



## Applied Anatomy of the Maxillofacial and Mandibular Regions of the Indian Blackbuck (*Antelope cervicapra*)

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### ABSTRACT

The study involved the measurements of some clinically important landmarks for regional anesthesia in the maxillary and mandibular regions of blackbucks. The mandibular parameters studied will provide important clinical landmarks for the regional anesthesia of mandibular nerve block. The observed data were also discussed with regard to their application in proper tracking of the infra-orbital, mental and mandibular nerves to aid in regional anesthetic procedures during treatment and manipulations of various clinical affections of this region. There was no information on the regional applied anatomy of maxillofacial and mandibular regions of blackbuck in available literatures. Therefore, this study was designed to provide information on clinically important parameters and landmarks of the head region. This information may aid for performing regional anesthesia conducted in upper (maxilla) and the lower (mandible) jaw bones of the Blackbuck.

**Keywords:** Applied anatomy, Maxillofacial, Mandibular, Blackbuck.

The blackbuck is an ungulate species of antelope native to the Indian Subcontinent that has been classified as near threatened by IUCN since 2003, as its range has decreased sharply during the 20<sup>th</sup> century. The blackbuck is protected under Schedule I of the Indian Wildlife Protection Act, 1972. The form and relationships of all organs located in a particular area are directly concerned with regional anatomy which helps the clinician as well as surgeon to visualize details of structures relevant to the case at hand and form one of the important foundations for clinical and surgical practice (Dyce *et al.*, 1996).

The information on the regional clinical anatomy of the head of blackbuck is scanty. Therefore, this study was designed to provide information on clinically important parameters and landmarks of the head. This information will aid the clinicians in the application of regional anesthesia in upper (maxilla) and the lower (mandible) jaw bones of the blackbuck.

### MATERIALS AND METHODS

The present study was conducted on the maxillofacial and mandibular regions of six adult blackbuck (*Antelope cervicapra*) of either sex. The permission for the specimen collection was sought from the Deputy Inspector General (WL), Ministry of Environment and Forests (MoEF), New Delhi, India and Principal Chief Conservator of Forest (PCCF), Government of Rajasthan. The skeletons were collected from the Jodhpur zoo after official approvals from the Principal Chief Conservator of Forest (PCCF) video letter no. F, 3 (02) Tech-II/CCF/2010/714 dated 07.05.2014. The skeletons were dug out from the graveyards located in the premises of Jodhpur zoo. Afterwards, these specimens were processed by the hot water maceration technique as described by Simoens *et al.* (1994).

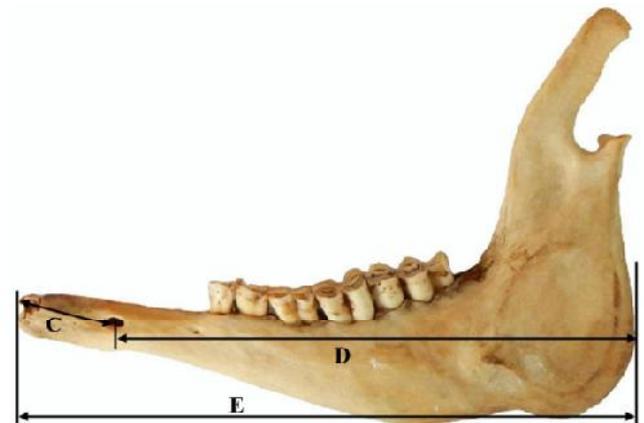
A total of 12 measurements were done in the upper jaw and mandibles using metric rules and the results were

presented as means  $\pm$  SE. The various parameters measured in the upper and lower jaw bones of the blackbuck skulls are described below and shown in Figure 2- 3.

- A. Facial tuberosity to the infra-orbital canal; from the level of the most lateral bulging of the facial tuberosity to the mid level of the infra-orbital canal.
- B. Infra-orbital canal to the root of alveolar tooth; the measurement was taken vertically from the mid-level of the infra-orbital canal to the root of the alveolar tooth.
- C. Lateral alveolar root to mental foramen; from the mental foramen to the lateral extent of the alveolar root of lower incisor.
- D. Mental foramen to the caudal mandibular border; from the level of the mental foramen to the extreme caudal border of the mandible.
- E. Mandibular length; from the level of the cranial extremity of the alveolar root of the incisor to the level of the caudal border of the mandible.
- F. Mandibular foramen to base of mandible; vertical line from the ventral limit of the mandibular foramen to the base of the mandible.
- G. Caudal border of mandible to below mandibular foramen; length from the caudal most border of the mandible to the vertical line produced by a description of the measurement of the mandibular foramen to the base of the mandible.
- H. Condylod fossa to the height of the mandible; from the maximum height of mandible to the condylod fossa.
- I. Maximum mandibular height; from the basal level of the mandible to the highest level of the coronoid process.
- J. Condylod fossa to the base of the mandible.
- K. Caudal border of mandible to the level of mandibular foramen.
- L. Mandibular foramen to mandibular angle; shortest distance from the mandibular foramen to the extreme caudal border of the angle of the mandible.



**Figure 1** Lateral view of Skull of blackbuck showing Facial tuberosity to infraorbital canal (A), Infraorbital canal to root of alveolar tooth (B).



**Figure 2** Medial view of mandible showing measurements; lateral alveolar root to mental foramina (C), Mental foramina to caudal mandibular border (D), Mandibular length (E).



**Figure 3** Lateral view of mandible showing measurements; Mandibular foramen to the base of mandible (F), Mandibular foramen to caudal mandibular border (G), Maximum height of mandible to the condylod fossa (H), Maximum mandibular height (I), Condylod fossa to the base of the mandible (J), Caudal border of mandible to the level of the mandibular foramen (K), Mandibular foramen to the border of mandibular angle (L).

These parameters of the mandible were measured and subjected to routine statistical analysis (Snedecor and Cochran, 1994).

## RESULTS AND DISCUSSION

The distance from the facial tuberosity to the infra-orbital canal and from the latter to the root of the alveolar tooth directly ventral to it (Figure 1) were  $2.37 \pm 0.009$  cm and  $0.72 \pm 0.008$  cm, respectively in blackbuck (Table 1) while in West African Dwarf goats were 1.6 - 1.8 cm and 1.3 - 1.6 cm (Olopade and Onwuka, 2005); in Gwembe Valley dwarf goat were  $2.06 \pm 0.14$  cm and  $1.13 \pm 0.11$  cm (Kataba et al., 2014); in Iranian native cattle were 2.8 cm and 2.5 cm (Monfared, 2013). Uddin *et al.* (2009) also reported same measurements for Black Bengal goat were  $1.85 \pm 0.14$  cm and  $1.75 \pm 0.19$  cm.

**Table 1. The measurements of Upper jaw and mandibles of blackbuck (*Antelope cervicapra*)**

Sr. No.	Different parameters	Mean Value (Cm)	S.E.
A	Facial tuberosity to infra-orbital canal	2.37	0.009
B	Infra-orbital canal to root of alveolar tooth	0.72	0.008
C	Lateral alveolar root to mental foramina	2.45	0.008
D	Mental foramina to caudal mandibular border	13.43	0.081
E	Mandibular length	16.53	0.128
F	Mandibular foramen to base of mandible	4.18	0.014
G	Mandibular foramen to caudal mandibular border	1.85	0.011
H	Maximum height of mandible to the condyloid fossa	3.09	0.008
I	Maximum mandibular height	10.69	0.024
J	Condyloid fossa to base of the mandible	7.57	0.024
K	Caudal border of mandibular to the level of mandibular foramen	1.36	0.010
L	Mandibular foramen to mandibular angle	3.07	0.006
M	Width of mental foramina	0.30	0.011
N	Height of mental foramina	0.53	0.009

The data are of clinical importance because the facial tuberosity is very prominent even in live animals as a guide for tracking the infra-orbital nerve and necessary for its desensitization during the manipulations in the skin of the upper lip, nostril and face at the level of the foramen. The injection of local anesthetic agents within the canal via the infra-orbital foramen will also lead to analgesia of the incisor, canine and first two premolar teeth. Moreover, the infra-orbital foramen was located directly dorsal to the second or the junction of the first and second upper premolar in blackbuck where as it was observed to be located dorsal to second premolar in Red Sokoto goats (Olopade and Onwuka, 2007). This information coupled with the observed distance of  $0.72 \pm 0.008$  cm between the root of the teeth and the foramen would prove a vital guide to regional anesthesia involving the infra-orbital nerve in the Blackbuck, while in Black Bengal goat the distance was 1.75 cm (Uddin *et al.*, 2009).

The distance between the lateral end of the alveolus of the third incisor tooth to the mental foramen was  $2.45 \pm 0.008$  (Fig.2, Table 1) which is an important landmark for achieving the location of the mental nerve for the regional nerve block in blackbuck while it was  $1.6 \pm 0.22$  cm and  $2.0 \pm 0.3$  cm in West African Dwarf goat and Red Sokoto (Maradi) goat of Nigeria, respectively (Olopade and Onwuka, 2005; 2007). The distance from the mental foramen to the caudal mandibular border was  $13.43 \pm 0.081$  cm. The width and height of the mental foramen were  $0.30 \pm 0.011$  and  $0.53 \pm 0.009$  cm, respectively.

The length and height of the mandible were  $16.53 \pm 0.128$  cm and  $10.69 \pm 0.024$  cm, respectively in blackbuck which was higher than the value obtained for West African Dwarf goats of Nigeria as  $12.00 \pm 1.89$  cm and  $6.90 \pm 1.09$  cm, respectively (Olopade and Onwuka, 2005) whereas length and height of the mandible were 27.4 cm and 15.88 cm, respectively in Iranian native cattle (Monfared, 2013). Kataba *et al.* (2014) had observed the length and height of mandible as  $11.24 \pm 0.52$  cm and  $6.64 \pm 0.44$  cm, respectively in Gwembe Valley dwarf goat. The distances between the condyloid fossa to the height of mandible and condyloid fossa to the base of the mandible were  $3.09 \pm 0.008$  and  $7.57 \pm 0.024$  cm, respectively in blackbuck.

The distance between the vertical line drawn downward from the caudal border of mandible (I) and the vertical line drawn from the mandibular foramen downwards (F)



was (G)  $1.85 \pm 0.011$  cm (Figure 3), while the distance from the mandibular foramen to the base of the mandible, caudal border of mandible to the level of mandibular foramen and the mandibular foramen to the border of mandibular angle were  $4.18 \pm 0.014$  cm,  $1.36 \pm 0.010$  cm and  $3.07 \pm 0.006$  cm respectively (Figure 2). Equivalent figures for West African Dwarf goats of Nigeria were  $1.57 \pm 0.44$  cm,  $2.58 \pm 0.34$  cm, respectively for caudal border of mandible to below mandibular foramen and the mandibular foramen to the base of the mandible (Olopade and Onwuka, 2005). In horse and dogs, the distance between the mandibular foramen and the base of the mandible was 3 cm and 1.5 to 2 cm, respectively. (Hall *et al.*, 2000).

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