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Gross morphological studies on the kidney of Barbari goat (*Capra hircus*)

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Abstract

A study was conducted on the kidneys of Barbari goats of either sex between the ages of 1.5 and 2 years. The morphological studies were conducted on the kidneys of 24 goats and revealed that the right kidney was slightly longer than the left, and there was no significant difference observed between the weight, width, thickness, circumference, and volume of the right and left kidneys. Both the kidneys were bean shaped, smooth, and reddish brown in color. The renal papilla is formed by the fusion of six to twelve pyramids.

Keywords: Barbari goat, kidney, physical parameters, body weight

Introduction

Barbari, also called "Dwarf Guinea Goat" (Singh *et al.*, 2022) [42], is a breed of goat with dual purposes (milk and meat). It is found in the Indian states of Haryana, Punjab, and Uttar Pradesh, as well as the Punjab and Sindh provinces of Pakistan. The coat is often short and has brownish-red spots on it, however, it can also have solid colors. (Valerie Porter *et al.*, 2016) [40]. As per the 2019 livestock census, the goat population in the country is 148.88 million. It is employed in intensive farming and is a seasonal breeder. After around 150 days of lactation, the output of milk is about 107 liters. (Mahgoub *et al.*, 2011) [23]. The kidneys are the body's primary excretory organs in mammals. They play a significant role in blood pressure regulation as well as the preservation of fluid and electrolyte balance. Erythropoietin is another humoral chemical that the kidneys produce and release into the blood stream to influence blood formation. The present investigation has been planned to study the gross morphological structure of the kidney in order to demonstrate the kidney's significance and necessity for the body.

Materials and Methods

The present study was conducted on 17 to 22 kg body weight bearing fifty apparently healthy adult Barbari Goat" (*Capra hircus*) of either sex, 18 to 24 months old. The freshly slaughtered adult animals were used for the topographic study of the kidney. The abdominal viscera were dissected, and the relations of the kidney with other visceral organs were studied. 48 kidneys were procured from the 24 freshly slaughtered goats at the local slougher units of Ayodhya District.

Measurements were taken for weight, length, breadth, thickness, and volume, among other physical characteristics. A physical balance was used to measure weight, Vernier callipers and a measuring scale were used to measure length, breadth, and thickness, and the water displacement method was used to measure volume. A cotton thread was used to measure the circumference.

Results and Discussion

The results of the gross parameters of the kidneys of the Barbari goat are described below.

Gross Examination

The kidneys in the current study were retroperitoneal and were next to the dorsal body wall. The left kidney was positioned below the bodies of the third, fourth, and fifth lumbar vertebrae, whereas the right kidney was located somewhere below the first three lumbar transverse processes (Fig 1). Surrounding both kidneys is a thick layer of fat. Akers and Denbow (2008)^[2] obtained similar results in sheep, and Sisson and Grossman (1956)^[33] in goats. A caudate ligament joined the right kidney's cranial end to the caudate lobe of liver, which was embedded in the renal impression of liver

Shape and colour

The kidneys had a reddish brown in colour and a bean shape. Both the kidneys were smooth externally without any superficial lobulation; (Fig 4) Raghavan (1964)^[27], Getty (1977)^[9] for goats, Konig and Liebich (2006)^[16] and Dyce *et al.* (2010)^[7] for domestic animals, Smuts and Benzuidenhout (1987)^[34] and Beniwal (1995)^[4] for camels, Halder *et al.* (2002 a)^[12] for spotted deer, and Al Asadi (2006)^[1] and Akers and Denbow (2008)^[2] for sheep all reported similar findings.

Getty (1977)^[9] reported in the kidneys of a horse that the right one resembles the heart of a playing card with a convex dorsal and slightly concave ventral surface. The left kidney was bean shaped and longer and narrower than the right one, with both surfaces being convex. He further stated that the kidneys of ox were superficially divided into polygonal lobes by fissures of variable depth. Such lobulation was also found in boars by Malik *et al.* (2000)^[21] in the elephant and Ladukar *et al.* (2006)^[19] in the black bear; however, no such differences were observed in the present study.

An outside dark brown cortex and an inside dull brown medulla were observed to make up the kidney (Fig. 4). as noted by Konig and Liebich (2006)^[16], Gaykee *et al.* (2008)^[8] in sambhar, Zade *et al.* (2007)^[41] in panthers, Smuts and Benzuidenhout (1987)^[34] in camels, and Dyce *et al.* (2010)^[7] in domestic animals. The medial boundary was where the hilus was located. A renal crest, also known as a common papilla, was created when eight to twelve pyramids fused together. On the other hand, Simpson and Grossman (1956)^[33] reported that in sheep, the union of 12–16 pyramids form the renal crest, also known as the common papilla.

Gross Measurements

The average weight of the right kidney was 32.38±0.69 grams and the average weight of the left kidney was 31.69±0.73 grams. The average length of the right kidney was 5.16±0.08 cm, and the average length of the left kidney was 5.01±0.08 cm. The average width, thickness, circumference, and volume of the right kidney were 2.91±0.08 cm, 2.54±0.03 cm, 9.26±0.10 cm, and 34.37±0.38 ml, respectively. Similarly, the average width, thickness, circumference, and volume of the left kidney were 2.87±0.08 cm, 2.43±0.05 cm, 9.06±0.11 cm, and 32.95±0.95 ml, respectively. In the present study, the average weight, length, width, thickness, and volume of the right kidney are slightly higher than those of the left kidney. These findings were similar to those of Getty (1977)^[9] in horses, Halder *et al.* (2002 a)^[12] in spotted deer, and Beniwal (1995)^[4] in camels. Sission and Grossman (1956)^[33] described sheep as having an average weight of about 4 ounces. Its length is about 3 inches (7.5 cm), its width is about 2 inches (5 cm), and it has been thinned a little more than 1 inch (3 cm); however, these values were lower in the Barbari goat.

Table 1: Statistical details of different variables for weight, length, width, thickness, circumference, and volume of the right and left kidneys

	Body weight (kg)	Kidney weight (gm)		Kidney length (cm)		Kidney Width (cm)		Kidney thickness (cm)		Kidney circumference (cm)		Kidney volume (ml)	
		R	L	R	L	R	L	R	L	R	L	R	L
Mean±SE	15.67±0.42	32.38±0.69	31.69±0.73	5.16±0.08	5.01±0.08	2.91±0.08	2.87±0.08	2.54±0.03	2.43±0.05	9.26±0.10	9.06±0.11	34.37±0.38	32.95±0.95
S.D.	2.09	3.4	3.58	0.44	0.4	0.41	0.41	0.19	0.25	0.52	0.54	1.9	4.7
C.V.	13.32	10.49	11.29	8.51	7.97	14.07	14.27	7.45	10.25	5.61	5.95	5.52	14.26



Fig 1: Photograph showing position and relation of the Goat kidney

Fig 2: Photograph showing measuring volume of the kidney

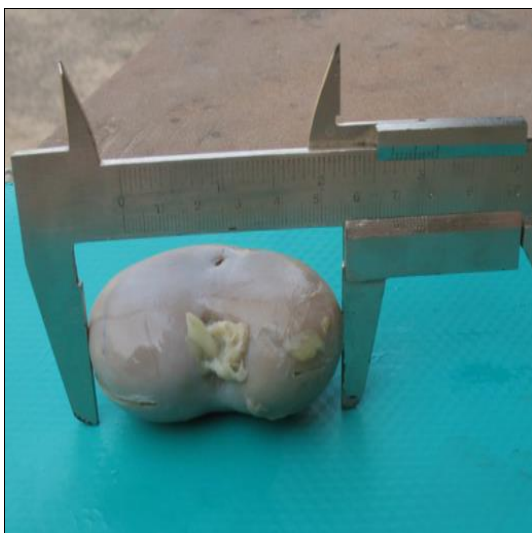


Fig 3: Photograph showing measuring length of the kidney



Fig 4: Photograph Bisected kidney of sheep showing (P) Renal Pelvis or Hilus, (C) Cortex, (M) medulla, (Ca) Capsule Medulla

Conclusion

In conclusion, the gross parameters analysis of Barbari goat kidneys revealed consistent features with previous studies in various species. The retroperitoneal positioning, surrounded by fat, and the reddish-brown bean-shaped appearance were typical. The absence of superficial lobulation and the distinct cortex and medulla were also in line with existing literature. While variations in size and weight between the right and left kidneys were observed, they remained within expected ranges. These findings not only contribute to our understanding of goat anatomy but also highlight similarities and differences across species. Further research could delve deeper into functional implications of these gross parameters in Barbari goats and other related species.

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Conflict of Interest

There is no conflict of interest among authors.

Reverences

1. Al-Asadi FS. Some morphological studies on the kidney of sheep with special technique to its arterial segmentation. *Basrah J Vet Res.* 2006;5(1):44-49.
2. Akers RM, Denbow DM. *Anatomy and physiology of domestic animals.* Blackwell Publishing; c2008. p. 413-416.
3. Arnautovic I, Hazima P, Avdic R, Cutahija V, Tandir F, Bejdic P, Hodzic A. Morphological differences of the kidneys of sheep and dog. *Veterinaria-Sarajevo.* 2007;56(3/4):85-98.
4. Beniwal G. Gross and histological studies of the kidney in camel (*Camelus dromedarius*) [thesis]. Rajasthan University of Veterinary and Animal Sciences, Bikaner; c1995. p. 1-45.
5. Culling CFA. *Handbook of histochemical technique.* 3rd ed. Butterworths & Co. Ltd; c1974. p. 302.
6. Dellmann HD. *Textbook of veterinary histology.* 4th ed. Lea and Febiger; c1993. p. 194-212.
7. Dyce KM, Sack WO, Wensing CJG. *Textbook of veterinary anatomy.* 4th ed. Saunders Comp; c2010. p. 176, 697.
8. Gaykee DE, Banubakode SB, Dalvi RS, Chaurasia D, Zade BA. Microanatomical study of kidney of sambhar, souvenir and abstract. In: *Proceedings of the Silver Jubilee National Symposium on Advancement in Veterinary Anatomy Teaching & Research with Special Reference to their Clinical Application and XXIII Annual Convention of Indian Association of Veterinary Anatomists.* CCSHAU, Hisar; c2008. p. 62.
9. Getty R. *Sisson and Grossman's the anatomy of the domestic animals.* 5th ed. W. B. Saunders Comp; c1977. p. 524-527, 937-939.
10. Gholami S, Haghghat, Jahromi M. Histomorphologic study of the renal artery in post-natal life of sheep (*Ovis aries*). *Iranian J Vet Res.* 2007;8(4):360-364, 388.
11. Gupta SK, Sharma DN. Microscopic anatomy of the kidney of yak. *J Indian Assoc Vet Ana.* 1991;3:50.
12. Halder D, Roy M, Mahata TK, Bhattacharjya MK, Hui AK, Dhara KC. Gross anatomical study on kidney of spotted deer (*Cervus axis*). *J Interacademia.* 2002a;6:656-659.
13. Halder D, Roy MM, Mahata TK, Bhattacharjya MK, Jana C, Hui AK, Dhara K. Histological structure of the kidney of spotted deer (*Cervus axis*). *Indian J Interacademia.* 2002b;6:638-641.
14. Jain RK, Singh Y. Angioarchitecture of kidney in goat. *Inter J Trop Agri.* 1987;5(3/4):235-239.
15. Jain RK, Gupta AN. The arcuate arteries and their branching pattern in the kidney of camel (*Camelus dromedarius*). *Haryana Vet.* 2006;45:49-52.
16. Konig HE, Liebich HG. *Veterinary anatomy of domestic animals.* 3rd ed. Schattauer; c2006. p. 367-377.
17. Krishna Nand Singh, Sanjeev Joshi, Rakesh Mathur, Mukesh Kumar, Sengar S. Histological Studies on The Kidney Of Marwari Sheep (*Ovis aries*). *J Pharmacogn Phytochem.* 2018; SPL:994-996.
18. Krishna Nand Singh, Sanjeev Joshi, Rakesh Mathur, Mukesh Kumar, M. K. Bamniya, Anandita Srivastava. Gross And Morphometrical Studies on the Kidney of Marwari Sheep (*Ovis aries*). *International Journal of Current Microbiology and Applied Science.* 2018;Special Issue-7:1418-1421.
19. Ladukar NO, Ladukar ON, Khanvilkar AV, Kulkarni MD. Histomorphological observations on kidneys of

- black bear. Indian Vet J. 2006;83(12):1300-1301.
20. Luna LG. Manual of histological staining methods of Armed Force Institute of Pathology. 3rd ed. McGraw-Hill Book Company; c1968. p. 87-88, 94-95.
 21. Malik MR, Shrivastava AB, Jain NK, Vaish R. Lobar pattern of kidney of elephant. Indian J Vet Ana. 2000;12(1):18-22.
 22. Malik MR, Shrivastava AB, Jain NK, Vaish R. A note on the kidney of Asian elephant. Indian J Vet Ana. 2001;13(2):163-165.
 23. Mahgoub O, Kadim IT, Webb EC. Goat meat production and quality. CABI; c2011. p. 71.
 24. Mbassa GK. Comparative histology of the kidney of Bos taurus and Bos indicus cattle. Anatomia Histologia Embryologia. 1988;17(2):157-163.
 25. Nanda BS, Gandhi SS, Josi SN. Segmental anatomy of kidney of goat. JNKVV Res. 1967;1:111-113.
 26. Ommer PA, Mariappa D. Histological observation on the kidney of the Indian buffalo (*Bos bubalis*). Indian Vet J. 1970;47:833-837.
 27. Raghavan D. Anatomy of ox. Indian Council Agricultural Research, New Delhi; 1964. pp. 407-410.
 28. Sarmad-Rehan, Qureshi AS. Microscopic evaluation of the heart, kidneys and adrenal glands of one-humped camel calves (*Camelus dromedarius*) using semi-automated image analysis system. J Camel Prac Res. 2006;13(2):123-127.
 29. Shang-Jian K, Chen-Yu Q, Shang-Zhi F, Yu-Shi Y, Han-Guo J, Jia-Zong P, *et al.* Renal histology and microvasculature in the Panthera pardus. Chinese J Zool. 2008;43(1):155-158.
 30. Singh A. Gross and histological studies of the kidney in Marwari goat (*Capra hircus*) [thesis]. Rajasthan Agricultural University, Bikaner, Rajasthan; 1994. pp. 1-23.
 31. Singh N, *et al.* Histological Studies of Udder in Barbari Goat in Barabanki District of Ayodhya Division of Uttar Pradesh. J Exp Zool India. 2023;26:935-942.
 32. Singh UB, Sulochana SA. Handbook of histological and histochemical technique. Premier publishing house; c1997. p. 8-57.
 33. Sisson S, Grossman JD. The anatomy of the domestic animals. W. B. Saunders Company; c1956. p. 574-577.
 34. Smuts MMS, Bezuidenhout AJ. Anatomy of the dromedary. Clarendon Press; c1987. p. 133-134.
 35. Trautmann A, Fiebiger J. Fundamentals of the histology of the domestic animals. Rev Print, Comstock Publishing Associates; c1957. p. 245-251.
 36. Tiwari GP, Swarup H. Histology of nephron in the kidney of Indian buffalo (*Bubalus bubalis*). Indian J Ani Sci. 1977;47(2):79-84.
 37. Umaraw P, Verma AK, Kumar P. Barbari Goats: Current Status. In: Sustainable Goat Production in Adverse Environments: Volume II. Springer International Publishing; c2017. p. 29-40.
 38. Vodenicharov A, Cirnuchanov P. Microscopical and ultrastructural studies of the renal artery in domestic swine. Anatomia Histologia Embryologia. 1995;24(4):237-240.
 39. Vodenicharov A, Danchev S. Comparative anatomical study of renal artery architectonics in the wild pig (*Sus scrofa scrofa*) and the domestic pig (*Sus scrofa domesticus*). Bulg J Vet Med. 2003;6(1):1-8.
 40. Porter V, Alderson L, Hall SJG, Sponenberg DP. Mason's World Encyclopedia of Livestock Breeds and Breeding. 6th ed. CABI; 2016. ISBN 9781780647944.
 41. Zade BA, Mainde UP, Gaykee DE, Dalvi RS. Histomorphology of kidney of panther (*Panthera pardus*). Vet World (India). 2007;6(3):75-76.
 42. Jordà Ó, Singh SR, Taylor AM. Longer-run economic consequences of pandemics. Review of Economics and Statistics. 2022 Jan 6;104(1):166-175.