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Morphometric Characteristics of the Maxillofacial and Mandibular Regions of Markhoz Goat Breed and its Clinical Value for Regional Anesthesia in Western Iran

[1]Nader Goodarzi and [2]Tooraj Shah Hosseini

[1]Department of Basic Sciences, Faculty of Veterinary Medicine, Razi University, Kermanshah, Iran
[2]Faculty of Veterinary Medicine, Islamic Azad University, Sanandaj branch, Sanandaj, Iran

Abstract: Markhoz goat breed, known as Angora goat in other places, is a dwarf breed that is indigenous mainly in kordish region of Iran such as kurdistan province where they are used as multipurpose animals for the production of milk, meat, mohair. This study involved some morphometric parameters of the mandibles and upper jaws of eight Markhoz goats. Then, a total of 12 head measurements and indices were recorded. In addition, this information study has been compared with those carried out on West African Dwarf goat and Iranian Native goat. The distance from fa*-ial tuberosity to the infra-orbital foramen and from the latter to the root of the alveolar tooth was 1.81 cm and 1.7 cm respectively. The distance between lateral alveolar root and mental foramen and from the latter to the caudal border of mandible was 1.85 cm and 11.42 cm respectively. The Maximum length and height of the mandibles were 13.37 and 8.94 cm respectively). The caudal border of the mandible to bellow of the mandibular foramen (Figure 3) and from mandibular foramen to the base of manbile was 1.91 cm and 3.43 cm respectively. The distance from caudal border of mandible to the mandibular foramen and form the latter to the border of mandibular angle were 1.04 cm and 2.74 cm respectively.According to our findings, morphometric values of the maxillofacial and mandibular region in this breed is comparable to African Dwarf goat in Nigeria while there are slight differences in comparison with Iranian native goat. These results are of clinical importance that will aid the regional anesthesia of the different nerves around the head especially during treating head injury, surgical operation and dental extraction.

Key words: Morphometric · Markhoz Goat · Rgional Anesthesia · Iran

INTRODUCTION

The goat was the first domesticated animal capable to produce food for the human being about ten thousand years ago. About 90% of the goats of the world are found in areas in development evidencing the capacity of the goat in adapting to the adverse conditions, justifying its reputation of rustic animal [1].

Morphologic and morphometric studies of the head region 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 [2, 3].

The regional anatomy of the head is very important because of such vital organs and structures as the brain, tongue, eyes as well as ears, teeth, nose, lips, horn and skull. Thus the head is needed for coordinating the body as well as for deglutition, olfaction and defense [4, 5]. In addition, 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 [6].

Markhoz goat breed, known as Angora goat in other places, is a dwarf breed is indigenous mainly in kordish region of Iran such as kurdistan province and many arid and semi-arid areas where they are used as multipurpose animals for the production of milk, meat, hair and hide [7-9].

This is the only breed raised for different colored mohais [10]. The mohair obtained from these animals is of socio-economical importance for dwellers and uses for making of local clothes in Kurdistan province [11].

Corresponding Author: Nader Goodarzi, Department of Basic Sciences, Faculty of Veterinary Medicine, Razi University, Kermanshah, Iran, Sheikhtoosi Blvd, Kermanshah, Iran.
Tel: +98-8318322599, +989365484858.

Although there are some reports on anatomy of the skull of other species such as the West African Dwarf Goat [5], Nigerian Red Sokoto goat [12], Iranian native goat [13], Black Bengal goat [14], as far as we know there is no information on the morphometric features of the head region of this breed in available literatures.

Therefore, we carried out this study to provide some comprehensive morphometric parameters of the mandible and maxillofacial region of the Dwarf Markhoz Goat which could be useful in head regional anesthesia. In addition, this information study will be compared to those carried out on West African Dwarf goat and Iranian Native goat.

MATERIALS AND METHODS

A total of eight skulls of Markhoz goat without any skeleton disorder were obtained from ansanandaj abattoir and processed in the dissection room of Razi University using the boiling maceration techniques for skeletal preparation that have been reported [15]. Briefly, at first skin and most of the muscles were separated and eyes were enucleated. Then the skulls put in polycaboxylate solution, anionic surfactant and soap chips and heated over 80°C for at least 30 minutes. Boiled heads then put in running tap water and remaining muscles were separated with the aid of sharp scalpel. Further separation of muscles and ligaments was done after left in detergent water, for about 30 minutes. Subsequently, the bones were kept in sodium hypochlorite solution 1%, for 24 hours and again separation of remaining muscles and ligaments were done. Then they were left in the same solution for 48-72 hours and during this period, the solution was changed twice. Then, the heads were cleaned in running tap water and were left to dry.

As a whole twelve parameters were measured on the upper jaw and mandibles using scale, thread and digital calipers and the results were presented as means±SD in Table 1. The parameters measured of the maxillofacial and mandibular region of the Markhoz goat skull are described below and shown in Figure 1-4.

- Afacial 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.
- Infra-orbital canal to root of alveolar tooth: From the mid-level of the infra-orbital canal to the root of the alveolar tooth.
- Lateral alveolar root to mental foramen: Shortest distance from the mental foramen to the lateral of the alveolar root of lower incisor.

Fig. 1: Skull of the Markhoz goat; lateral view
A: Facial tuberosity to infra-orbital canal
B: Infra-orbital canal to root of alveolar tooth

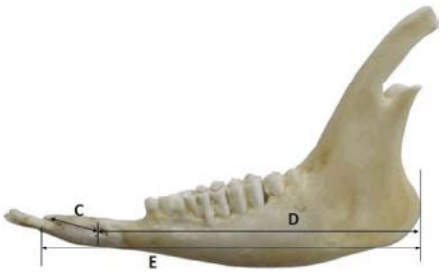

Fig. 2: Mandible of the Markhoz goat; lateral view.
C: Lateralalveolar root to mental foramen
D: Mental foramen to caudal mandibular Border
E: Mandibular length

Fig. 3: Mandible of the Markhoz goat; medial view.
F: Mandibular foramen to base of mandible
G: Condyloid fossa to height of mandible
H: Mandibular foramen
I: Maximum to mandibular angle.

Fig. 4: Mandible of the Markhoz goat; medial view.
K: Caudal border of mandible to the level of
K: Mandibular foramen Condyloid fossa to base of mandible Mandibular height.

- Mental foramen to caudal mandibular border: From the level of the mental foramen to the extreme caudal border of the mandible.

Table 1: Parameter measured in maxillofacial and mandibular region of Markhoz goat breed in Comparison to those of West African Dwarf (WAD) goat and Iranian native goat. Means ± SD. *Data from Olopade (2005) and Monfared (2013)

Morphometric Parameter (cm)	Markhoz goat WAD goat*Iranian native goat*	
A	1.81±0.06	1.6-1.81.92±0.17
B	1.7±0.08 1.3-1.6	1.64 ± 0.11
C	1.58 ±0.11 1.56±0.22	2.40 ± 0.26
D	11.42 ±0.429.96±1.67	11.34 ± 0.96
E	13.37 ±0.6212±1.89	14.1 ± 1.03
F	3.43 ±0.252.58±0.34	2.88 ± 0.93
G	2.45 ±0.152.21±0.37	2.29 ± 0.67
H	5.87 ±0.442.68±0.454.37±0.59	
I	8.94 ±0.436.9±1.09	8.69 ± 0.18
J	1.04 ±0.141.57±0.44	1.29 ± 0.12
K	1.91 ±0.17 -	0.9 ± 0.48
L	2.74 ±0.17 -	2.50 ± 0.73

- Mandibular length: From the level of the cranial extremity of the alveolar root of the incisor to level of the caudal border of the mandible.
- Mandibular foramen to base of mandible: Vertical line from the ventral limit of the mandibular foramen to the base of the mandible.
- Maximum height of mandible to the condyloid fossa.
- Condyloid fossa to the base of the mandible.
- Maximum mandibular height: From the basal level of the mandible to the highest level of the coronoid process.
- 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 the base of the mandible.
- Caudal border of mandible to the level of mandibular foramen.
- Mandibular foramen to mandibular angle: Shortest distance from the mandibular foramen to the extreme caudal border of the angle of the mandible.

RESULTS

In the current study, the distance from facial tuberosity to the infra-orbital foramen and from the latter to the root of the alveolar tooth was 1.81 and 1.7 cm respectively (Figure 1, Table 1). The distance between lateral alveolar root and mental foramen and from the latter to the caudal border of mandible were 1.85 and 11.42 cm respectively (Figure 2, Table 1). The maximum mandibular length and height in Markhoz goat are inserted in Tabel 1. These Parameters in Markhoz goat breed were 13.37 and 8.94 cm respectively (Figure 2 and 3). The caudal border of the mandible to bellow of the mandibular foramen and from mandibular foramen to the base of manbile was 1.91 and 3.43 cm respectively (Figure 3). The distance from caudal border of mandible to the mandibular foramen and form the latter to the border of mandibular angle were 1.04 and 2.74 cm respectively (Figure 4).

DISCUSSION

As shown in Table 1. the distance from facial tuberosity to the infra-orbital canal and from the latter to the root of the alveolar tooth in Markhoz goat were higher than the value reportedin West African Dwarf goat [5] and Iranian native goat [13]. The facial tuberosity is very prominent even in live animals, as a guide to tracking the infra-orbital nerve, the desensitization of which affects the skin of the upper lip, nostril and face on that side of the level of the foramen and also lead to analgesia of the incisor, canine and first two premolars, so these data are of clinical importance.

The infra-orbital foramen was located directly dorsal to junction of the first and second upper premolar in Markhoz goat breed. This information coupled with the observed distance of 1.81 ±0.06cm between the root of the teeth and the foramen would prove a vital guide to regional anesthesia involving the infraorbital nerve in the Markhoz goat [6].

The distance between lateral end of the alveolus of the incisor tooth to the mental foramen (Figure 2, Table 1) which serve as a guide in the location of the mental nerve for this regional nerve block in this study was higher than the valueobtained in Western African Dwarf goat [5] and Iranian native goat [13]. In the anterior aspect of the mandibular canal, injection can be made through the mental foramen to desensitize mental aspect of the mandibular nerve. This will ensure the loss of sensation of the lower incisors, premolar and lower lip on the same sideduring dental extraction and treatment of tooth injuries [14].

The mandibular length in the Markhoz goat (Figure 2, Table 1) was longer than the data obtainedfor Western African Dwarf goat which was 12.00 cm but it was shorter in comparison with the length of Iranian native goat which was reported to be 14.1cm. Furthermore, maximum mandibular height in the Markhoz goat (Figure 3, Table 1) was slightly longer than the value accessed for Iranian native goat which was 8.69 cm while the difference between studied breed and Western African Dwarf goat was more tangible [5, 13].

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 (Figure 3, Table 1) in Markhoz goat were longer than those reported in Western African Dwarf goat and Iranian native goat [5, 13].

In Markhoz goat the caudal border of mandible to the level of mandibular foramen and from the latter to the border of mandibular angle were 1.91 cm and 2.94 cm respectively (Figure 4, Table 1) while in the Iranian native goat these values were 0.9 cm and 2.5 cm respectively [13], but there is no data available about these parameters in Western African Dwarf goat. On the othe hand, the distance between the caudal border of mandible to below of the mandibular foramen was 1.04 cm in Markhoz goat while equivalent figures for Western African Dwarf goat and Iranian native goat were 1.57 cm and 1.29 cm respectively [5, 13]. These data are of clinical important landmarks that will aid the regional anesthesia of mandibular nerve block, necessary for desensitization of all the teeth in lower jaw of the side of the block [14].

In conclusion, according to our findings, morphometric values of the maxillofacial and mandibular region in this breed is comparable to African Dwarf goat in Nigeria while there are slight differences in comparison with Iranian native goat. 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, surgical operation and dental extraction.

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