The Indian Journal of Veterinary Sciences & Biotechnology ***(2017) Volume 13, Issue 1, 17-21***
ISSN (Print) : 2394-0247 : ISSN (Print and online) : 2395-1176, abbreviated as IJVSBT
***http*://dx.doi.org/10.21887/ijvsbt.v13i01.8727**

Submitted : 20-03-2017 ***Accepted : 29-03-2017*** ***Published : 16-08-2017***

Morphology and Morphometry of Mandible of Stripped Hyena (*Hyena hyena*)

Sweta Pandya*, D.M. Bhayani and Y.L. Vyas

Department of Anatomy, College of Veterinary Science & Animal Husbandry

Anand Agricultural University, Anand-388 001, India

Corresponding Author: drsweta26@gmail.com

Abstract

The morphological and morphometrical study of mandibles of hyena was carried out at Sakkarbaug Zoo, Junagadh (Gujarat). The average weight, length and width of mandible was 0.221 kg, 14.25 cm and 1.84 cm, respectively. The mandible was formed by two symmetrical halves fused rostrally by symphysis. The average length of symphysis mandibularis was 4.75 cm. The alveolar border presented six alveoli for lower incisors, two large deep alveoli for canine teeth, three alveoli for premolars and one for molar teeth. The diastemal mandibular length was 2.69 cm. The mental foramen was one. The mandibular height up to condylar and coronoid processes were 9.16 and 6.74 cm, respectively. The distance of mandibular foramen from posterior border was 3.22 cm. The angular process was placed at caudal border of horizontal ramus and found pointed and laterally curved. The average length of angular process was 1.23 cm.

Key Words: Mandible, Morphometry, Hyena, Diastemal length, Angular process.

Introduction

The family hyenidae includes three sub-species of hyenas, which are the spotted hyenas, the stripped hyenas and the brown hyenas. They are recognized as aggressive, highly efficient killers and ruthless scavengers. They are also socially well organized and able hunters of live prey. Their hunting and killing techniques are just as effective as those of the big cats and may be more efficient. The hyenas are capable of cracking open the hard bones as thick as the thigh bone of a Zebra; for they have small but very strong jaws set with incredibly robust teeth (Woodward, 1988). Vey meager information is available on morphology as well as morphometry of mandible of hyena. Present study was carried out on mandible of stripped hyenas from the Gir Sanctuary and National Park. This work will help in establishing basic data bank and will also fulfill the need for authentic references in proceedings in the courts of law.

Materials and Methods

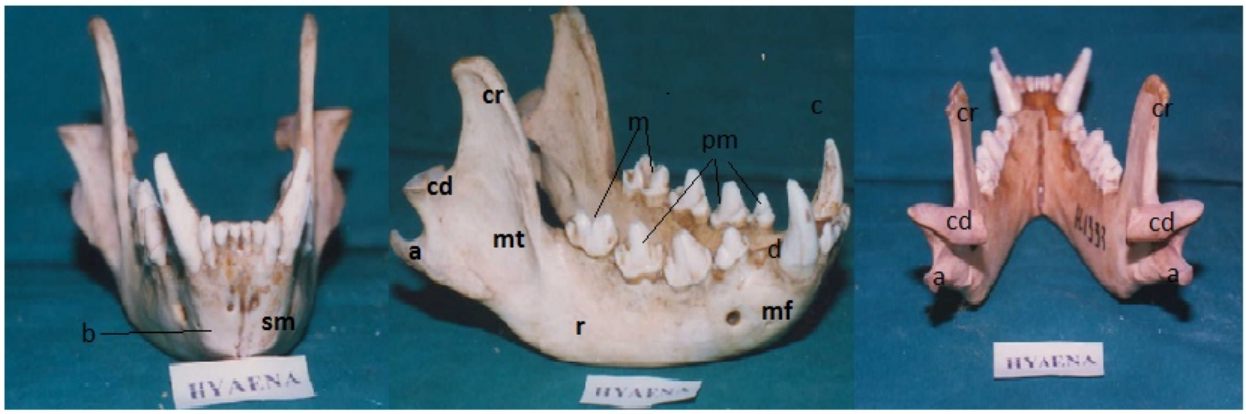
The present study was undertaken at the Sakkarbaug Zoo, Junagadh, with the prior permission of Chief Conservator of Forest, Government of Gujarat, Gandhinagar. The skulls of various wild animals were preserved after maceration. The skulls of hyena so preserved, were used for present study. However, the age and sex of majority of skulls could not be known. The morphological and

morphmetrical studies on various parameters were made on 6 mandibles of hyena. The measurement like length, width, height, thickness and distance of foramina were taken with digital Vernier calipers, thread and scale. The weight of mandible was taken on top pan balance. The data were analyzed as per standard statistical procedures (Snedecor and Cochran, 1994).

Result and Discussion

The mandible was the largest and strongest bone of skull. The morphology and measurements of various parameters of mandible of stripped hyena are presented in Figure 1 and Table 1.

Fig:1 Showing rostral,lateral and caudal view of mandible of Stripped hyena



b-body of mandible,r-ramus, sm-symphysis mendibularis,mf-Mental foramen, mt-massertric fossa ,mn-mendibular foramen, cr-coronoid process,cd condyloid process,a-angular process,i-incissors,c-canine,pm-premolars,m-molars,ds-diastema.

Table 1: Measurements of various parameters of mandibles of stripped hyena

No.	Parameter	Measurement	CV %
1	Mandibular weight (kg)	0.221 ± 0.16	18.13
2	Mandibular length (cm)	14.24 ± 0.31	5.38
3	Mandibular width (cm)	1.84 ± 0.05	7.54
4	Length of symphysis mandibularis ventral aspect (cm)	4.75 ± 0.20	10.46
5	Distance between inner surface of mandibular ramus (cm)	7.23 ± 0.19	6.62
6	Diastemal length (cm)	2.69 ± 0.31	11.81
7	Length of mandibularcondyle (cm)	3.25 ± 0.16	12.35
8	Mandibular height up to condylar process (cm)	2.65 ± 0.14	12.41
9	Mandibular height up to coronoid process (cm)	6.74 ± 0.18	6.65
10	Distance of mandibular foramen from caudal border (cm)	3.22 ± 0.11	8.41
11	Length of angular process (cm)	1.23 ± 0.06	12.77

Weight and Length

The average weight of the mandible was 0.221 kg in hyena which is lower than that documented for tiger (0.466 kg), as well as lion (0.338 kg) and tiger (0.271 kg) (Pandit, 1994 and Sweta *et al.*, 2016). However, it is more than that of the leopard (0.145 kg, Sweta *et al.*, 2016). The average length of mandible of hyena was 14.24 cm, while width of body of mandible was 1.84 cm. This length was lower than that reported in tiger (18.00 cm, Malik *et al.,* 1988) and in lion and tiger (19.08 & 17.40 cm, resp., Kalita *et al.,* 2000), but was comparable to leopard (13.54 cm, Kalita *et al.* (2000).

Body

The mandible had a body and two ramus. The body (Fig.1) was thick and very strong with lingual and labial surfaces and the alveolar border. The lingual surface was smooth and slightly concave. The labial surface was found more extensive than the lingual surface. The bony protruding ridge of the alveolar border was absent in hyenas. The alveolar border bore six alveoli for lower incisors. There were 3 pairs of incisors; the central, the middle and the corner. The size of alveoli increased from center to corner pair of incisors. There were two large deep alveoli at corner for lower canine teeth, which were placed obliquely outward in direction. These findings are in agreement with Pandit (1994) and Ishwarsingh (1997) in tiger; Ray *et al.* (1997), Meena *et al.* (2011) and Sreeranjini *et al.* (2012) in leopard, as well as with Sweta *et al.* (2016) in all three pantherines. The later authors also found presence of bony protruding ridge of alveolar border in pantherines.

Diastemal length

A diastema is a space between two teeth. In hyena the space was present between canine and first premolar tooth. It ranged from 2.03 to 2.93 cm. Sweta *et al.* (2016) reported diastemal in the range of 4.18 to 6.05, 3.63 to 5.20, and 2.60 to 3.45 cm in lion, tiger and leopard. Miller *et al*. (1964) reported that the free dorsal border between canine and 1st premolar is larger in dog and is called interalveolar margin. However, Ray *et al.* (2000) observed short interalveolar space in leopard.

Symphysis mandibularis

The mandible consisted of two symmetrical halves fused together rostrally and formed symphysis mandibularis joint, which was found an unossified. In present study, the length of symphysis mandibularis at ventral aspect ranged from 4.0 to 5.25 cm with an average of 4.75 cm. More or less similar values were reported by Ishwarsingh (1997) and Pandit (1994) in tiger (5 to 6 cm) and Sweta *et al.* (2016) in lion (6.58 cm), tiger (6.68 cm) and leopard (4.47 cm).

Mental foramina

The lateral surface of ramus at the cranial end presents only one mental foramen below the 1st premolar tooth. Miller *et al*. (1964) in dog, and Malik *et al.* (1988), Pandit (1994) and Ishwarsingh (1997) in tiger reported three mental foramina; anterior, middle and posterior. The middle one is larger compared to other two. Ray *et al.* (1997) and Meena *et al.* (2011) reported one large and one small mental foramen placed one behind the other in leopard, while Sweta *et al.* (2016) reported three mental foramina in tiger and two in lion and leopard. The rostral foramen were found larger placed below the interdental space, whereas the caudal foramen were just below the 1st premolar tooth in all three pantherines.

Ramus

The right and left rami were placed in a manner forming 'V' shaped inter mandibular space and formed angle of divergence. The average inter mandibular space in hyena was 7.23 cm with the range of 6.66 to 7.64 cm. Sweta *et al.* (2016) reported the average distance of 10.41, 10.24 and 7.04 cm in lion, tiger and leopard, respectively. The mandible contained only horizontal ramus which ended into coronoid, condyloid and angular processes giving no visual appearance of vertical ramus and hence of the angle of jaw. This was in agreement with Miller (1964) in dog; Malik *et al.* (1988), Pandit (1994) and Ishwarsingh (1997) in tiger, and Sweta *et al.* (2016) in all three pantherines. The horizontal ramus (Fig.1) showed two borders; dorsal and ventral and two surfaces; lateral and medial. The dorsal border was found concave in shape and bore alveoli for cheek teeth. There were three alveoli for premolars and one for molar in hyenas. These findings were however not in agreement with other authors, as they observed two alveoli for premolars and one for molar in all pantherines. In hyenas, the ventral border was thick, which gradually raised upward caudally and gave concave shape to this border. However in pantherines, the ventral border was thick,

rounded and remained in touch with ground throughout its length when rested on flat surface. Malik *et al.* (1988) observed straight ventral border in tiger when laid on a flat surface. Again the findings of present study were in agreement with Ray *et al.* (1997) in leopard and Sweta *et al*. (2016) in pantherines.

Mandibular foramen

The single large mandibular foramen was found on medial surface caudal to the alveolar border of ramus. Just below the mandibular foramen a rough ridge was present which extended up to the angular process. Distance of mandibular foramen from caudal border was 3.22 cm in hyena. Pandit (1994) and Kalita *et al.* (2000) reported 4.0 to 5.0 cm and 2.3 to 2.7 cm of distance in tiger, while Ray *et.al.* (1997) and Sreeranjini *et al.* (2012) reported 2.5 cm and 2.0 cm distance rostral to caudal border in leopard. Sweta *et al.* (2016) measured this distance as 5.2 cm in lion, 4.65 cm in tiger and 3.45 cm in leopard.

Masseteric fossa

Masseteric fossa was the rough triangular fossa located on lateral surface of ramus which was bounded by dorsal and ventral ridges. Malik *et al.* (1988) and Pandit (1994) in tiger as well as Meena *et al.* (2011) and Sreeranjini *et al.* (2012) in leopard also observed deep and extensive massateric fossa. Sweta *et al.* (2016) found more deeper masseteric fossa in all three pantherines. The three prominent processes, viz., coronoid, condylar and angular were found at caudal aspect of ramus.

Condylar process

The condylar process was smooth transversely elongated articular process which formed tempero-mandibular joint. It was thick medially and thin and pointed laterally located at the level of alveolar border of the ramus and measured 3.25 cm in length and 2.65 cm in height. Sweta *et al.* (2016) reported average length and height of condylar process as 3.50 cm and 3.04 cm, respectively, in leopard which is similar to hyena in present study. The findings of Pandit (1994) and Ishwersingh (1997) in tiger and Ray *et al.* (1997) and Sreeranjini *et al.* (2012) in leopard were also more or less similar to present findings.

Coronoid process

The coronoid process was located most dorsal to the caudal end. The rostral border was thick while caudal border was thin. More or less similar observations were made by Pandit (1994) and Ishwersingh (1997) in tiger; Ray *et al.* (1997), Meena *et al*. (2011) and Sreeranjini *et al.* (2012) in leopard, and Sweta *et al.* (2016) in all pantherines. The average height of mandible upto coronoid process was 6.74 cm in hyena, which is in agreement with that of Kalita *et al.* (2000) in Indian leopard (5.6 to 6.3 cm). However, Sweta *et al.* (2016) reported 9.26, 9.14 and 7.14 cm height in lion, tiger and leopard, respectively, which is more than that of hyena.

Angular Process

The angular process was very well developed and was placed caudally below the condylar process. The process was pointed and curved laterally. Malik *et al.* (1988), Pandit (1994) and Ishwarsingh (1997) in tiger as well as Ray *et al.* (1997), Meena *et al.* (2011) and Sreeranjini *et al*. (2012) in leopard made similar observations. The average length of angular process was 1.23 cm in hyena. Similarly, Sweta *et al*. (2016) reported average length of angular process as 1.56, 1.28 and 0.92 cm in lion, tiger and leopard, respectively. The processes were pointed and curved medially.

Acknowledgment

The authors are thankful to the Chief Conservator of Forest, Government of Gujarat, Gandhinagar for permission granted and the Dean, College of Veterinary Science & AH, AAU, Anand, and Zoo Superintendent, Sakkarbaug Zoo, Junagadh, Gujarat for providing all the facilities and cooperation to carry out this study.

Conflict of Interest: All authors declare no conflict of interest.

References:

Ishwar Singh (1997). Anatomical studies on the skull of tiger. *Indian J. Anim. Sci.,* **67**(9): 777-778.

Kalita, A., Sarma, M. and Sarma, K.K. (2000). Anatomy of the mandible of Indian leopard (*Panthera pardus*). Paper presented at *XV Convention of Indian Association of Veterinary Anatomist and National Symp.* held during 23-25 December at Veterinary College, Chennai, India.

Malik, M.R., Shrivastava, A.M. and Lt Col Parmar, B.S. (1988). Biometry of tiger skull. *J. Remount and Vet. Corps,* **88**(9): 159-162.

Meena Mrigesh, Mansi Shukla, Aditya Kumar and Arora, B.M. (2011). Morphology of the skull and mandible of Leopard Cat. Pantnagar J. Res., **9**(1): 109-110.

Miller, M.E., Christensen, G.C. and Evans, H.E. (1964). Anatomy of the dog. *In "The Skeletal System",* pp. 6-48. W.B. Sounders Company, Philadelphia, USA.

Pandit, R.V. (1994). Osteology of Indian Tiger (*Panthera tigris tigris*). *Technical Bulletin No. VI.* Published by the Conservator of Forest and Director, Project Tiger Melghat, Amraravati-444 602, Maharashtra, India.

Ray, S., Dutta, G.K. and Ray, M. (1997). Anatomy of leopard (*Panthera pardus*). *Indian Vet. J.,* **74**(9): 765-767.

Sreeranjini, A.R., Rajani, C.V., Indu, V.R. and Ashok, N. (2012). Morphology and morphometry of the mandible of Leopard (*Panthera pardus*). *Indian Vet. J.,* **89**(2): 52-53.

Sweta Pandya, Bhayani, D.M. and Vyas, Y.L. (2016). Morphology and morphometric study of mandible of Asiatic lion (*Panthera leo*), Indian tiger (*Panthera trigris*) and common leopard (*Panthera pardus*). *Indian J. Vet. Sci. & Biotech*., **12**(1): 18-23.

Snedecor, G.W. and Cochran W.G. (1994). *Statistical Methods*. Oxford and IBH Publishing Co., Bombay, India.

Woodward, J. (1988). *The Illustrated Encyclopedia of Wild Life*. Volume III, pp. 121-160. Orbis Publishing Ltd., Griffin house, London W 6 8SD.

❑