DOI : 10.5958/2277-8934.2025.00008.2 *Vol 32 No 1, p 41-46*

# GROSS MORPHOLOGICAL STUDIES ON THE OVARIES OF SHE-CAMEL (*Camelus dromedarius*)

**Purushottam and Pankaj Kumar Thanvi**

Department of Veterinary Anatomy and Histology, College of Veterinary and Animal Science, Rajasthan University of Veterinary and Animal Sciences, Bikaner-334001, Rajasthan, India

## ABSTRACT

In this study, the ovaries of six female camels (*Camelus dromedarius*) were examined gross morphologically. The ovaries were located at the level of the 6th and 7th lumbar vertebrae and were suspended by the broad ligament, with the left ovary commonly positioned more cranio-ventrally than the right. The ovaries were connected to the broad ligament by the ovarian ligament. Young camels exhibited a thinner broad ligament compared to older ones. Each ovary was enclosed by the bursa ovarica, with fimbriae of the oviduct attached at the hilus. The size and appearance of the ovaries varied with the animal's age and reproductive activity, becoming more irregular and lobulated with age due to follicles, corpus luteum, and corpus albicans. Each ovary had two borders, ends, and surfaces, with visible follicles and corpora lutea during the breeding season. The left ovary was generally larger than the right, with mature corpus luteum being compact and spherical. The size of Graafian follicles ranged from 1.5 to 3.0 cm. The study found that the left ovary measured larger in all dimensions compared to the right ovary.

**Key words:** Broad ligament, dromedary camels, follicles, ovary, reproductive system

Camels are though seasonal breeders but are induced ovulators (Novoa, 1970). They have a relatively short breeding period during which ovarian activity is increased (Sghiri and Driancourt, 1999).

Camels have successive follicular waves, each consisting of growth phase, maturation phase and regression phase. During the growth phase usually one follicle becomes dominant from a cohort of small follicles and continues the growth. During the maturation phase, the dominant follicle ovulates if mating occurs, otherwise it could continue to grow (large anovulatory follicle) or regress (regression phase). The follicular development depends on the concentration of estrogen which reaches its maximum when one dominant follicle is present in the ovary (Skidmore, 2011).

The ovary is an important endocrine organ in the female body, as it is the primary source of sex steroids. As a result, a healthy ovary is required for the proper function and maintenance of the female reproductive tract, mammary gland and sexual behaviour (Couse and Korach, 1999; Mayes, 2002 and Rodgers *et al,* 2003).

Anatomical studies of the ovary and oviduct in camel (*Camelus dromedarius*) has been studied (Abdalla, 1966, Musa, 1979 and Salari et al, 2011). Hidaia and Osman (2021) investigated the topography of the ovary in relation to the mesonephros and metanephros, time of descent of the ovary, the gross anatomy of the ovary during the three trimesters in camels. The present study was aimed to study the gross morphological studies on the ovaries of she-camels.

## Materials and Methods

The ovaries of six recently died she- camels which were free from any pathological condition of reproductive system, were collected. These animals were brought to the Veterinary Clinical Complex, RAJUVAS, Bikaner. The collected samples were fixed in 10% Neutral buffered formalin. The shape and colour of the organs were recorded before fixation. The ovaries were used for the further study and recording of biometrical parameters. The weight of each ovary was measured by a weighing scale. The length was recorded by measuring scale. The circumference was measured by encircling a thread around the organ and then measured this length on the measuring scale. The width and thickness of the ovaries were measured by Vernier's caliper. The ovaries were dissected out by opening the abdominal cavity and pelvic cavity. The gross and topographic anatomical examinations of the ovaries were done.

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The mean and standard error of various parameters of the ovaries were calculated.

**Results and Discussion**

In the present study, left and right ovaries were found at the level of the $6^{th}$ and $7^{th}$ lumbar vertebra and 6 - 7 cm from crest of ilium. The ovaries were found hanging by the broad ligament. This finding resembled the reports of Jarrar and Faye (2015) in camel. The left ovary was largely visible under the left horn. More frequently, the right ovary was detected lateral to the right horn, a finding which is in agreement with the observation of Dyce *et al* (2010) in domestic animals. The left ovary was commonly further cranio-ventral in position than the right ovary (Fig 1, 2). This finding was in congruence with the observation of Skidmore and Adams (2003) in camel. In cattle these ovaries were laid slightly medial to the tips of the uterine horns to which they were connected directly by portions of the broad ligaments, the ovarian ligament (Ball and Peters, 2004).

Ovaries were connecting to the broad ligament by an ovarian ligament, also known as the proper ligament, which extended from the ovarian hilus to the tip of the adjacent uterine horn. These findings resembled to that of El-Wishy (1988) and Skidmore and Adams (2003) in camel. The ovarian ligament or proper ligament was present at mid distance between the ovary and lateral border of the uterine horn. When compared to older animals, young animals had a thinner broad ligament, which get thicker with age (Fig 3).

The ovary was enclosed by the bursa ovarica, a long, conical, pocket-like fold of the mesosalpinx. The findings of the present study were in conformity with the reports of Novoa (1970) and El-Wishy (1988) in camel. Arthur *et al* (1985) noted that the mesosalpinx and the mesovarium together formed a very well-developed bursa which closely invests the ovary in camels.The oviduct's fimbriae were located within a large, circular orifice that forms the bursa's apex (Fig 4). At the hilus of the ovary the fimbriae of the oviduct were attached closely. It was in agreement with the reports of Skidmore and Adams (2003), Novoa (1970) and Ali and Derar (2020) in camel.

Size and general appearance of the ovaries varied according to the activity and age of the animal. Primarily, the ovaries were small, bean-shaped, pinkish white in colour, and basically smooth, glistening, only with one or two grooves (Fig 5). In adult animals ovaries were more irregular, reddish, lobulated, or granular in appearance. Due to the presence of more raised vesicles (follicles), large follicles, corpus luteum, and corpus albicans with increasing age, the ovaries were more irregular in shape. Ovaries were shaped into a cluster by these bodies (Follicles) and resembled a "bunch of grapes". Multiple ovisacs on the surface of the ovary resembled a pear or nut in appearance. These findings resembled to that of Novoa (1970), in which the shape of camel ovary was pear or nut with many ovisacs on its surface. The camel ovaries were flattened, reddish, lobulated organ with a circular outline. The ovaries of camels were found broad bean shape (Ghazi, 1981) and granular in appearance due to small follicles around 3-5 mm in diameter (El-Wishy 1988). However, Skidmore and Adams (2003) found that the camel ovaries had a smooth and glistening surface with several raised small vesicles (2 - 5 mm) throughout the surface. They also found that the ovaries were oval or circular, flattened laterally and had an irregular surface due to many small follicles. Present findings favoured the observation of Ismail (1987) in camel who found that the ovaries were oval, flattened and lobulated organs and there was presence of numerous follicles which gave the ovary an appearance of a bunch of grapes (Fig 6, 7 and 8).

Each ovary had two borders, two ends and two surfaces. The attached border (medial) of ovary was also known as mesovarial border and had a shallow hilus of the ovary, from here vessels and nerves enter and leave the organ. Both the borders as well as the cranial and caudal ends were convex. The cranial end was also known as oviductal or tubal end. This end was wide and fimbriae of the infundibulum were attached with it (Fig 4). The caudal end was narrow and rounded. The medial and lateral surfaces were irregular and somewhat convex (Fig 5, 9). The present findings were in partial harmony with the findings of Ismail (1987) who reported in camel that the lateral and medial surfaces were slightly convex and the free border was also convex but the attached border was straight. El-Wishy (1988) found camel ovaries flattened laterally and somewhat convex at the lateral and medial surfaces, Novoa (1970) found the hilus a somewhat straight, and the lateral and medial surfaces were slightly convex; Jarrar and Faye (2015) found that the ovary of camel as oval, flattened laterally, and were slightly convex medial and lateral surfaces.

On the surface of each investigating ovary, many follicles of various sizes were visible, including a few elevated vesicles and one or two small growing follicles which were transparent (Fig 6, 7).

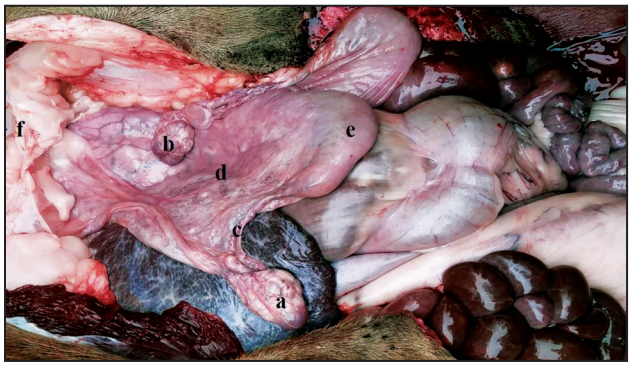


**Fig 1.** Ventral view of reproductive tract of she-camel. a. Left Ovary, b. Right Ovary c. Oviduct, d. Broad Ligament, e. Horn of uterus and f. Crest of ilium.

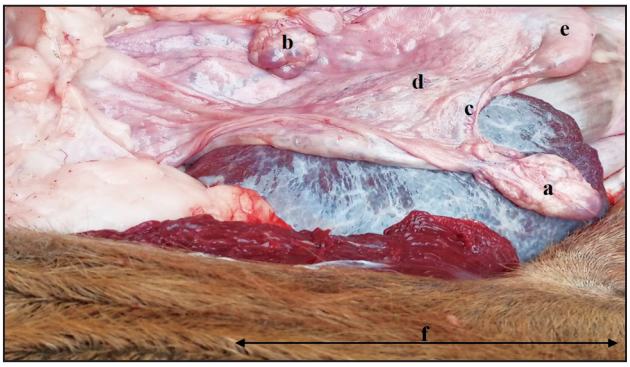


**Fig 2.** Left Lateral view of reproductive tract of she-camel. a. Left Ovary, b. Right Ovary c. Oviduct, d. Broad Ligament, e. Horn of uterus and f. Site of the Lumbar Vertebrae.

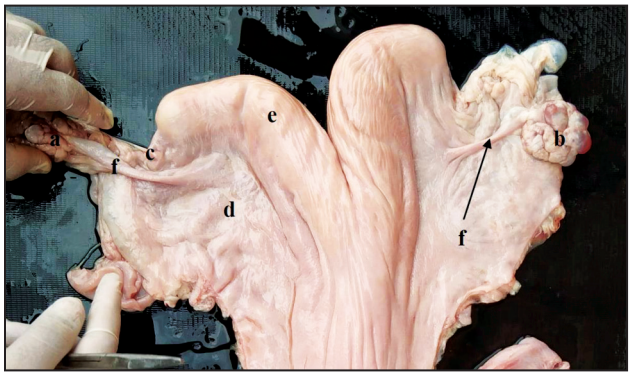


**Fig 3.** Dorsal view of the reproductive tract of she-camel. a. Left Ovary, b. Right Ovary c. Oviduct, d. Broad Ligament, e. Left horn of uterus and f. Proper ligament of Ovary.

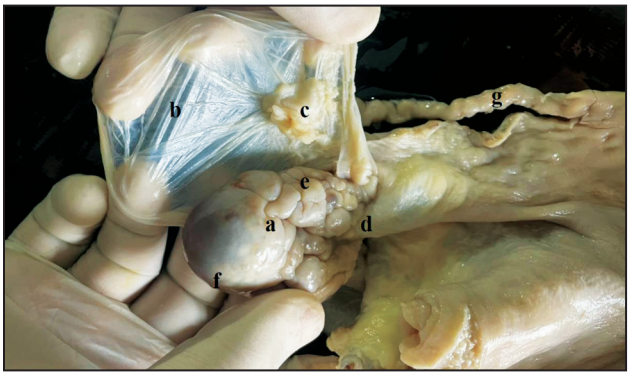


**Fig 4.** Left ovary of she-camel showing ends, bursa and infundibulum. a. Left Ovary, b. Bursa ovarica c. Infundibulum and Fimbria, d. Hilus of ovary, e. Oviductal end, f. Caudal end and g. Isthmus.

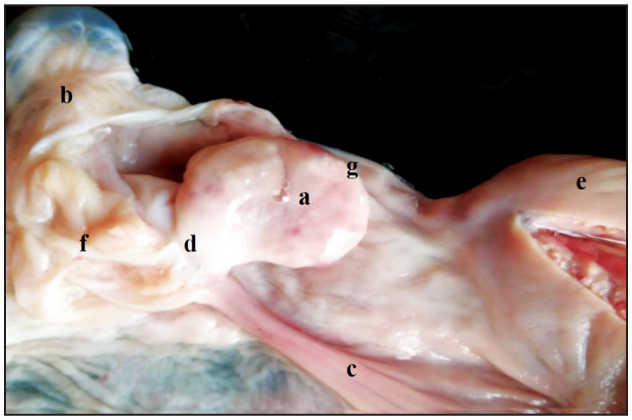


**Fig 5.** Left ovary of she-camel showing its medial surface. a. Left Ovary, b. Bursa ovarica or Mesovarium c. Proper ligament of ovary, d. Hilus of ovary (Attached border), e. Left uterine horn, f. Infundibulum and g. Free border.

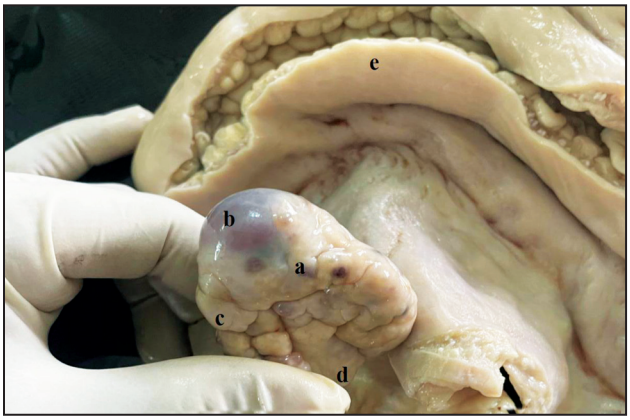


**Fig 6.** Left ovary of she-camel. a. Left Ovary, b. Large raised follicle (pyriform), c. Corpus Albicans, d. Hilus of ovary and e. Left uterine horn.

The ovary takes on a more lobular form during the breeding season when mature follicles and copora lutea (CL) protrude from the main contour. The lobulation was mostly caused by the presence of old corpora albicantia and increasing with more previous ovulations or pregnancies. One or two ovaries contained one or two periform, white, regressing corpus luteums and one or two small growing follicles which were in accordance with findings of Arthur *et al* (1985) in she camel. Skidmore and Adams (2003) also found that the mature follicles and current CL project from the main contour of the ovary and give it a more lobular form in camels. During pregnancy the ovaries increase in weight due to bearing the CL. Present study also favoured the statement of

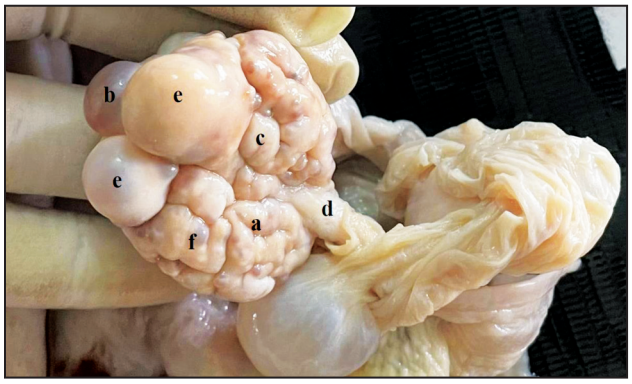


**Fig 7.** Right ovary of she-camel. a. Right Ovary, b. Large raised follicle (pyriform), c. Corpus albicans, d. Hilus of ovary, e. Regressing Corpus Leutium (pyriform) and f. Small growing follicle.

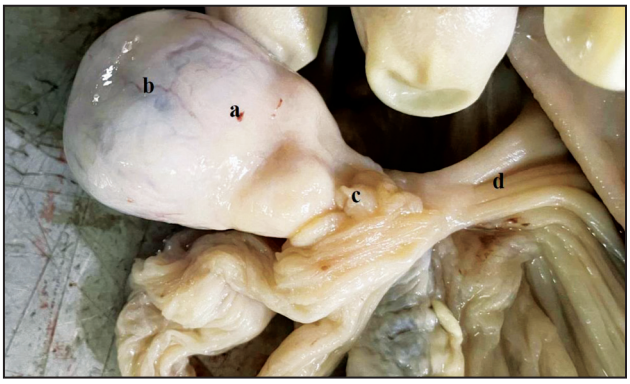


**Fig 8.** Left ovary of she-camel with CL in Pregnant Animal. a. Pyriform left ovary, b. Corpus luteum, c. Hilus of ovary and d. Ovarian ligament.

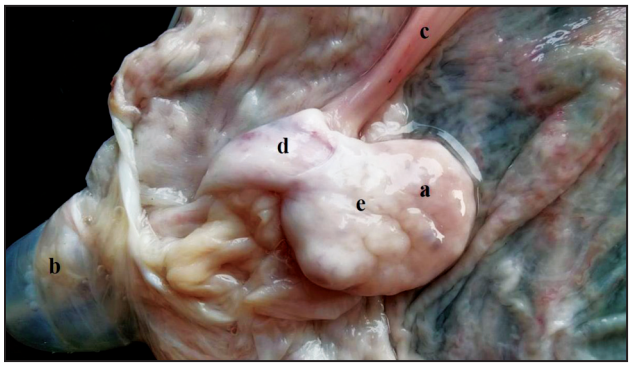


**Fig 9.** Left ovary of she-camel showing its lateral surface. a. Left Ovary, b. Bursa ovarica or Mesovarium c. Proper ligament of ovary, d. Hilus of ovary and e. Lateral surface of the ovary.

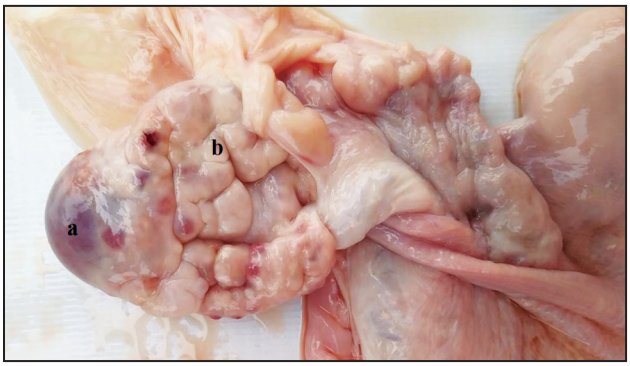


**Fig 10.** Ovary showing Graafian follicle. a. Graafian follicle and b. Corpus Albicans.

Dyce *et al* (2010) in domestic animals that each ovary was a solid, ellipsoidal body, though projections of big follicles from the surface and corpora lutea can make it uneven. Contrarily, Jarrar and Faye (2015) in camel found that the size of the left and right ovaries was the same. The ovary of older she-camels gets increasingly irregular and lobulated shape. The appearance and size of the ovaries differ depending on the animal's age and activity level. The left ovary was found somewhat larger in both length and width than the right one in present study, which was not reported earlier in camel.Both ovaries also had the corpus albicanus, which was seen there in varying numbers, sizes, and colours of white or grey (Fig 6, 7 and 8).

The mature CL in the left ovary was a compact, spherical body with a centre of fibrous tissue. The left ovary CL was pyriformed and ranges in colour from dark pink to grey. Shape of the ovary was pears like due to the CL. While the right ovary had a regressing CL which was also pyriform shaped but creamy in colour. The CL was a flabby, soft, laterally compressed sphere that protruded entirely from the surface of the ovary. These findings were in partial harmony with the findings of Arthur *et al* (1985), according to which in camel the corpora albicantia, were cream-coloured and the main contour of the ovary was obscured by mature follicles and the current corpora lutea of the breeding season, giving the latter an exaggerated, lobular form (Fig 7, 8).

The size of the Graafian follicles was found 1.5 to 3.0 cm. The mature follicle were readily separated from the ovary as a discrete sphere by slight presure. These findings resembled to the findings of Arthur *et al* (1985) in camel. The mature follicle can easily be separated from the ovary as a discrete sphere by gentle pressure at its attachment (Fig 7, 10). The mature follicle had a vascular wall; the follicular fluid was first yellowish and then becomes red. The young CL had a central blood clot and was spherical, soft, and brownish in colour. Present findings partially resembled the findings of Novoa (1970), according to which the corpus luteum was a soft, flabby, laterally-compressed sphere in camel. But according to Dyce *et al* (2010) each ovary was a solid, ellipsoidal body, though projections of big follicles from the surface

**Table 1.** Morphometerical observations of Left and Right Ovary of female camel.

| Srial no. | Left Ovary | | | | | Right Ovary | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Weight (g) | Volume (ml) | Length (cm) | Width (cm) | Thickness (cm) | Circumferance (cm) | Weight (g) | Volume (ml) | Length (cm) | Width (cm) | Thickness (cm) | Circumferance (cm) |
| 1. | 25.00 | 23.50 | 4.00 | 3.00 | 2.00 | 10.00 | 20.00 | 18.50 | 3.50 | 3.00 | 2.00 | 8.50 |
| 2. | 13.40 | 12.00 | 3.50 | 3.00 | 2.00 | 8.00 | 7.00 | 6.50 | 3.00 | 2.40 | 1.80 | 6.00 |
| 3. | 11.50 | 10.60 | 3.20 | 3.00 | 2.00 | 7.80 | 8.10 | 7.50 | 3.00 | 2.50 | 1.80 | 6.00 |
| 4. | 30.40 | 28.00 | 4.50 | 3.50 | 2.00 | 10.50 | 18.40 | 16.60 | 3.50 | 3.00 | 2.00 | 8.00 |
| 5. | 28.10 | 27.00 | 4.20 | 3.20 | 2.00 | 10.20 | 11.00 | 12.50 | 3.20 | 2.80 | 2.00 | 7.00 |
| 6. | 25.90 | 24.00 | 4.00 | 3.00 | 2.00 | 10.00 | 10.00 | 10.50 | 3.00 | 2.70 | 2.00 | 6.50 |
| Mean | 22.38 | 20.85 | 3.90 | 3.12 | 2.00 | 9.42 | 13.08 | 12.02 | 3.20 | 2.73 | 1.93 | 7.00 |
| SD7. | 94113762 | 7.606247 | 0.473286 | 0.20412415 | 0 | 1.19065808 | 5.35029594 | 4.82510794 | 0.244949 | 0.25033311 | 0.10327956 | 1.048809 |
| SE3. | 24195586 | 3.105238 | 0.193218 | 0.08333333 | 0 | 0.48608413 | 2.18424917 | 2.96984207 | 0.1 | 0.10219806 | 0.04221637 | 0.4228174 |

and corpora lutea can make it uneven in domestic animals (Fig 10, 7). The mature CL was a 2.6 cm in diameter, flesh-coloured, compact sphere with a central region of grey connective tissue. Older CL had a bluish-grey or greenish external appearance (Fig 10, 7).

The shape and size of the ovary varied with their CL and content of follicles. The left ovary measured 3.90 ± 0.47 cm in length, 3.12 ± 0.20 cm in width, 2.00 cm in thickness, 9.42 ± 1.19 cm in circumference, 22.38 ± 7.94 g in weight and 20.85 ± 7.61 ml in volume. The right ovary measures 3.20 ± 0.24cm in length, 2.73 ± 0.25 cm in width, 1.93 ± 0.10 cm in thickness, 7.00 ± 1.05 cm in circumference, 13.08 ± 5.35 g in weight and 12.02 ± 4.82 ml in volume. Whereas according to El-Wishy (1988) the ovary of camel was measured 26 mm (2.6 cm) in length, 22-40 mm (2.2-4 cm) in width and 5-9 mm (0.5-0.9 cm) in thickness. Ghazi (1981) observed that the ovary of camel was 2 cm in length and 1.5 cm in width. Skidmore and Adams (2003) found that the ovary varied from 2.6 - 6 cm in length, 2 - 4 cm in width and 0.5 - 0.9 cm in thickness and each ovary weights between 3 - 4 g in dromedaries and approximately 5 g in bactrians. Novoa (1970) found that the ovary was a flattened organ with a length between 2 and 5 cm in camels. Ismail (1987) stated in camel the average dimensions and weight of the ovary were 2-4 x 1.5-2.5 x 0.5-1 cm and 2-5 g, respectively (Table 1).

## Conclusion

The left and right ovaries' structure and positioning of camels was studied. The ovaries were found suspended by the broad ligament near the lumbar vertebrae, with the left ovary typically more prominent and positioned ventrally compared to the right one. Both ovaries exhibited variations in size and appearance, influenced by age and reproductive activity. The left ovary was found larger and had mature corpus luteum, while the right ovary showed signs of regression. Detailed measurements revealed differences in size between the two ovaries.

## References


Abdalla O. Anatomical study of the female genital system of the one-humped camel (*Camelus dromedarius*). I. The ovaries. Sudan Journal of Veterinary Science and Animal Husbandry. 1966; 6:41–52.

Ali A and Derar DR. Ovary and ovarian bursa in dromedary camels: Clinical relevance of the topographical features. Anatomia, Histologia, Embryologia. 2020; 49(3):325-332.

Arthur GH, Al-Rahim AT and Al-Hindi AS. Reproduction and genital diseases of the camel. The British Veterinary Journal. 1985; 141(6):650-659.

Ball PJH and Peters AR. Reproduction in Cattle. 3rd Edition, Blackwell Publishing. 2004; pp 20-27.

Couse JF and Korach KS. Estrogen receptor null mice: What have we learned and where will they lead us? Endocrine Reviews. 1999; 20(3):358-417.

Dyce KM, Sack WO and Wensing CJG. Text book of Veterinary Anatomy. 4nd Edn. 2010; pp 196-215.

El-Wishy AB. A study of the genital organs of the female dromedary (*Camelus dromedarius*). Journal of Reproduction and Fertility. 1988; 82(2):587-593.

Ghazi R. Angioarchitectural studies of the utero-ovarian components in the camel (*Camelus dromedarius*). Journal of Reproduction and Fertility. 1981; 61(1):43-46.

Hidaia BZ and Osman DI. Topography and Gross Anatomy of the Ovary of the Prenatal Dromedary Camel (*Camelus Dromedrius*). Corpus Journal of Dairy and Veterinary Science. 2021; 2:1022

Ismail ST. A review of reproduction in the female camel (*Camelus dromedarius*). Theriogenology. 1987; 28(3):363-371.

Jarrar B and Faye B. Normal Pattern of Camel Histology. FAO Publications, Riyadh, Saudi Arabia. 2015; pp 140.

Mayes M. The meiotic arrest of bovine oocyte. Collection. Memoirise et Theses elcectroniques. 2002.

Musa BE. Studies on the ovary of the camel (*Camelus dromedarius*). Sudan Journal of Veterinary Science and Animal Husbandry. 1979; 20:51-54.

Novoa C. Reproduction in camelidae. Reproduction. 1970; 22(1):3-20.

Rodgers RJ, Iriving-Rodgers HF and Russel DL. Extracellular matrix of the developing ovarian follicle. Reproduction Cambridge. 2003; 126(4):415-424.

Salari E, Ahmad Raji and Farzaneh N. Comparative study of anatomy and histology on the ovary and oviduct in camel (*Camelus dromedarius*) and cow. Journal of Camel Practice and Research. 2011; 18:115-118.

Sghiri A and Driancourt MA. Seasonal effects on fertility and ovarian follicular growth and maturation in camels (*Camelus dromedarius*). Animal Reproduction Science. 1999; 55(3-4):223-37. doi: 10.1016/s0378-4320(99)00017-2. PMID: 10379674.

Skidmore JA. Reproductive physiology in female old-world camelids. Animal Reproduction Science. 2011; 124(3-4):148-154.

Skidmore L and Adams GP. Anatomy of the Camel Reproductive Tract. Recent advances in camelids reproduction. International Veterinary Information Service. Online publication:www.ivis.org. 2003.