International Journal of Engineering Inventions
e-ISSN: 2278-7461, p-ISSN: 2319-6491
Volume 13, Issue 5 [May. 2024] PP: 15-22

Morphometric Investigation of Lumbal and Sacral Vertebrae in Aksaray Malakli Dogs*

Muhammet Alperen FİDAN[1] Zekeriya ÖZÜDOĞRU[2]
[1]Aksaray University, Faculty of Veterinary Medicine, Department of Veterinary Anatomy, 68220, Aksaray, Turkey
Corresponding Author: Muhammet Alperen FİDAN
[2]Balıkesir University, Faculty of Veterinary Medicine, Department of Veterinary Anatomy, 68220, Balıkesir, Turkey
**This article was produced from Muhammet Alperen FİDAN's Master's Thesis.*

***ABSTRACT*:** *This research focused on the dimensions and shape of the lumbal and sacral vertebrae of Aksaray Malakli dogs. Within the scope of the study, the lumbal and sacral vertebrae of six Aksaray Malakli dog cadavers were examined, various measurements were performed on these vertebrae and the data obtained were presented. This investigation delves into the morphometric analysis of the lumbal and sacral spinal bones from six Aksaray Malakli dogs that succumbed to diverse causes between 2022 and 2023 at Aksaray University Faculty of Veterinary Medicine Animal Hospital. The cadavers were initially subjected to a 14 day detection period in a 10% formaldehyde solution before being meticulously readied for dissection. In the study, it was determined that the processus spinousus and processus transversus protrusions of the lumbal vertebrae extend regularly until the sixth lumbal vertebra. Regarding the transverse diameters of the vertebral body, it was determined that the lowest value was "1.60±0.17 cm" in the second lumbal vertebra and the highest value was "1.81±0.09 cm" in the fifth lumbal vertebra. It was observed that the body length of the lumbal vertebrae increased steadily until the fifth vertebra and then decreased steadily until the seventh vertebra. The first four lumbal vertebrae were found to have processus accesorius near the processus articularis caudalis. It was observed that the sacrum is formed by the fusion of three sacral vertebrae and that the processus spinousus and processus transversus of these three vertebrae fuse to form the sacrum bone. Consequently, this study aims to enhance breed registration initiatives conducted by various institutions worldwide. By conducting a thorough examination of the lumbal and sacral vertebrae of the Aksaray Malakli dog, a breed deemed a local asset, we aim to provide valuable insights from both macroanatomical and morphometric perspectives. This endeavor aspires to bolster the breed's recognition on both local and global scales.*
Keywords: Anatomy, Sacral Bone, Lumbal Vertebra

Date of Submission: 24-04-2024 Date of acceptance: 02-05-2024

I. INTRODUCTION

Shepherd dogs in Turkey are divided into two different breeds, Akbaş and Karabaş [2]. Among the Karabaş dogs, the most well-known member accepted as a special breed by FCI (International Canine Institution) is Sivas Kangal [1]. Among the Karabaş shepherd dogs, there are also local breeds such as Alabay and Aksaray Malakli.

Aksaray Malakli dogs are seen in Central Anatolia, especially in Aksaray, Nevşehir and Şereflikoçhisar regions. These dogs, whose anatomical structure is quite similar to the Sivas Kangal breed, have a larger body, less hair thickness and a straight tail than the Sivas Kangal. They are also behaviorally more aggressive towards humans and other dogs [3].

Although the bones that form the columna vertebralis are generally similar in shape between species, macro-anatomical differences may exist [8]. These differences can be observed in terms of the anatomical structures as well as in the number of bones forming the column [14]. The columna vertebralis includes the region from the skull to the atlas and the tip of the tail. These parts are called the neck (pars cervicalis), back (pars thoracalis), waist (pars lumbalis), rump (pars sacralis) and tail (pars caudalis) [5]. The lumbal vertebrae define the lumbal part of the spine and can range in number from 5 to 7. Carnivores usually have 7 bones in total [7]. A notable characteristic of the lumbal vertebrae is the extension of the processus transversus towards the skull [25]. Therefore, they are characterized as vertebrae with the longest processus transversus. The height of the processus spinousus is greater than the width, usually 5/3, but the height/width ratio varies between animal species. The caudal part of the bones usually has a processus accesorius close to the processus articularis caudalis [10]. The Os sacrum comprises the rump of the vertebral column. It consists of 3 or 5 sacral vertebrae

[9]. When observed ventrally, it usually has a structure reminiscent of a triangle. Cranially, it articulates with the last lumbal vertebra (seventh lumbal vertebra in carnivora) and caudally with the first caudal vertebra [9]. It also articulates ventrally with the facies auricularis, which is located on the facies sacropelvina of the os coxae [24].

In recent years, studies have been carried out on the columna vertebralis [15], skull [16], tibia [23], mandible [17] and plexus lumbosacralis [13] of the Aksaray Malakli dog. This study aimed to increase the diversity of studies on Aksaray Malakli breed dogs, to create a data source for future studies, to reveal anatomical differences as well as to examine breed-specific features and to contribute to the recognition of the breed in this way.

II. MATERIALS AND METHODS

In this study, the lumbal and sacral spinal bones of 6 adult Aksaray Malakli dogs that died of various causes between 2022-2023 at Aksaray University, Faculty of Veterinary Medicine Animal Hospital were morphometrically analyzed. The cadavers were previously preserved in 10% formaldehyde solution for 14 days and then prepared for dissection. To obtain the lumbal and sacral vertebrae, the skin and fascia, nerve and muscle tissues were removed, and the costae were cut with a costatome. Then the L1-S3 vertebrae were separated with a saw. Fat and tissue residues on the obtained vertebrae were removed and the vertebrae were macerated in 10% ammonium hydroxide solution for 3 days. After the maceration process was completed, anatomical measurements were made using a Xolo Steel 150 mm Digital Caliper and statistical data were obtained. Veterinary anatomy terms Nomina Anatomica Veterinaria (6th Edition, 2017) were used in the study. Aksaray University Animal Experiments Local Ethics Committee approval (05.12.2022/2022-11/50) was obtained and the study was carried out accordingly.

III. RESULTS

In this study, a detailed anatomical examination and morphometric measurements of the lumbal and sacral vertebral bones of Aksaray Malakli dogs were performed and the results of the measurements were analyzed.

In the study, considering the processus transversus measurements, it was found to be the shortest for the first lumbal vertebra (5.84±0.51 cm) and the longest for the sixth lumbal vertebra (9.14±1.01 cm). Processus transversus lengths showed a linear increase with the 6th lumbal vertebra, but there was a decrease between the 7th lumbal vertebra (8.71±0.61 cm) and the 6th lumbal vertebra (Table 1).

The measurements also showed that the processus spinousus for the first lumbal vertebra (Figure 1) was shorter (3.24±0.44 cm) than the other vertebrae (Table 1). It was observed that the length of the processus spinousus increased steadily until the 6th lumbal vertebra (4.03±0.25 cm), and the 7th lumbal vertebra (3.43±0.25 cm) had a shorter processus spinousus than the other 5 vertebrae except for the first lumbal vertebra (Table 1).

The vertical measurements of the foramen vertebrale neither increased nor decreased regularly. The lowest value was found in the seventh lumbal vertebra (1.11±0.18 cm) and the highest value was found in the first lumbal vertebra (1.29±0.20 cm). A regular increase was observed in the transversal diameter measurement values until the 6th vertebra, while the mean value of the transversal diameter of the foramen vertebrale measurement of the 7th lumbal vertebra (1.63±0.35 cm) was only higher than that of the 1st vertebra (1.58±0.19 cm) (Table 1).

Regarding the transversal diameters of the corpus vertebrae, the lowest value belonged to the 2nd lumbal vertebra (1.60±0.17 cm) and the highest value belonged to the 5th lumbal vertebra (1.81±0.09 cm). On the other hand, the vertical diameters of the other vertebrae were close to each other, but showed a regular increase (Table 1).

Regarding the thickness of the bone wall that forms the foramen vertebrale, there was no significant difference between the vertebrae, but there was a slight increase towards the last vertebrae (Table 1).

The body lengths of the lumbal vertebrae showed a regular increase until the 5th lumbal vertebra and a regular decrease until the 7th vertebra. According to these data, the 5th lumbal vertebra had the longest body length (3.72±0.22 cm) and the 1st lumbal vertebra had the lowest body length (3.18±0.14 cm). Regarding the width of the vertebrae, a regular increase was observed from the first vertebra to the 7th vertebra (Table 4).

In the present study, different measurements of the lumbal vertebral bones of the animals used were reported (Table 1). For example, the average width of the processus transversus, the average length of the processus spinousus, and the average thickness of the bone wall of the foramen vertebrale were measured as 5.84 cm, 3.24 cm and 0.62 cm, respectively, in L1 (first lumbal vertebra). Similarly, the mean measurements of other lumbal vertebral bones were also presented (Table 1).

In the study, it was determined that the processus accesorius was found near the processus articularis caudalis on the caudal aspect of the first 4 lumbal vertebrae. It was observed that the sacrum was formed by the fusion of 3 sacral vertebrae and the processus spinousus and processus transversus of these vertebrae fused to form a single bone. The anatomical features of the sacrum were examined and reported in detail (Table 2, Figure

2). It was observed that the ventral and dorsal faces of the sacrum had different holes. The facies auricularis had a lateral structure and the crista sacralis mediana was flattened and thin.

In the results of the study, a series of measurements of the sacrum, such as craniocaudal length, laterolateral length, and measurements of the canal of the canalis sacralis were presented (Table 2). These measurements provide detailed information about the general structure of the sacrum.

IV. DISCUSSION

In this study, the lumbal and sacral vertebrae of Aksaray Malakli dogs were examined in detail and the measurements obtained were presented with statistical data. It was determined that there were 7 lumbal and 1 sacral vertebrae in Aksaray Malakli dogs, in line with the studies reported by Karan et al. (2016) [19] in lynx, Nur et al. (2021) [20] in cats, Dursun (2005) [9], İlgün et al. (2017) [15] in dog, Girgin et al. (1988) [14] in fox and domestic dogs.

On the other hand, in the same direction as the studies conducted by Tecirlioğlu (1983) [26] and Girgin et al. (1988) [14] in different species, it was observed that the processus transversus of the lumbal vertebrae were in the cranioventral direction and the length of these processes increased from beginning to end in the Malakli dog. Similarly, Miller et al. (1979) [21] noted that the length of the processus transversus of the lumbal vertebrae increases up to the fifth or sixth vertebra, and usually the seventh lumbal vertebra is not as long as the sixth but has a sharper slope in front. The data measured in this study supported Miller's findings, confirming that the increase was from the 1st lumbal vertebra to the 6th vertebra and that the 7th lumbal vertebra was shorter than the 6th vertebra.

Regarding the processus accesorius, Dursun (2006) [10] reported that this structure was present in all lumbal vertebrae, while Jones et al. (1995) [18] reported that this structure was present up to the 5th lumbal vertebra. In a study conducted on Aksaray Malakli dogs in 2017, this structure was not found in the last 3 lumbal vertebrae [15]. Studies conducted by Girgin et al. (1988) [14] in the last lumbal vertebrae of the dog and fox, Karan et al. (2016) in the lynx, and Girgin et al. (1988) [14] in the wolf reported that this structure was not evident in the last 2 lumbal vertebrae.

This study found the processus accesorius in the first four lumbal vertebrae but not in the last three lumbal vertebrae.

Wang et al. (2015) [27] reported a continuous increase in the width of the foramen vertebrae from the first lumbal vertebra to the last lumbal vertebra in humans and deer. Bai et al. (2012) [4], in a study on humans, deer and sheep, reported that in humans, the transversal diameter gradually increased from L1 to L5, but the sagittal diameter decreased from L1 to L3 and slightly increased at L4 and L5; in deer, both values increased from cranial to caudal; and in sheep, there was a regular increase in vertebrae other than L2.

In dogs, Feeney et al. (1996) [12] reported that both the dorsoventral and transversal diameter of the vertebral canal of the first six vertebrae widened from cranial to caudal. In Aksaray Malakli dogs, the transversal diameters of the foramen vertebrae showed a regular increase from L1 (first lumbal vertebra) to L6 (sixth lumbal vertebra); however, the mean value of the transversal diameter of the foramen vertebrale of the 7th lumbal vertebra was higher than that of the 1st lumbal vertebra only. Regarding the vertical diameter measurements of the foramen vertebrale structure of the vertebrae, it was determined that it did not show a regular increase or decrease graph, with the lowest value in the seventh and the highest value in the first lumbal vertebra.

Bai et al. (2012) [4] reported that the width and length of the lumbal vertebrae of humans, deer and sheep show a regular increase from L1 to L5. However, in this study, it was determined that the width of the lumbal vertebrae increased from 1 to 7, but the length increased until the 5th lumbal vertebra and then decreased until the 7th vertebra.

In this study, the lumbal and sacral vertebrae of Aksaray Malakli were analyzed macroanatomically and morphometrically in detail. Tecirlioğlu (1983) [26] in hyena, Dursun and Tıpırdamaz (1989) [11] in mink, Karan et al. (2016) [19] in lynx, reported that the processus spinousus of the sacrum is free, Girgin et al. (1988) [14] stated that it is completely fused from the top in a wolf, but there is an incisura in a fox and dog. In this study, it was determined that the corpus and processus spinousus of the sacral vertebrae of the Aksaray Malakli dog were completely fused and looked like a single bone.

Ocal et al. (2006) [22] reported that the average ventral length of the sacrum was 4.3 cm and the average sacral width was 5.227 cm in a study on the sacrum of the dog. However, this study determined that the mean craniocaudal length measured from the ventral side of the sacrum of the Aksaray Malakli dog was 5.77 cm and the mean laterolateral length was 6.65 cm. In both studies, it was observed that the value measured laterolateral length was longer than the value measured craniocaudal length.

Regarding the measurements of the sacral canal, Ocal et al. (2006) [22] reported that the mean vertical diameter measurement of the sacral canal was 0.756 cm and the mean transversal diameter measurement was 2.666 cm. However, according to the measurements made in this study, it was determined that the mean vertical

diameter measurement of the sacral canal was 1.24 cm and the mean transversal diameter measurement was 1.90 cm. In both studies, the transversal measurement was found to be longer than the vertical measurement.

It is believed that this study may also help in the macroanatomical aspects of surgical interventions for the treatment of diseases such as intervertebral disc degeneration, disc protrusion involving the vertebral canal and intervertebral foramen, articular process osteophytosis, articular process fracture, spondylosis deformans in the lumbosacral region, which are common in dogs.

V. CONCLUSION

As a result, this research aims to contribute to the breed registration studies of various institutions around the world to increase the local and global recognition of this breed by examining the lumbal and sacral vertebrae of the Aksaray Malakli dog, which is considered a local value, from both macroanatomical and morphometric perspectives. These measurements performed on the sacrum and lumbar vertebral bones of the Aksaray Malaklı dog will contribute morphometrically to future operative interventions. In addition, the measurements made in the study constitute a dimensional example of an anatomical apparatus that can provide prosthesis-like walking support for loss of function caused by neural or bony traumas in the anatomical region in question.

REFERENCES

[1]. Atasoy F. Köpek-kedi yetiştiriciliği ders notları. Ankara Üniversitesi Veteriner Fakültesi. Zootekni Anabilim Dalı. Ankara. 2010.
[2]. Atasoy F, Erdoğan M, Özarslan B, Yüceer B, Kocakaya A, Akçapınar H. Malaklı Karabaş köpeklerde bazı morfolojik ve genetik özellikler. Ankara Üniv. Vet. Fak. Derg., 2014; 61(2):125-132.
[3]. Atasoy F, Erdoğan M, Yüceer B, Özarslan B, Kocakaya A. Türk mastifi morfolojik ve genetik özelliklerinin belirlenmesi ve bu köpeğin tanıtılması. Broşür 1. Baskı. Medisan Yayınevi Ltd Şti., Ankara. 2011.
[4]. Bai X, Liu G, Xu C, Zhuang Y, Zhang J, Jia Y, Liu Y. Morphometry research of deer, sheep, and human lumbal spine: feasibility of using deer and sheep in spinal animal models. Int J Morphol, 2012; 30(2):510-20.
[5]. Boyd J. S. Atlas en color de anatomía clínica del perro yel gato 2'a Ed, Elsevier España, 2008.
[6]. Budras K. D. Veteriner anatomi atlası: Köpek. Medipres. ISBN: 978-975-6676-38-7. 6, 2009.
[7]. Crouch J. E. Text-Atlas of cat anatomy, 1969.
[8]. De Carvalho Barros R. A, Leonel L. C. P. C, De Carvalho Souza C. E, de Oliveira L. P, de Oliveira T. S, de Oliveira Silva D. C, Silva Z. Anatomy of lumbosacral plexus in hoary fox (Lycalopex vetulus LUND, 1842). IJAERS, 2019; 6(3).
[9]. Dursun N. Veteriner Anatomi, Cilt 1, 9. Baskı. Medisan Yayınevi, Ankara, 2005.
[10]. Dursun N. Veteriner Anatomi I, 10. Baskı. Medisan Yayınevi, Ankara, 2006.
[11]. Dursun N, Tıpırdamaz S. Vizonun (Mustela vison) iskelet kemikleri üzerinde makroanatomik araştırmalar. Selçuk Üniv. Vet. Fak. Derg., 1989; 5(1):13-27.
[12]. Feeney D. A, Evers P, Fletcher T. F, Hardy R. M, Wallace L. J. Computed tomography of the normal canine lumbosacral spine: a morphologic perspective. Vet. Radiol. Ultrasound., 1996; 37(6):399-411.
[13]. Fidan M. A, Özüdoğru Z, İlgün R. Macro-anatomical investigations on the Plexus Lumbosacralis of the Aksaray Malakli Dog. Iranian Journal of Veterinary Medicine, 2024; 18(1):43-50.
[14]. Girgin A, Karadag H, Bilgiç S, Temizer A. Kurt (Canis lupus) ve tilki Canis vulpes) iskelet kemiklerinin yerli köpeğinkilerine (Canis familiaris) göre gösterdikleri makro-anatomik ayırımlar üzerine araştırmalar. Selçuk Üniv. Vet. Fak. Derg., 1988; 4(1):169-182.
[15]. İlgün R, Özkan Z. E, Yılmaz S, Karan M. Aksaray Malaklı köpeklerinde Columna Vertebralis'in makro-anatomik olarak incelenmesi. F.Ü. Sağ. Bil. Vet. Derg., 2017; 31(2).
[16]. İlgün R, Özkan Z. E. Comparative study of some osteometric measurements of the neurocranium and splanchnocranium bones in Aksaray Malaklı and Kangal dogs. F.Ü. Sağ. Bil. Vet. Derg., 2015; 29(3):157-161.
[17]. İlgün R, Özüdoğru Z. Macroanatomical and morphometric investigation of Mandibula in Aksaray Malaklı dogs. Van Vet. J., 2020; 31(1).
[18]. Jones J. C, Cartee R. E, Bartels J. E. Computed tomographic anatomy of the canine lumbosacral spine. Vet. Radiol. Ultrasound., 1995; 36(2):91-99.
[19]. Karan M, Yılmaz S, Özkan Z. E, Baygeldi S. B. Vaşaklarda (Lynx lynx) Columna Vertebralis'i oluşturan omurların makro-anatomik olarak incelenmesi. F.Ü. Sağ. Bil. Vet. Derg., 2016; 30:177-180.
[20]. Nur İ, Pérez W, König H. E, Linton A. Origin and distribution of the lumbosacral plexus anatomy in Van Cats Int. J. Morphol., 2021:39(3).
[21]. Miller M. E, Evans H. E, Christensen G. C. Miller's Anatomy of the Dog. No: SF 767. D6. M53 1979.
[22]. Ocal M. K, Ortanca O. C, Parın U. A Quantitative study on the Sacrum of the Dog. Ann. Anat., 2006; 188(5):477-482.
[23]. Özüdoğru Z, Fidan M. A, Gümüş F, İlgün R. Aksaray Malaklı köpeklerinde tibia ve interkondiler genişlik indeksi üzerine morfometrik bir çalışma. J. Adv. VetBio. Sci. Tech., 2023; 8(2):143-149.
[24]. Pasquini C, Spurgeon T. L. Anatomy of domestic animals. Sudz Publishing. ISBN: 0962311421. 1989.
[25]. Sisson S, Grossman J. D, Getty R. Sisson and Grossman's The Anatomy of the Domestic Animals. Saunders, 1975.
[26]. Tecirlioğlu S. Sırtlan ve köpeğin iskelet kemikleri üzerinde makro-anatomik araştırmalar. Ankara Üniv. Vet. Fak. Derg., 1983:30(01).
[27]. Wang Y, Lıu T, Song L. S, Zhang Z. X, Lı Y-Q, Lu L. J. Anatomical characteristics of deer and sheep lumbal spines: Comparison to the human lumbal spine. Int. J. Morphol., 2015; 33(1):105-112.

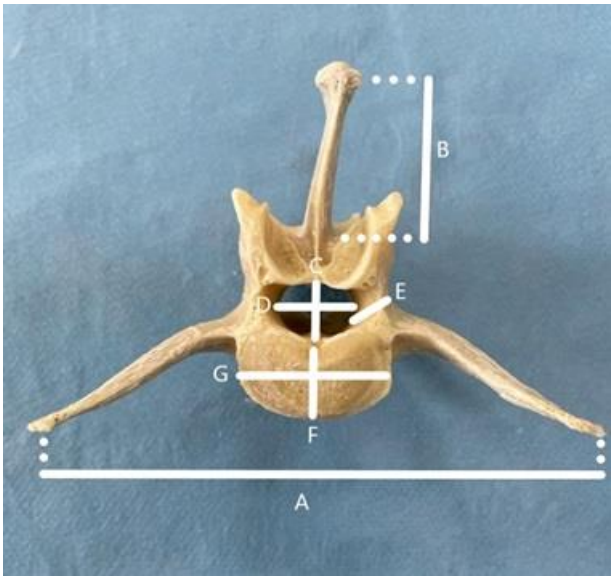

Figure 1. Macroanatomical measurement regions on the sixth lumbal vertebra (The values in Table 1 will be evaluated based on Figure 1.)

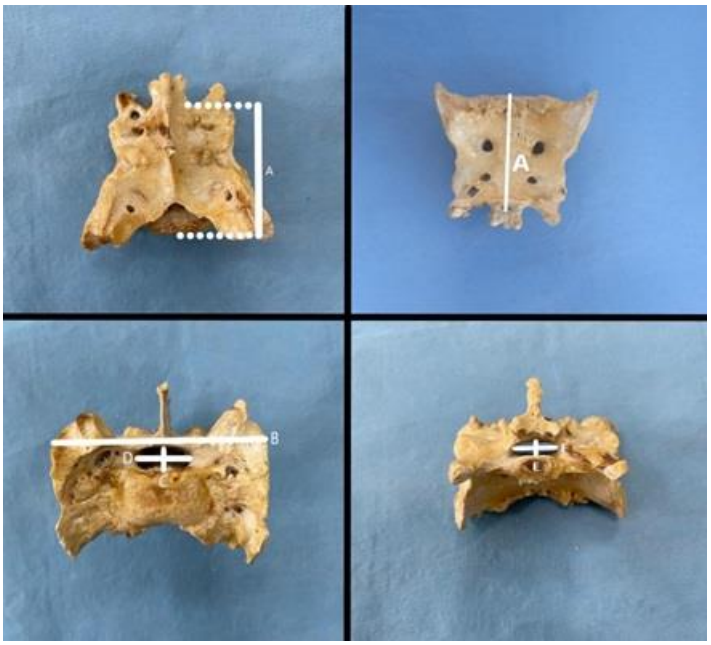

Figure 2. Macroanatomical measurement regions on the sacrum bone (The values in Table 2 will be evaluated based on Figure 2.)

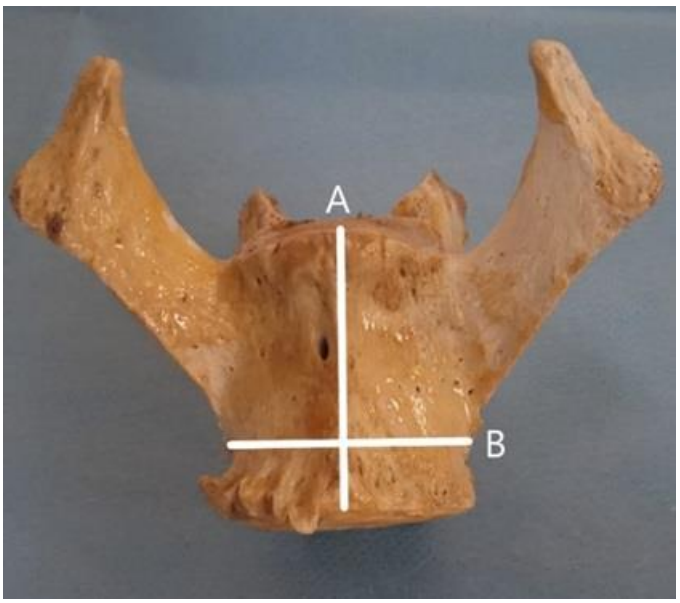

Figure 3. Length (A) and width (B) of the vertebral body. (The values in Table 4 will be evaluated based on Figure 3.)

Table 1. Macroanatomical measurements on the lumbal vertebrae of Aksaray Malakli dog. (Cm)

Region / Value	A	B	C	D	E	F	G
L1 Min.	5.26	2.90	1.08	1.37	0.4	1.45	2.23
L1 Max.	6.71	4.11	1.62	1.87	0.78	1.92	2.78
Mean S.d.	5.84 ±0.51	3.24 ±0.44	1.29 ±0.2	1.58 ±0.19	0.62 ±0.13	1.64 ±0.17	2.54 ±0.19
L2 Min.	6.20	3.27	1.01	1.49	0.53	1.38	2.20
L2 Max.	7.97	3.90	1.34	1.91	0.66	1.78	2.88
Mean S.d.	6.82 ±0.66	3.51 ±0.24	1.13 ±0.11	1.66 ±0.17	0.62 ±0.06	1.60 ±0.17	2.53 ±0.29
L3 Min.	6.77	3.05	1.05	1.57	0.42	1.31	2.27
L3 Max.	8.48	3.99	1.36	1.96	0.74	1.99	3.00
Mean S.d.	7.34 ±0.68	3.62 ±0.41	1.24 ±0.11	1.74 ±0.18	0.58 ±0.11	1.67 ±0.24	2.55 ±0.26
L4 Min.	7.07	3.33	0.96	1.59	0.42	1.35	3.00
L4 Max.	9.25	4.15	1.49	2.03	0.75	1.99	1.89
Mean S.d.	7.90 ±0.76	3.86 ±0.31	1.15 ±0.19	1.78 ±0.16	0.55 ±0.12	1.72 ±0.08	2.49 ±0.37
L5 Min.	7.53	3.17	0.99	1.68	0.49	1.68	2.51
L5 Max.	9.77	4.39	1.48	2.36	0.69	1.91	3.09
Mean S.d.	8.68 ±0.92	3.89 ±0.42	1.17 ±0.18	1.98 ±0.27	0.59 ±0.10	1.81 ±0.09	2.73 ±0.23

L6 Min.	7.47	3.71	1.01	1.56	0.53	1.46	2.61
L6 Max.	10.32	4.34	1.49	2.36	0.76	2.07	3.2
Mean S.d.	9.14 ±1.01	4.03 ±0.25	1.22 ±0.19	2.04 ±0.29	0.65 ±0.1	1.75 ±0.23	2.8 ±0.22
L7 Min.	8.07	3.12	0.92	1.23	0.67	1.58	2.8
L7 Max.	9.79	3.81	1.34	2.13	1.26	1.95	3.29
Mean S.d.	8.71 ±0.61	3.43 ±0.25	1.11 ±0.18	1.63 ±0.35	1.00 ±0.2	1.77 ±0.16	2.9 ±0.19

A: Processus transversus width
B: Processus spinousus length
C: Foramen vertebrale vertical diameter
D: Foramen vertebrale transversal diameter
E: Bone wall thickness forming the foramen vertebrale
F: Corpus vertebrae vertical diameter measurement

Table 2. Macroanatomical measurements of Sacrum bone of Aksaray Malakli dog.

Region / Value	Min. Value (cm)	Max. Value (cm)	Mean & S.d. (cm)
A	5.13	6.23	5.77 ± 0.43
B	6.28	6.83	6.65 ± 0.23
C	0.58	1.31	1.24 ± 0.29
D	1.49	2.6	1.9 ± 0.40
E	0.42	0.78	0.62 ± 0,14
F	0.73	1.76	1.49 ± 0.40

A: Craniocaudal length of the sacrum.
B: Laterolateral length of the sacrum.
C: Vertical diameter of the cranial entrance of the canalis sacralis of the sacrum.
D: Transversal diameter of the cranial entrance of the canalis sacralis of the sacrum.
E: Vertical diameter of the caudal outlet of the canalis sacralis of the sacrum.
F: Transversal diameter of the caudal outlet of the canalis sacralis of the sacrum.

Table 3. Craniocaudal length of the lumbosacral vertebrae of Aksaray Malakli dog.

Example Sequence Number	Lumbosacral Vertebrae Craniocaudal Length
1	33,33 cm
2	34,07 cm
3	32,10 cm
4	36,61 cm
5	34,45 cm
6	30,63 cm
Mean & S.D.	33,53 ±2.06 cm

Table 4. Length and width measurements of the body size of the vertebrae of Aksaray Malakli dog. (cm)

Region / Value	Length (A)	Width (B)
L1 Min.	3.01	2.42
L1 Max.	3.35	2.96
Mean & S.d.	3.18±0.14	2.74±0.20
L2 Min.	3.16	2.64
L2 Max.	3.58	3.09
Mean & S.d.	3.35±0.28	2.79±0.17
L3 Min.	3.31	2.70
L3 Max.	3.70	3.10
Mean & S.d.	3.53±0.15	2.91±0.14
L4 Min.	3.30	2.75
L4 Max.	3.80	3.15
Mean & S.d.	3.59±0.21	3.03±0.16
L5 Min.	3.38	2.81
L5 Max.	3.96	3.39
Mean & S.d.	3.72±0.22	3.15±0.19
L6 Min.	3.44	2.72
L6 Max.	4.06	3.65
Mean & S.d.	3.66±0.24	3.20±0.29
L7 Min.	2.82	2.87
L7 Max.	3.70	3.71
Mean & S.d.	3.26±0.31	3.38±0.31