

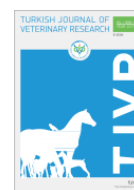


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Applied anatomy to the Gurcu goat's mandible in Kafkas and its clinical significance in regional anesthesia

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ABSTRACT

Objective: This study was designed to provide important clinical signs for tracking nerves in the mandible during regional anesthesia in Gurcu goats.

Materials and methods: The study was conducted on the mandible bones of ten adult Gurcu goats of both sex (five male and five female). The mandible bone samples of naturally dead Gurcu goat were collected from Kafkas University veterinary faculty education, research, and application farm and processed as per the standard maceration technique. Altogether, 16 measurements were taken in the mandible bones of Gurcu goats by using a digital caliper and the results were expressed as mean and standard deviation.

Results: The obtained parameters from the present study can be useful for an extraoral and intraoral approach for nerve block of mental and mandibular nerve in the mandibular regions of Gurcu goat. According to results the mandibular length and height were 158.86±10.37 mm, 89.38±5.81 mm, in females and 198.93±3.85 mm, 114.5±7.29 mm, in males of Gurcu goats, respectively. The distance between the first inferior incisor tooth and mental foramen and to the first premolar tooth was 19.72±2.3, 19.26±0.44 mm in females, and 29.41±6.10, 21.83±1.02 mm, in males, respectively. The present study revealed that all the obtained parameters related to regional anesthesia showed a significant statistical difference (p<0.01**) between the males and females of Gurcu goat.

Conclusion: It can be concluded from the present study that the various applied parameters of the present study are thought to assist clinicians in the administration of regional anesthesia in the lower jaw area (mandibular region) of the Gurcu goat.

Keywords: Anesthesia, Mandibular Region, Mental nerve, Gurcu goat

INTRODUCTION

Gurcu goats, also known as Tbilisi goat or Caucasian goat, whose origins are Caucasian, are bred and raised in Northern Anatolia, especially in the province of Kars and Çıldır a district of Ardahan. The Gurcu goat, mostly in black, gray, and white colors, originates from the auger horned goat *Capra falconeri* (Batu, 1951; Yalçın et al., 1990; Sezgin et al., 2010). The long and upright horns of male Gurcu goats touch each other at the tip and

sometimes seen to reach 50 cm as described from Batu (1951) (Figure 1).

The lower jaw is the only movable bone of the face which moves through the temporomandibular joint. Mandibles provide support for incisors, premolars, and molars as well as support for all oral base structures.

Under natural conditions, sheep often suffer from various problems such as abscesses in the jaw, damage, and loss of various teeth, fractures of the lower jaw bone, damage to the jaw joint, etc. which

seriously harm to the health and productivity of the animal through non-intake of the food, improper food processing and consequently inefficient conversion of it.



Figure 1. Male of the Gurcu goat.

According to Duncanson (2012), up to 25% of the small cattle herd have problems with incisors from trauma due to bare or uneven grazing in grazing, or the use of mineral and feed blocks. In addition, the study conducted by Erjavec and Crossley (2010) showed that up to 34% of the animals in the small herd had incisor problems.

In these conditions, preventive or even surgical interventions are necessary. The success of which depends on a very good knowledge of the clinical anatomy or applied anatomy of the mandible, which includes two holes: the mandibular and mental foramen, which are of fundamental importance in regional anesthesia of the mandible.

Regional anatomy is one of the most important foundations of clinical and surgical practice, as it enables the clinician or surgeon to visualize the details of the case-related structures. (Dyce et al., 1996). The knowledge of the regional anatomy of the head is crucial as it has to coordinate the body, deglutition, olfaction, and defense (Dyce et al., 1996). A great deal of research has been done on the regional anatomy of the head and jaw of domestic and wild animals such as ox, horse, sheep, goat, dog, pig, and camel. (Dyce et al., 1996; Hall et al., 2000; Onar et al., 2001; Olopade and Onwuka, 2005; Karimi et al., 2011a; Avdić et al., 2013; Gündemir et al., 2020; Yılmaz and Demircioğlu, 2020; Özkan et al., 2020; Yılmaz, 2020). It has been reported previously that the mental and mandibular nerve passes from the mental and mandibular foramen, respectively (Getty, 1975; Ghosh, 2012). In an emergency requiring surgical intervention for the

mental and mandibular nerve, it is very easy to position this area as a topographic landmark for quick and easy anesthesia of the involved nerves.

There is no reported data on the applied anatomy and clinical anatomy of the mandible region in Gurcu goats. Therefore, this study aimed to identify and evaluate some of the clinically important parameters and landmarks for regional anesthesia of the mandibular region in Gurcu goat.

MATERIALS and METHODS

The present study was carried out in the Department of Veterinary Anatomy at Kafkas University. The necessary permissions were obtained from the Kafkas University local ethical committee (KAÜ-HADYEK/2020-152). In this study, we have measured and evaluated ten mandibles of adult Gurcu goats (2-3 years) of both sexes (5 male and 5 female). It was collected from animals slaughtered for sacrifice, and consumption in the education, research and application farm of the Faculty of Veterinary Medicine of Kafkas University. After the samples were processed by using the boiling maceration techniques for skeleton preparation described by Simoens et al. (1994) and after cleaning it from all soft tissues, the mandibles were kept in 4% hydrogen peroxide for one day and further sundried for five days. Altogether, 16 measurements were taken in the mandible of Gurcu goats by using a digital caliper and the results were expressed as mean \pm standard deviation (SD). The parameters taken into the mandible are described in Figures 2-4.

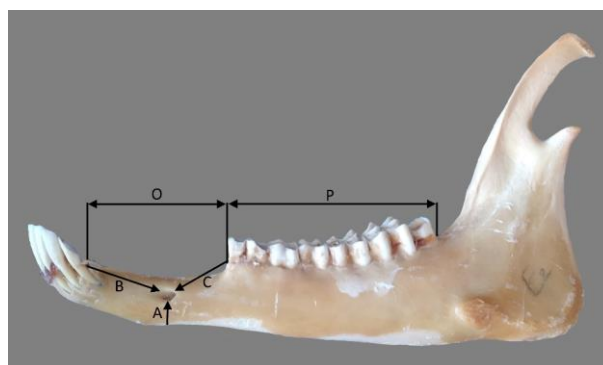


Figure 2. A. Space between the base of the mandible and mental foramen, B. Space between lateral incisor tooth and mental foramen, C. Distance between first premolar tooth and mental foramen, O. Diastema length, P. Distance between from first premolar tooth to the caudal border of last molar teeth.

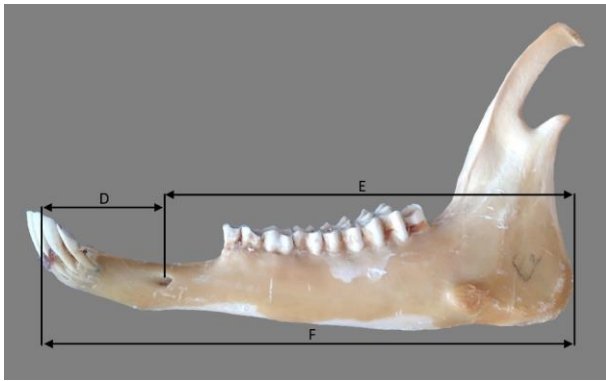


Figure 3. Space between inferior third incisor tooth and mental foramen (D), Space between mental foramen and caudal mandibular border (E), mandibular length (F).

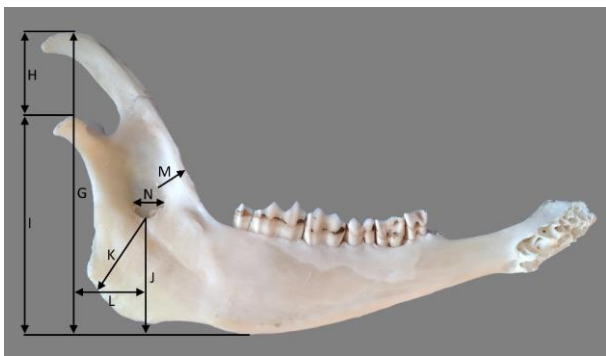


Figure 4. Maximum mandibular height (G), height of mandible to the condylar process (H), condylar process to the ventral margin of the mandible (I), mandibular foramen to the horizontal plane at the level of the ventral margin of the mandible (J), mandibular foramen to the border of mandibular angle (K), below mandibular foramen to the caudal mandibular border (L), mandibular foramen to the cranial border of the mandible (M), and mandibular foramen length (N).

A. The distance between the base of the mandible (ventral border of the mandible) and mental foramen.

B. The distance from the lateral extent of the alveolar root of the lower incisor to the mental foramen.

C. The distance between the lateral alveolar border of the first premolar tooth and mental foramen.

D. It was measured from the lateral extent of the alveolar root of the third inferior incisor tooth to the mental foramen.

E. was measured from the mental foramen level to the caudal border of the mandible ramus.

F. Mandible length

G. It was measured from the highest level of the coronoid process perpendicular to the ventral mandibular edge of the mandible.

H. It was measured from the condylar process to the maximum height of the mandible.

I. Condylar process to the ventral margin of the mandible: It was measured from the highest level of the condylar process to the ventral mandibular margin.

J. Measured from the ventral border of the mandibular foramen to the horizontal plane at the level of the ventral border of the mandible.

K. was measured from the extreme caudal border of the mandible to the mandibular foramen.

L. Caudal border of the mandible, sub-mandibular foramen: measured from the caudal border of the mandible to the vertical line, created by a description of the measurement of the mandibular foramen to the ventral edge of the mandible.

M. Mandibular foramen to the cranial border of the mandible: It was measured from the mandibular foramen to the cranial border of the mandible.

N. The length of mandibular foramen

O: Diastema length

P: Distance between from first premolar tooth to the caudal border of the last molar teeth



Figure 5. The shape variation and numbers of mental foramen.

All the above measurement parameters of the mandible of Gurcu goats were obtained and analyzed by routine statistical analysis (IBM, SPSS, 20.0 version) program.

RESULTS

In general, the mandible of the "Gurcu" goat is similar to the mandibles of the other goats' breeds. In the body of the mandible, the mandibular symphysis is distinct, not ossified, and easily separable. The mandibular angle is quite pronounced and presents masseteric tuberosity. The articular surface of the condylar process is slightly concave and the coronoid process is easily turned caudally.

All the parameter results of this study are presented in Table 1.

Table 1. The morphometric parameters of Gurcu goat's mandible.

Parameters	Female		Male		P-value
	Mean	SD	Mean	SD	
A	9.16	0.6	10.63	1.17	-
B	19.26	0.4	21.83	1.02	-
C	19.72	2.3	29.41	6.1	-
D	33.2	2.3	44.34	1.93	p<0.01**
E	125.30	8.49	151.31	0.54	p<0.01**
F	158.86	10.37	198.93	3.85	p<0.01**
G	89.38	5.81	114.5	7.29	p<0.01**
H	26.25	1.70	37.69	4.94	p<0.01**
I	62.32	6.48	79.14	2.69	p<0.01**
J	32.22	2.80	42.79	2.36	p<0.01**
K	25.53	2.81	37.99	1.73	p<0.01**
L	19.56	2.54	28.55	1.90	-
M	14.30	1.25	19.80	1.43	-
N	9.04	0.24	8.78	0.81	-
O	33.58	2.54	41.08	0.7	-
P	60.53	2.87	80.27	3.70	-

DISCUSSION

The mandibular length and height were 158.86±10.37 mm, 89.38±5.81 mm, in females and 198.93±3.85 mm, 114.5±7.29 mm, in males of Gurcu goats, respectively. Whereas, the similar mandibular data were 12.00±0.89 cm, 6.90±1.09 cm for WAD goats (Olopade and Onwuka, 2005); 14.21±0.98 cm and 8.83±0.40 cm in black Bengal goat (Uddin et al., 2009); 14.1±1.03 cm and 8.69±0.18 cm, respectively (Monfared et al., 2013); 17.6±0.32 cm and 9.96±0.25 cm in sheep, while in roe deer 15.6±1.22 cm and 8.43±0.15 cm (Avdić et al., 2013); 11.24±0.52 cm, 6.64±0.44 cm in GVD goat (Kataba et al., 2014); 16.53±0.12 cm, 10.69±0.02 cm in blackbuck

(Choudhary and Singh 2015b) and 14.18±0.48 cm, 8.21±0.33 cm in males; 12.93±0.96 cm, 7.33±0.50 cm in females of chinkara (Din et al., 2020).

The morphometric parameters related to the mandibular and mental foramen as the most two important clinical parameters of the mandible situated on the medial and lateral surface of the mandible bone respectively have been shown in Figure 2-4. The mental foramen at the Gurcu goats looks oval in shape (Figure 5). Mandible incisure was found to be narrower in females than in male Gurcu goats. In two cases, it was found double mental foramen on mandibles belonging to female goats.

The distance between the first inferior incisor tooth and mental foramen and to the first premolar tooth was in females 19.72±2.3, 19.26±0.44 mm and 29.41±6.10, 21.83±1.02 mm, in males, respectively (Figure 2). The space between the lateral alveolar roots of the third inferior incisor tooth to the mental foramen was 33.2±2.3 mm in females, 44.34±1.93 mm in males of Gurcu goats (Figure 3), which was an important landmark for achieving the location of the mental foramen nerve for the regional nerve block in Gurcu goats. In contrast, it was 1.60±0.22 cm in WAD goat (Olopade and Onwuka, 2005); 2.00±0.3 cm in red Sokoto (Maradi) goats (Olopade and Onwuka, 2007); 2.45 cm in blackbuck (Choudhary and Singh, 2015a); 1.25±0.19 cm in females of chinkara (Din et al., 2020). The space from the lateral alveolar first inferior incisor tooth to the mental foramen was 2.40±0.26 cm, which is the study made by Monfared et al. (2013).

Nervus mentalis is a branch of the lower alveolar nerve that arises through the foramen mentale and divides into three branches below the musculus depressor anguli oris. (Farak et al., 2017; NAV, 2017). These branches are distributed to the skin of the chin as well as the skin and mucous membrane of the lower lip (Farak et al., 2017). In Gurcu goat mandibles, the blockage of the extraoral can be obtained by injecting the mental nerve approximately 3-4 cm of the anesthetic drug into the mental foramen from the lateral extension of the alveolar root of the lower third incisor. However, a similar nerve block can be successful by injecting approximately 2.80 cm of the anesthetic drug into the barking deer and approximately 3.00 cm into the sambar deer (Keneisenuo et al., 2020). The blockade of the nervus mentalis is beneficial in numbing the lower lip during surgical procedures.

The maximum distance from the mental foramen to the caudal border of the ramus of the mandible was 125.30 ± 8.49 mm in females, 151.31 ± 0.5 mm in males of Gurcu goats, while the same parameters were 13.43 ± 0.08 cm in blackbuck (Choudhary and Singh, 2015b); 11.69 ± 0.40 cm in black Bengal goat (Uddin et al., 2009); 13.74 ± 0.18 cm in Mehraban sheep (Karimi et al., 2011b); 9.26 ± 0.49 cm in GVD goat (Kataba et al., 2014); 15.23 ± 1.46 cm in Barbados black belly sheep (Mohamed et al., 2016); 11.8 ± 0.89 cm in black Bengal goat (Poddar et al., 2018) and 12.38 ± 1.52 cm in Abaza goats (Dalga, 2020).

The mandibular foramen looks quite large, 9.04 ± 0.24 mm in females and 8.78 ± 0.81 mm in males. It is located at about one-third of the maximum height of the mandible and is positioned almost in the middle of the pterygoid fossa, which is not very pronounced.

The distances from the mandibular foramen to the ventral margin of the mandible was 32.22 ± 2.80 mm in females and 42.79 ± 2.36 mm in males, whereas the distance from mandibular foramen to the border of mandibular angle was 19.56 ± 2.54 mm in females and 28.55 ± 1.90 mm in males of Gurcu goat. These two parameters of the mandibular foramen had statistically significant differences between females and males of Gurcu goats. The distance from the caudal border of the mandible to the level of the mandibular foramen was 25.53 ± 2.81 mm in females and 37.99 ± 1.73 mm in males (Figure 3). Whereas the same parameters were recorded as; 4.18 ± 0.01 cm, 1.36 ± 0.01 cm, 3.07 cm in blackbuck (Choudhary and Singh, 2015a); 2.88 ± 0.93 cm, 2.50 ± 0.73 cm, and 1.29 ± 0.12 cm respectively about the study made by Monfared et al., (2013). The same distances for WAD goats of Nigeria were 1.57 ± 0.44 cm, 2.58 ± 0.34 cm for the caudal border of the mandible to below mandibular foramen and the mandibular foramen to the ventral margin of the mandible (Olopade and Onwuka, 2005).

Mandibular nerve blockage is used to anesthetize the mandibular nerve during clinical examinations and surgical procedures involving the alveoli and teeth of the lower jaw in animals (Lahunta and Habel, 1986).

The mandibular nerve is beneficial in the treatments to be obtained with all operational intervention related to the lower jaw such as lower incisors, molars, and premolars, tooth extraction, tumor. Mandibular nerve block can be achieved by injecting anesthetic drugs approximately 32.22 ± 2.80 mm to 42.79 ± 2.36 mm in Gurcu goat from the

horizontal plane at the level of the ventral margin of the mandible to the ventral limit of the mandibular foramen. However, the same nerve block can be achieved by injecting anesthetic drugs approximately 2.5 cm and 5 cm in barking deer and sambar deer, respectively at the level given above (Keneisenuo et al., 2020) or, 3.43 ± 0.25 , 2.58 ± 0.34 cm to Markhoz goat WAD goat and 2.88 ± 0.93 cm to Iranian native goat (Goodarzi and Hosseini, 2013).

The distance from the mandibular foramen to the cranial border of the mandible was 14.30 ± 1.25 mm in females and 19.80 ± 1.43 mm in males of Gurcu goats; however, the same parameter was recorded as 5 ± 55 cm in cattle (Nazih and El-Sherif, 2018). An intraoral mandibular nerve block can be achieved by injecting anesthetic drugs approximately 1.4-1.9 cm in Gurcu goat from the cranial border of the mandible to the mandibular foramen.

CONCLUSION

The applied anatomical data created from the mentioned parameters described in the present investigation were not reported previously in the Gurcu goat, which has great surgery significance and may be used as a landmark for tracing the mental and mandibular nerve desirable for their desensitization during any type of operative procedure at the level of the specific foramen.

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Author's Contributions: SD, KA designed the study. SD collected the materials and made the maceration operations. SD created certain parameters based on samples and took measurements. SD made the statistical analysis of the measurements taken. SD and KA did the writing of the study (SD:Semine Dalga, KA:Kadir Aslan)

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