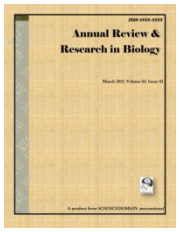

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Biometry of Mandible in Tiger (*Panthera tigris*)

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Research Article

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ABSTRACT

The jaw of tiger (*Panthera tigris)* is derived for predation with powerful killing bites. They use large canine in a shearing bite to the throat of prey for severing nerves and blood vessels causing rapid collapse. The present study was proposed to keep on record the gross anatomical features of mandible of tiger. Gross anatomical study was conducted on mandibles of 3 adult tigers (age more than 8 years) of either sex. It was found that the mandible was the largest and thickest bone of the skull weighing 350.9gm. It forms the lower jaw in tiger. The mandible was formed of 2 halves which were symmetrical to each other and were fused rostrally by symphysis. Each half was consisted of one horizontal rod like part, it was flattened mediolaterally and thicker anteriorly. The other part was vertical, short plate like dorsal border of symphysis was bearing alveoli for teeth. The alveoli of each corner were larger for canine and medial to this 3 small alveoli were present on each side for incisors. The dorsal border of horizontal part of mandible was having 3 alveoli for only 3 cheek teeth on each side. The mandibular and mental foramina were large. It can be stated from the present study that the mandible of tiger can be differentiated on gross morphological and morphometrical parameters with leopard by presence of 3 incisor teeth and more prominent angle of mandible.

Keywords: Panthera tigris, mandible, predation, symphysis, canine, cheek teeth;

1. INTRODUCTION

The tiger is the national animal of India. It is necessary to know about tiger's anatomy, so that it can be applied as a tool for identification, as information in tiger for monitoring its treatment and protection to save our environment. Tiger forms the apex of the pyramid of food chain. As we all know that due to excessive poaching and lack of sufficient knowledge

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and proper monitoring system, the tiger became an endangered species. Tiger is the important component of environment and our ecosystem can get imbalance. Osteological studies were conducted on skeleton of leopard by Kale et al. (1999), Podhade (2007) and Kumar (2008). In feline, Evans (1964) and in canine Getty (1975) gave some morphological features of bones. Patil et al. (2000) and Pandey et al. (2004) reported some osteological features in panther and Asiatic lion, respectively.

Walker et al. (2000) and Kirberger et al. (2005) reported radiographic features of bones in lion and Kunzel et al. (1999) in leopard and cheetah. Since systematic information on characteristic features of bones in tiger is meager, hence, it is difficult to distinguishing between the skeleton of a tiger and that of a lion; the two cats are so similar in size and shape that they are hard to tell apart.

An understanding of the tiger's hunting habits and daily behaviors illuminates the striking features of its skeleton - that enables it to endure the vastly different rigors of both speed and strength.

Hence the present study was proposed to keep on record the gross anatomical features of mandible of tiger (*Panthera tigris)*. The information obtained in the present study would be useful for identification of bones of tiger and also as an aid in wildlife forensic.

2. MATERIALS AND METHODS

2.1 PLACE OF STUDY

The work was conducted in the Department of Veterinary Anatomy and Histology, College of Veterinary Science and Animal Husbandry, M.P.P.C.V.V., Jabalpur, (M.P.), India.

2.2 STUDY ANIMALS

Gross anatomical study was conducted on mandibles of 3 adult tigers (age more than 8 years) of either sex procured from Department of Anatomy / Wildlife Health and Management, College of veterinary science and animal husbandry. M.P.P.C.V.V., Jabalpur, (M.P.), India.

2.3 TECHNICAL PROGRAMME

2.3.1 MENSURATION

The various parameters of mandible of tiger were recorded with the help of Vernier caliper/ thread / scale in centimeter. Weight was taken with the help of electronic balance.

The salient comparative anatomical features of the bone were also studied.

Table. 1. Different Parameters taken under study

Sr. No.	Parameters
1	Weight of the mandible by electronic balance.
2	Greatest linear length, width, thickness and height of the mandible.
3	Length, width and thickness of the body of mandible.
4	Height, width and thickness of vertical ramus.
5	Length and width of horizontal ramus.
6	Greatest length and width of mandibular space.
7	Height and width of coronoid process.
8	Rostrocaudal (longitudinal) and Transverse diameter of the mandibular condyle.

3. RESULTS

The lower jaw of tiger was formed by only single bone that was the mandible. As described by evans and cristensen (1964) in dog and Pandit (1994) in tiger that the mandible of tiger was a single bone consisted of 2 halves the right and left. These two halves were attached by mandibular symphysis, which was a fibrous joint. It was not completely ossified in adult tiger. Each half was divided in to a body that was the horizontal part and a ramus that was the vertical part. As in ox and dog these do not fuse completely even in the adult/old age (Raghavan 1964).

The mandible was the largest and heaviest (350 ± 2.5g) bone of the skull and was movably articulated with the same (Table 2). Raghavan (1964) and Getty (1975) described the mandible as largest bone of the skull and face respectively in ox. The greatest length, width and height of the mandible measured were 20.1± 1.833cm, 18.00 ± 0.632cm and 10.30 ± 0.769cm, respectively. It was thickest (3.50± 0.316 cm) at its rostral border caudal to the last cheek tooth. The body or the horizontal part again divided into the rostral part that was bearing incisor teeth and the part that was containing molar teeth. The horizontal part of mandible of tiger was a thick rod like which was flattened mediolaterally. Anterior part was thicker (2.1cm) than posterior part because the messeteric fossa was present in posterior part. The anterior end of the bone was thick, blunt and curved upward. This part forms the mandibular symphysis, which was 6.4 cm wide. The dorsal surface of symphysis formed a wide flate area. Anterior part of the body was bearing alveolus for incisor teeth. The corner alveolus was largest measuring larger diameter of 2.1cm and small diameter of 1.5 cm. Lower canine tooth was shorter than upper. There were single alveoli for roots of three incisors teeth. The alveoli for three cheek teeth were having divisions for two roots of each cheek teeth and there were in increasing size (Figure 1).

The lingual surface of body was smooth and flat except some rough lines anteroventrally known as myelohyoid lines. The cranial surface of the body of mandible was curved and ventral to incisor. It was flattened and had 2-4 small vascular foramens. On lingual surface in posterior 1/4th there was a large foramen at the end of wide groove called mandibular foramen measuring diameter 1.1 cm.

On the lateral surface of cranial 1/4th of body there were 2-3 mental foramens out of which middle one was larger than other two (Figure 2). There was no carnasial tooth in the tiger.

The posterior half of the lateral surface was thin due to the depression known as Masseteric fossa.

The ventral surface was thick convex smooth in middle but slightly roughened at both ends for muscle and soft tissue attachments.

The dorsal border or the alveolar border between the canine and 1st cheek tooth had free space called interalveolar margin measuring 2.90 cm similar but very narrow space was present between other adjacent cheek teeth called interalveolar septa measuring 0.10-0.20 cm.

The two halves of the mandible was arranged in a diverging manner from the symphysis providing space for tongue known as mandibular space measuring length 17.00 ± 0.769 and width11.5 ± 0.654 (Table 2). The dorsal border behind the last cheek tooth runs backward and upward and continued with vertical ramus of the mandible (Figure 1).

Table 2. Range, Mean and SE of weight (g) and linear parameters (cm) of mandible in tiger

Parameter	Mean ± SE
Mandible	
Weight	350 ± 2.5
Length	20.1 ± 1.883
Width	18 ± 0.632
Thickness	3.50 ± 0.316
Height	10.30 ± 0.761
Body of mandible	
Length	16.1 ± 0.687
Width	4.30 ± 0.359
Thickness	3.50 ± 0.207
Vertical ramus	
Height	10.5 ± 1.080
Width	11.8 ± 0.303
Thickness	5.10 ± 0.363
Mandibular space	
Length	17.00 ± 0.769
Width	11.5 ± 0.654
Coronoid process	
Height	5.50 ± 0.477
Width	2.90 ± 0.166
Mandibular condyle	
Rostrocaudal diameter	1.40 ± 0.334
Transverse diameter	4.50 ± 0.316
Mandibular foramen diameter	1.1± 0.328

The vertical part of the mandible, ramus was non teeth bearing caudal part of the bone. It was having three processes. The dorsal border behind the last cheek tooth extended upward

forming flate, large, thin plate of bone with thick ended rostral border called coronoid process measuring height 5.50 ± 0.477cm caudoventral to this process there was a transverse elongated sagittally convex condyloid articular process to form articulation with zygomatic part of temporal bone in mandibular fossa. This articular condyle is known as Mandibular condyle measuring rostro caudal diameter 1.40 ± 0.334cm and transverse diameter 4.50 ± 0.316cm. It was a movable joint. There was a notch between the condyle and coronoid process known as mandibular notch. Caudoventral part of mandible extended caudally and formed a mediolaterally compressed prominent angular process known as angle of the mandible.

Fig. 1. Photograph of the dorsal view of mandible showing mandibular condyle (C), coronoid process (Cp), body of the mandible (B) and alveoli of incisor teeth (I) Rostral canine tooth (Ca).

On the lateral surface of coronoid process there was masseteric fossa. It was triangular and gave insertion to masseter muscle which was limited by coronoid crest rostrally and by

condyloid crest caudally. The Medial surface of coronoid process was slightly rough for insertion of temporal muscle, just above the mandibular foramen. This mandibular foramen was the caudal opening of mandibular canal, which communicated rostrally with mental foramen and dorsally with teeth alveoli. This canal contains the mandibular artery vein and mandibular alveolar nerve.

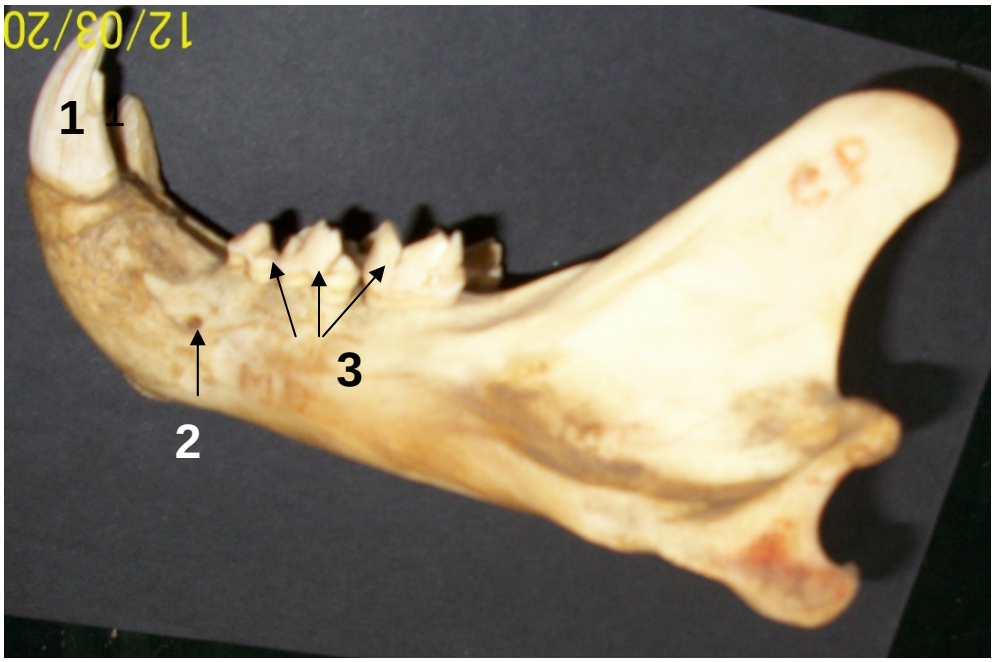

Fig. 2. Photograph of lateral surface of the mandible of tiger showing rostral canine tooth (1), mental foramen (2) and Cheek tooth (3)

4. DISCUSSION

Evans and Christensen (1964) described that the mandible of dog consists of right and left halves firmly united in life at the mandibular symphysis, which is a strong, rough surfaced fibrous joint. While Pandit (1994) supported that in tiger the bone consists of two halves which are symmetrical and are fused anteriorly at symphysis, which remains unossifical even in adult tiger. Evans and Christensen (1964) and Pandit (1994) supported that each half of mandible consists of vertical and horizontal part.

Skull of tiger differs from leopard by number of alveoli present in incisive and mandible. In leopard, there were 4 alveoli in incisive and mandible reported by Prajapati (2007), while Pandit (1994) supported the finding of 6 alveoli in incisive bone and mandible of tiger. In case of dog, the numbers of alveoli for incisors are same as in tiger (Evans and Christensen, 1964). Pandit (1994) supported that the carnasial tooth was absent in tiger while present in dog as described Evans and Christensen (1964).

The ventral ends of two halves of the mandible united rostrally and formed the body as reported in horse (Getty, 1975). It was completely ossified and was long and narrow. The dorsal surface was dorsoventrally concave and grooved. In fresh state it was covered by

buccal mucous membrane. The ventral surface was convex and more extensive than the lingual surface (Figure 1-2).

The vertical part was expanded and served for the purpose of muscular attachment. Each ramus presented two surfaces, two borders and two extremities as has been described by Getty (1975). The lateral surface of horizontal ramus was smooth and convex from above downwards. At the junction with the body there was a fossa containing comparatively large mental foramen which is the external opening of the mandibular canal. The vertical part of the ramus of the mandible presented rough lines on the lateral surface for the attachment of masseteric muscles. The medial surface of the horizontal part was smooth and convex. Close to the alveolar border there was a faint rough myelohyoid line for the attachment of mylohyoid muscle. The medial surface of the vertical part of ramus was convexo concave from before backwards. It was marked by a prominence at the junction of the alveolar border and rostral border of the vertical part of ramus. The mandibular foramen was approximately in middle of the medial surface of vertical ramus of mandible as reported by Rashid and Kausar (2005) in ox and dog and it was further forward in the horse. The mandibular foramen marked the entrance of the mandibular canal which traversed through the bone and passed below the roots of lower cheek teeth and opened at mental foramen.

The ventral extremity of the ramus was fused with the body. The articular extremity consisted of coronoid process, mandibular notch and mandibular condyle. The coronoid process was almost straight with blunt and thick caudal end. It projected upwards and backwards. It was flattened from side to side. In the articulated condition it projected into the temporal fossa and served for the attachment of the temporalis muscle as reported by Prajapati (2007) in leopard and by Pandit (1994) in tiger. In horse the coronoid process is reported as thin transversely and curved slightly medially and backward. In ox it curves backward (Getty, 1975). In dog it is very extensive and bent slightly outward and backward (Rashid and Kausar, 2005).

5. CONCLUSION

The following conclusions were drawn out of the present study:

1. The gross morphological and morphometrical parameters were established.
2. The mandible of tiger can be differentiated on gross morphological and morphometrical parameters with leopard by presence of 3 incisor teeth and more prominent angle of mandible.
3. The information obtained by the study will be of academic importance. The data base of the present study will be helpful as an aid in wildlife forensic.

6. SUGGESTIONS FOR FURTHER WORK

1. Gross morphological features and measurements of major bones of animals belong to schedule-I of Wildlife Protection Act (1972) should be studied for preparation of a complete database for species identification.
2. Comparative osteological studies of major bones of threatened species should be carried out.
3. Radiological study of major bones of tiger may be carried out for identification and determination of age.

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