyle; 39. Paracondyloid process; 40. Basilar part of occipital bone; 41. Posterior foramen lacerum; 42. Stylohyoid foramen; 43. Body of sphenoid bone; 44. Temporal condyle; 45. Pterygoid bone; 46. Vomer bone; 47. Choanae (posterior nares); 48. Horizontal process of palatine bone; 49. Major palatine foramen; 50. Palatine groove; 51. Hypoglossal foramen; 52. Bulla tympanica; 53. Anterior foramen lacerum; 54. Hamulus of pterygoid bone; 55. Perpendicular part of palatine bone; 56. Palatine fissure; F. Minor Palatine foramen; G. Alveolar process of maxillary bone; H. Palatine process of incisive bone.
Mohamed; Morphology of Wild Boar Skull

Figure 5: Photograph showing the caudal view of the skull of the wild pig.

15. Nuchal crest; 27. Pterygoid process of palatine bone; 28. Paracondylar process; 37. Foramen magnum; 38. Occipital condyle; 39. Paracondyloid process; 57. Nuchal tubercle; 58. Occipital fossa.

Figure 6: Photograph showing the lateral view of the mandible of the wild pig.

59. Condylar process; 60. Coronoid process; 61. Mandibular notch; 62. Masseteric fossa; 63. Ramus of the mandible; 64. Mental foramen; 65. Molar teeth; 66. Premolar teeth; 67. Upper canine tooth; 68. Upper incisor teeth.

Figure 7: Photograph showing the caudal view of the mandible of the wild pig.

59. Condylar process; 60. Coronoid process; 61. Mandibular notch; 69. Mandibular foramen; 70. Body of the mandible.

Figure 8: Photograph showing the rostral view of the mandible of the wild pig.

67. Lower canine tooth; 86. Lower incisor teeth (I1, I2, I3); 70. Body of the mandible.

Discussion

Literature on the gross description of the osteology of the skull and mandible of the wild boar in the Caribbean was limited. However, the description of the skull of the wild boar of Mizoram[8] and the mandible of the local pig of Mizoram[9] were available. In this study, the skull was wide at the level of the zygomatic arch and narrow at the level of the temporal fossa as mentioned in the dum pigs.[10] The supraorbital foramina and supraorbital grooves were present in the skull of the wild boar; a similar result was noticed in the wild boar of Mizoram[8] and in the pygmy pig.[11] The supraorbital foramina were present in the skull of the wild boar; a similar result was noticed in the wild boar of Mizoram[8] and in the pygmy pig.[11] The supraorbital foramina were present in the skull of the wild boar; a similar result was noticed in the wild boar of Mizoram[8] and in the pygmy pig.[11] The supraorbital foramina were present in the skull of the wild boar; a similar result was noticed in the wild boar of Mizoram[8] and in the pygmy pig.[11] The supraorbital foramina were present in the skull of the wild boar; a similar result was noticed in the wild boar of Mizoram[8] and in the pygmy pig.[11] The supraorbital foramina were present in the skull of the wild boar; a similar result was noticed in the wild boar of Mizoram[8] and in the pygmy pig.[11] The supraorbital foramina were present in the skull of the wild boar; a similar result was noticed in the wild boar of Mizoram[8] and in the pygmy pig.[11] The supraorbital foramina were present in the skull of the wild boar; a similar result was noticed in the wild boar of Mizoram[8] and in the pygmy pig.[11] The supraorbital foramina were present in the skull of the wild boar; a similar result was noticed in the wild boar of Mizoram[8] and in the pygmy pig.[11] The supraorbital foramina were present in the skull of the wild boar; a similar result was noticed in the wild boar of Mizoram[8] and in the pygmy pig.[11] The supraorbital foramina were present in the skull of the wild boar; a similar result was noticed in the wild boar of Mizoram[8] and in the pygmy pig.[11] The supraorbital foramina were present in the skull of the wild boar; a similar result was noticed in the wild boar of Mizoram[8] and in the pygmy pig.[11]
the zygomatic bone to the zygomatic process of the frontal bone. Moreover, the orbital rim showed two lacrimal foramina, optic foramen, foramen orbitotorundum, ethmoidal foramen and internal opening of the supraorbital canal. Similar findings were reported in the wild boar of Mizoram and in domestic animals. The skull had the large maxillary foramen which leads to a short wide infraorbital canal, the large sphenopalatine foramen and the small caudal palatine foramen; similar findings were reported in the wild boar of Mizoram. Moreover, the facial crest was short, sharp and prominent showing the deep periorbital fossa; similar findings were reported in the wild boar of Mizoram. However, the facial crest was less distinct in pig. The upper canine teeth curves and on the maxilla there is an enlargement, caused by its root, known as eminentia canina; similar findings were reported in the wild boar of Mizoram and in domestic animals. The tympanic bulla was small in the wild pig; similar result was observed in the wild boar of Mizoram and in the domestic animals. Moreover, due to the absence of the styloid process in the skull of the present as mentioned in the skull of the wild pig of Mizoram and in the skull of domestic animals, the hyoid apparatus articulated with the nuchal process. This investigation recorded that the upper dental formula of the wild pig is similar to that of the wild boar of Mizoram and domestic animals. Similarly, also, the alveolar process of the incisive bone carried the three dental alveoli for the upper incisor teeth, while the alveolar process of the maxilla carried the dental alveoli for the upper canine, four premolars and three molars. On the dorsal aspect, the nuchal crest of the skull of the wild pig was prominent and showed central tubercle and thickened lateral extremities and the deep occipital fossa had a triangular shape, similar result was recorded in the skull of the wild boar of Mizoram and in the dum pig of Assam. Moreover, there was no external occipital protrusion in domestic pigs, while it was a rough elongated ridge in the centre of the occipital fossa in the wild boar of Mizoram. In the skull of the wild pig, the mandible was the largest bone; similar result was noticed in the local pig of Mizoram in the ox and in the horse. Furthermore, the mandible consisted of two parts that were connected firmly at the mandibular symphysis, as mentioned in the local pig of Mizoram in the dog and in the chital. The mandible of the wild pig carried the dental alveoli for upper six incisors, two canines, eight premolars and six molars; similar result is noticed in the local pig of Mizoram. The present investigation records that each part of the part contained one mental foramen correspond to that of the yak and chital. However, it has two mental foramina in the local pig of Mizoram.

**Conclusion**

The description of the foramina and bones of the skull and mandible of the wild pig was recorded. There were many similarities between the osteology and foramina of the skull and mandible of the wild pig from the Caribbean island of Trinidad and Tobago and that of other mammals. Moreover, this study can be of great importance in taxonomic affiliation of the skull and mandible of the wild pig and can make way for future studies in functional and comparative anatomy.

**References**

1. Rothschild MF. Porcine genomics delivers new tools and results: This little piggy did more than just go to market. Genetics Research. 2004; 83: 1-6.
2. Stembierek J, Kyllar M, Putnová I, Stehlik L and Buchtová M. The pig as an experimental model for clinical craniofacial research. Laboratory Animals. 2012; 46: 269-279.
3. Dyce KM, Sack WO, WensingCIG. Textbook of veterinary Anaesthesia and Analgesia. 3rdedn. WB Saunders, Philadelphia; 2002.
4. Hall, L., Clarke, K.W., Trim, C.M. Wright s Veterinary Anaesthesia and Analgesia. 10thedn. ELBS and BailliereTindall, London; 2001.
5. Olópade JO. The morphometry of the craniofacial and maxillofacial regions of the West African Dwarf Goats (Capra hircus). M. Sc. thesis, Department of Veterinary Anatomy, University of Ibadan, Ibadan, Nigeria; 2003.
6. Hildebrand M. Anatomical preparations. University of California Press. Berkely and los Angeles, California; 1968.
7. International Committee on Veterinary Gross Anatomical Nomenclature. Nomina Anatomica Veterinaria, 5th ed.; World Association on Veterinary Anatomist: Knoxville, TN, USA; 2012.
8. Dooley PJ, Kalita PC, Kalita A, Choudhary OP and Das H. Morphological Study on the Skull of Wild Boar of Mizoram (Sus scrofa). International Journal of Livestock Research. 2018; 8 (6): 185-193.
9. Choudhary OP, Kalita PC, Dooley PJ and Kalita A. Morphological Studies on the Mandible of Local Pig (Zovawk) of Mizoram (Short communication). Journal of Animal Research. 2018; 8 (4): 919-922.
10. Sarma K and Sarma M. Anatomy of the skull of dum pig of Assam. Indian Veterinary Journal. 2002; 79 708-711.
11. Kalita PC, Deka A, Kalita A, Dooley PJ and Das BJ. Morphology of the skull of Pygmy Hog (Porculusalvianus)- A Forensic Approach. IOSR Journal of Agriculture and Veterinary Science. 2015; 8 (1): 23-26.
12. Nickell R, Schumnn A and Seiferle E. Viscera of the Domestic Animals. Vol. 2, Verlog Paul Parey, Hanburg; 1981.
13. Konig H E and Liebich H G. Veterinary Anatomy of Domestic Mammals Textbook and Colour Atlas. Schattauer GmbH, Stuttgart, Germany; 2009.
14. Raghavan D. Anatomy of ox, Indian Council of Agricultural Research, New Delhi; 1964.
15. Getty R. The Anatomy of the Domestic Animals. Vol. I, 5th edn. W.B. Saunders’ Company, Philadelphia; 1975.
16. Miller ME, Christensen GC and Evans HE. Anatomy of the Dog. W.B. Saunders’ Company, Philadelphia; 1964.
17. Kumawat R, Mathur R, Joshi S and Choudhary OP. Gross morphological studies on mandible of Indian blackbuck (Axis axis). Ind. Vet. J. 2014; 91(9): 105-107.
18. Archana, Sudhakar LS and Sharma DN. Anatomy of the mandible of yak (Bosgrunniiens). Indian J. Vet. Anat. 1998; 10(1/2):16-20.
