Global Veterinaria 10 (3): 271-275, 2013
ISSN 1992-6197

DOI: 10.5829/idosi.gv.2013.10.3.7253

Clinical Anatomy of the Skull of Iranian Native Sheep

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Abstract: Sheep are important animals worldwide for the provision of animal protein and wool. Since, there is very little information on the clinical anatomy of the head region of the Iranian native sheep; therefore the present work was carried out. For this study; twenty-five Iranian native sheep were used and a total of 17 morphometric indices in the upper jaw and mandibles were measured. The supraorbital foramina distance, infraorbital foramina distance, skull length, cranial length and nasal length of the Iranian native sheep were 9.5 cm, 6.1 cm, 20.9 cm, 11.7 cm and 9.2 cm, respectively. Also, the distances from facial tuberosity to the infra-orbital canal and from the latter to the root of the alveolar tooth were 1.87 cm and 1.63 cm, respectively. The length and height of the mandibles were 14.08 cm and 8.28 cm, respectively. Furthermore, the distances from the lateral alveolar root to mental foramen and from the mental foramen to caudal mandibular border were 2.76 cm and 11.29 cm, respectively. The distances from mandibular foramen to the base of mandible as well as from caudal border of mandible to below of the mandibular foramen were 2.99 cm and 1.32 cm, respectively. Also, the distances from the base of mandible to condyloid fossa and from the latter to the maximum height of mandible were 6.46 cm and 2.03 cm, respectively. These data are necessary for achieving the regional anesthesia of the various cranial nerves around the head of the Iranian native sheep.

Key words: Clinical Anatomy · Head · Sheep · Iran

INTRODUCTION

Clinical anatomy is one of the main principles of the clinical and surgical practice; because it enables the clinician to visualize details of structures relevant to the case at hand [1, 2]. On the other hand, the clinical anatomy of the head region is very important because of such vital organs and structures as the brain, tongue, eyes as well as ears, teeth, nose, lips and cranium. Thus the head is needed for coordinating the body as well as for deglutition, olfaction and defense [2, 3]. Also, the morphologic and morphometric studies of the skull are not only reflect contributions of genetic and environmental components to individual development and describe genetic and ecophenotyipic variation, but also are foundations of the clinical and surgical practices [4, 5]. Similarly, the directions of the cranial nerves and their passages from different foramina in the skull are of clinical importance in regional anesthesia around the head [2, 6].

Sheep are important animals worldwide for the provision of animal protein and wool. Their other products such as fiber, milk or skins are also important as a source of income for small holders in the less developed parts of the world. The sheep population in Iran is 50 million, comprising 26 genetic groups. Meat production by sheep and goat amounts to 57% of the total red meat production in the country [7]; therefore, there has been an increasing interest and necessity to have more information concerning the clinical anatomy of the head region of this specie. Since, there is very little information on the clinical anatomy of the head osteology of the Iranian native sheep; therefore the aim of this study was to evaluate some morphometric parameters of the head region of this specie.

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MATERIALS AND METHODS

To make the present work, a total of twenty-five Iranian native sheep aged between 2-5-year-old were used. The live animals were first selected during ante mortem examination at Ilam abattoir based on parameters of apparent good health and no skeletal disorders. After slaughter, the heads were severed at the occipito-atlantal joint, purchased and processed in the veterinary anatomy laboratory of Ilam University using the boiling maceration techniques for skeleton preparation that have been reported by Simoens *et al*. [8]. The main steps in skull skeleton preparing briefly are following:

- On the working day, frozen sheep head were allowed to thaw.
- Skin and most of the muscles were separated and eyes were enucleated.
- Heads were heated to over 80 ºC for at least 1 hour in solution of anionic surfactant (detergent) and soap chips
- Muscles of boiled heads were separated with the aid of forceps and scalpel in running water.
- Further separation of muscles and ligaments from the skulls was done after left in detergent water at least 20-30 minutes.
- Separation of remaining muscles and ligaments from the skull was done after left in 1% sodium hypochlorite solution for at least 24 hours.
- After that, the skulls were left in the above solution, for 48-72 hours with solution, being changed at least twice and clean in running tap water.
- The skulls were then left to dry.

A total of 17 morphometric measurements were done in the upper jaw and mandibles using scale, thread and digital calipers and the results were presented as means ± SD in Table 1. These morphometric parameters of the upper and lower jawbones of the Iranian native sheep´s skulls are defined below and shown in Figs. 1-5.

A. Supraorbital Foramina Distance: Greatest width between the supraorbital foramina.

B. Infraorbital Foramina Distance: Facial width between the supraorbital foramina.

C. skull Length: From the dorsal lateral nasal cartilages to the external occipital protuberance; sub-divided into cranial length and nasal length.

D. cranial Length.

E. nasal Length.

F. Facial Tuberosity to Infra-orbital Canal: From the level of the most lateral bulging of the facial tuberosity to the mid level of the infra-orbital canal.

G. Infra-orbital Canal to Root of Alveolar Tooth: Measurement is taken vertically from the mid-level of the in infra-orbital canal to the root of the alveolar tooth.

H. 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.

I. Lateral Alveolar Root to Mental Foramen: Shortest distance from the mental foramen to the lateral extent of the alveolar root of lower incisor.

J. Mental Foramen to Caudal Mandibular Border: From the level of the mental foramen to the extreme caudal border of the mandible.

K. Mandibular Foramen to Base of Mandible: Vertical line from the ventral limit of the mandibular foramen to the base of the mandible.

L. Caudal Border of Mandible to below of the Mandibular Foramen: Length from the caudal most border of the mandible to the vertical line produced by description of measurement of mandibular foramen to base of the mandible.

M. Condyloid Fossa to Height of Mandible: From the maximum height of mandible to the condyloid fossa.

N. Condyloid Fossa to the Base of the Mandible.

O. Maximum Mandibular Height: From the basal level of the mandible to the highest level of the coronoid process.

P. Caudal Border of Mandible to the Level of Mandibular Foramen.

Q. Mandibular Foramen to Mandibular Angle: Shortest distance from the mandibular foramen to the extreme caudal border of the angle of the mandible.

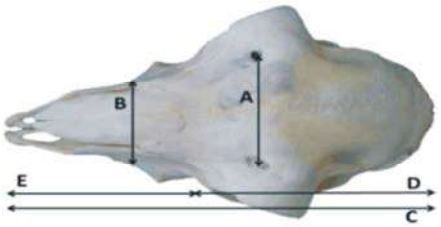

Fig. 1: Skull of the Iranian native sheep; dorsal view. A: Supraorbital foramina distance, B:Infraorbital foramina distance, C: Skull length, D: Cranial length, E: Nasal length.

Fig. 2: Mandible of the Iranian native sheep; lateral view. F: Facial tuberosity to infra-orbital canal, G: Infra-orbital canal to root of alveolar tooth.

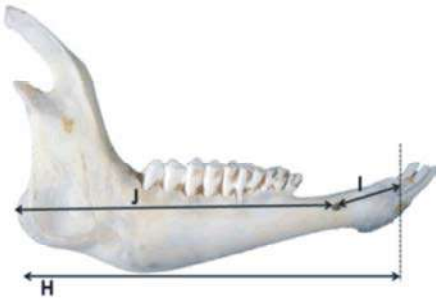

Fig. 3: Mandible of the Iranian native sheep; medial view. H: Mandibular length, I: Lateral alveolar root to mental foramen, J: Mental foramen to caudal mandibular border.

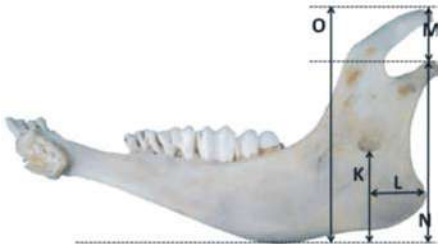

Fig. 4: Mandible of the Iranian native sheep; medial view. K: Mandibular foramen to base of mandible, L: Caudal border of mandible to below of the mandibular foramen, M: Condyloid fossa to height of mandible, N: Condyloid fossa to the base of the mandible, O: Maximum mandibular height.

Fig. 5: Mandible of the Iranian native sheep; medial view. P: Caudal border of mandible to the level of mandibular foramen, Q: Mandibular foramen to mandibular angle.

Table 1: Mean ± SD of the morphometric measurements of the mandibles and upper jaws of Iranian native sheep (cm).

Morphometric parameter	Mean ± SD
A	9.5 ± 1.44
B	6.1 ± 0.57
C	20.9 ± 4.77
D	11.7 ± 2.03
E	9.2 ± 0.46
F	1.87 ± 0.09
G	1.63 ± 0.04
H	14.08 ± 0.01
I	2.76 ± 0.05
J	11.29 ± 0.47
K	2.99 ± 0.03
L	1.32 ± 0.63
M	2.03 ± 0.11
N	6.26 ± 0.17
O	8.28 ± 0.48
P	0.86 ± 0.03
Q	2.82 ± 0.04

RESULTS

In the current work, the supraorbital foramina distance, infraorbital foramina distance, skull length, cranial length and nasal length of the Iranian native sheep were 9.5 cm, 6.1 cm, 20.9 cm, 11.7 cm and 9.2 cm, respectively (Figure 1, Table 1). In addition, the distances from facial tuberosity to the infra-orbital canal and from the latter to the root of the alveolar tooth were 1.87 cm and 1.63 cm, respectively. (Figure 2, Table 1).

The length and height of the mandibles of the Iranian native sheep were 14.08 cm and 8.28 cm, respectively. Furthermore, the distances from the lateral alveolar root to mental foramen and from the mental foramen to caudal mandibular border were 2.76 cm and 11.29 cm, respectively (Figure 3, Table 1). In the present

study, the distances from mandibular foramen to the base of mandible as well as from caudal border of mandible to below of the mandibular foramen were 2.99 cm and 1.32 cm, respectively. Also, the distances from the base of mandible to Condyloid fossa and from the latter to the maximum height of mandible were 6.46 cm and 2.03 cm, respectively (Figure 4, Table 1). Finally, the distance from caudal border of mandible to mandibular foramen and from the latter to mandibular angle were 0.86 cm and 2.82 cm, respectively (Figure 5, Table 1).

DISCUSSION

The values of supraorbital foramina distance, skull length, cranial length and nasal length of the Iranian native sheep were relatively similar to the results of previous works on the Mehraban sheep [4,9].

In the Iranian native sheep; the distances from facial tuberosity to the infra-orbital canal and from the latter to the root of the alveolar tooth were 1.87 cm and 1.63 cm, respectively. Since the facial tuberosity is very prominent as a guide for tracking the infra-orbital nerve and necessary for the desensitization of the skin of the upper lip, nostril and face on that side of the level of the foramen [1], therefore; these data are of clinical importance. 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 premolars. Furthermore, the infra-orbital foramen is located directly dorsal to the first upper premolar tooth in Iranian native sheep and goats [9]. This information would provide a major landmark to regional anesthesia involving the infra-orbital nerve in the Iranian native sheep.

In the present study, the distance from the lateral alveolar root to mental foramen was 2.76 cm while in the Iranian native goats were 2.40 cm [9]. This parameter is a vital guide that will detect the location of the mental nerve for this regional nerve block in the Iranian native sheep; especially for lower lip anesthesia. The injection of the local anesthetic drugs can be made in the rostral aspect of the mandibular canal through the mental foramen to mandibular nerve block in the mental zone. This will ensure the loss of sensation of the lower incisors, premolar and lower lip on the same side [6] during lower lip trauma, dental extraction and treatment of the tooth injuries.

The mandibular length and height in the Iranian native sheep (Table 1) were relatively similar to the data obtained for Iranian native goats [9]. Similar results had been reported in the values of the distances between the mandibular foramen to base of mandible, the condyloid fossa to height of mandible and condyloid fossa to the base of the mandible [9].

The caudal border of the mandible to bellow of the mandibular foramen was 1.32 cm in the Iranian native sheep. In addition, the distance from the caudal border of mandible to the level of mandibular foramen and from the latter to the border of mandibular angle was 0.86 cm and 2.82 cm, respectively. The anesthetic agents must to be injecting on the medial side of the mandible, thereby; a successful nerve block produces anesthesia of the lower jaw with its teeth and the lower lip. These data are necessary for achieving the regional anesthesia of the mandibular nerve and also have clinical importance for desensitization of all the teeth in lower jaw [6].

In conclusion, the morphometric values of the skull and clinical anatomy of the head region of the Iranian native sheep are comparable to goats and cows and also current results provide an important baseline for further studies on the skull of sheep. Furthermore, these results are of clinical importance that will aid the regional anesthesia of the different nerves around the head especially during treating head injury and dental extraction.

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