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Histological and histochemical features of ovary in adult female one humped camel *Camelus dromedarius* in AL-Muthanna province

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Abstract

This study aimed to focus light on the gross and histomorphometry structure in addition to histochemical features of the camels' ovary. For this study, 7 ovaries (left and right) from adult female camels were used. The camel's ovary was huge, irregularly shaped, and appeared spherical to oval and not smooth surfaces that was somewhat convex on the medial and lateral surfaces. The ovaries have a variety of elevated follicles, big follicle, the corpus luteum, corpus albicanus. The medial and lateral surfaces are transparent and include several protrusions that may indicate the presence of growing follicles or yellow bodies. The ovaries' oval to irregular form was caused by these bodies. One or two performed, white, regressing corpus luteums and one or two tiny, developing follicles are seen in one or two ovaries. Simple cuboidal epithelium covered the ovaries' surface, and it was continually present at the hilus with the ovarian ligament's mesothelium. The ovary was covered by a germinal epithelium beneath a cortex that was packed with vascular medulla and several follicle maturation phases. The mature follicles had cumulus oophorous, granulosa cells around the usual oocytes, and a wide antrum and thick theca. revealed the cortex, which included many primordial follicles, was filled with various phases of growing follicles, encircled by stromal cells that were grouped in a concentric pattern, giving the appearance of a spindle, and having spindle basophilic nuclei in the center. Zona

pellucida had a robust positive PAS response. The majority of reproductive structures are found in the ovarian cortex. The she-camel's ovaries had varying numbers of the follicles at different stages of development. The left ovary was larger than the right in every way, and it had more noticeable yellow bodies and ovarian follicles. **Conclusion**, demonstrated the follicular growth in camels took place in a follicular wave, that ovulation may take place in both ovaries, and that the left ovary's follicular activity may be marginally greater than the right ovary's.

Key words: camel, ovary, follicles, cortex, medulla

Introduction

The one- and two-humped camels are considered Old World camelids, while alpacas, guanacos, llamas, and vicuñas are considered New World camelids. Both Bactrian and dromedary camels are induced ovulatory that usually only ovulate in reaction to mating, and they both have seasonal polyestrous (1,2). The short breeding season, delayed puberty starts, prolonged gestation duration, and longer gap between births due to prolonged lactation-related anestrus are some of the factors that contribute to camels' inferior reproductive efficiency (3,4). Estrus usually marks the beginning of female puberty. The attainment of reproductive capacity through physiological, morphological, and behavioral development is known as puberty (5,6). Many researchers have a great deal of interest in the female reproductive system. This system was broadly described in a number of animal species twenty years ago. Two the ovaries, uterine tubes, a uterus having two horns, the body, the cervix, the vagina with a correct vestibule, with external genitalia, vulva and clitoris, make up the female genital system (7,8,9). Compared to cattle, who are negatively impacted by water scarcity, poor feed, and extreme stress over the year's long summer months, camels are most likely a better source of food (10). However, improving the camel's reproductive capacity is necessary to fully utilize its productive potential (11). Animals' ovary and the ovarian bursa anatomical configurations influence their accessibility throughout clinical evaluation and make them more susceptible to uncommon genital illnesses. Only a small percentage of ovarian follicles in mammals are selected for ovulation during ovarian follicular development; the other follicles

undergo atresia at various stages of development (12,13). Apoptosis, a type of programmed cell death, occurs in the somatic cells that are present in follicle and the oocytes during atresia (14), the ovary's surface protrusions, which could be signs of growing follicles, which would indicate a change in reproductive activity. The goal of this study is to investigate the morphological traits and histological architecture of ovary in adult one humped camels. The ovarian activity caused the ovaries to become more irregular and lobulated in appearance (15,16). Additionally, this thesis highlights the need for more study and may aid in the diagnosis, leading to the best possible treatment for the illnesses. A solid grasp of mammalian reproductive biology is necessary to take advantage of current developments in methods like ovulation and embryo transfer, and this research has improved our knowledge of the animals' reproductive biology.

Materials and method

Animals: The study used seven healthy adult female one-humped camels *Camelus dromedarius*, aged 5-6, who were gathered at a slaughterhouse in the AL-Muthanna district. The left and right ovary were inheriting their gross and histological characteristics from these animals. Nine 1 cm^3 samples were collected for histological examination from various regions of each ovary (left and right) (3).

Histological methods: many stains used Hematoxylin and Eosin (H&E), Masson's trichrome, periodic acid Schiff (PAS), and alcian blue 2.5 pH (AB) (17).

STATISTICAL ANALYSIS; This study was examined at the 1% significant levels using one-way analysis of variance (ANOVA) tests. Social science statistical approaches were used to process and the regulate of the data (18).

Results and discussion

According to the morphological results, the adult she-camel's ovaries were large, irregularly characterized, and appeared oval with a no smooth surface. They also had multiple protrusions on the surface, which could indicate the presence of developing follicles. The ovaries were laterally flattened, with lateral and medial surfaces that were slightly convex, and they contained complex terrain because of the camel's relatively long reproductive cycle (Fig. 1,2), These findings contradicted (19), which states that Bactrian camels are flat or elliptical, and agreed with (10) about dromedary camels. A greater variety of elevated follicles, big follicles, corpus albicanus , and corpus luteum may have

contributed to the she-camel's ovaries' more asymmetrical appearance. However, unlike mares the unrestricted ventral boundary does not have an ovulation fossa (7). In Bactrian camels, the ovary is flat or elliptical, whereas in mature dromedaries, it resembles a wide bean (1,2). The female gonad called the ovary is in charge of differentiating and releasing the fully developed oocyte, that's essential for fertilization and the effective continuation of the species. The primary female sex hormones, progesterone and estrogen, are synthesized in the ovaries (9). (20) showed that the corpus luteum has a major impact on ovarian dimensions and that ovarian size varies according to the animal's age, nutritional status, and number of parturitions.

In the current study, the camel ovaries showed that the cortex was filled with various stages of developing follicles, with the primordial follicles being numerous, surrounded by concentrically arranged stromal cells that had spindle-like shapes and centrally located spindle basophilic nuclei (Fig. 3,4,5). The current study showed that the ovary of an adult camel was coated in a layer of germinal epithelium, demonstrating that the outermost layer of mammalian ovaries has been covered by an uninterrupted layer of germinal epithelium. These cells were cubical in some areas and flattened in others; cows showed comparable results (8,13). The simple cubodial epithelium covering the ovaries was continuously on hilus with the ovarian ligament mesothelium (Fig. 5,6). These findings were consistent with (4) in camels and (7) in mares. This epithelium is involved in ovarian surface renewal and protection following ovulation. Just below the epithelium lies a thick layer of connective tissue called Tunica Albuginea. maintains the ovary's form and offers structural support. It is covered by a sheet of the germinal epithelium beneath a cortex that is packed with vascular medulla and various follicle developmental phases, mature follicle had a cumulus oophorus, a broad antrum with a thick theca externa, and typical oocytes encircled by granulosa cells (Fig. 5). Moderate PAS positive reaction was seen in Zona pellucida (Fig. 7).

The majority of the reproductive organs are found in the ovarian cortex. The she-camel's ovary has varying numbers of the follicles on different stages of development. showed that the follicular growth in she-camel happened in a follicular wave, as previously noted by (2,10). The results were consistent with (3)'s hypothesis that the histological characteristics of follicles in female camels were influenced

by the season and the stage of development of the follicles. The primary follicles, which were the smallest and closest to the periphery, had a granulosa cells. They were spherical in shape, centered, and had a large, asymmetrically placed nucleus. The secondary follicles had multiple layers of granulosa cells, and theca interna and externa developed. Large, fluid-filled antrums with distinct granulosa and the theca layers were found in f tertiary follicles (Fig. 8-12). These findings concurred with (10) who proposed the that camel's oocyte resembled the oocytes of cows (9,21,22) and had a shape similar to other mammalian oocytes. The results, however, did not agree with them regarding the shape of the primary follicle, particularly with regard to the shape of these follicles, which appeared prolate because of the long axis and the clustering of granulosal cells on both opposite poles, thin processes of the granulosal cells extending to surround the oocyte between the two poles (23). (24) who hypothesized that follicular expansion starts with oocyte enlargement and is finished by the time the antrum forms.

These theories aligned with research that tracked the fate of individual oocytes based on the particular follicle of origin, which confirmed that oocyte diameter increased with follicular size. The outcome supported (4) assertion that the ova were not impacted by the seasons. The current study's findings supported those previously reported in mares, as the wall inside the preovulatory follicle was distinguished by plump rectangular thecal cell and blood supply (7). (25) indicated that in order to preserve follicular oestradiol synthesis, a thick theca layer may be necessary in the developing preovulatory follicle for the provision of androgen substrate. Luteum Corpus, develops following ovulation. abundant in progesterone-producing luteinized cells and blood vessels. Atretic follicles: Apoptosis occurs in follicles that do not ovulate. observed as granulosa cells that have been broken up in collapsed follicles Collagen fibers, fibroblasts, and stromal cells make up the ovarian stroma. incredibly vascularized to facilitate the development of follicles. Medulla of the ovary includes nerves, lymphatics, and major blood vessels, composed of loose tissue that connects. gives the ovarian cortex nutrition and hormonal assistance.

The sections of an atretic follicle, which lacked observable blood flow and gradually shrank in diameter, and a pre-ovulatory follicle, which showed a blood region surrounding the antral cavity, clearly differed in the current study. This finding is consistent with (26) who proposed that

blood flow velocity and follicular vascularization may be utilized to detect healthy follicles and forecast when ovulation will occur. We hypothesized that the presence of the big anovulatory follicle was caused by the absence of ovulation because camels undergo induced ovulation, which happens 30 to 48 hours after copulation (3). This is consistent with (10) who proposed that despite the observation of ovarian activity, a reduction in male lipoid was the cause. The anovulatory follicle experiences atresia and has a fewer vascularized wall compared to the preovulatory follicle. The results of the currant study are in line with earlier research (9) in cows and (7) in mares, which suggested that low levels of circulating LH and trophic hormones may be linked to poor vascularity.

The recent findings of (2), who demonstrated comparable results in dromedary and llama camels, respectively, during the non-breeding season, totally corroborated the prior indication by (27) that the preovulatory follicles is located on the opposite side to the corpus luteum. (28) proposed that the two ovaries' ovarian activity alternated over subsequent cycles, whereas (29) proposed that these findings might be explained by the corpus luteum's brief lifespan and the quick follicular development. (30) proposed that the dominant follicle was selected in part by the follicular microenvironment. In contrast to (31) who observed the corpus luteum only in the spring, the current studies observed a corpus luteum as a hemorrhage and corpus luteum covering the ovarian surface during the non-breeding season. However, (6) proposed that the high level of LH during ovulation caused the corpus luteum to become one of the most vascularized organs and get the highest rate of flow of blood for each unit of tissue.

The cortex and medulla are two distinct structures found in the ovaries of the majority of domestic animals, with the exception of mares.The statistical analysis indicated the left ovary is larger in all parameters than that of the right ovary (Table 1). Variations in the blood flow and hormone distribution throughout a reproductive system could be the cause of this measurement discrepancy. The process of reproduction Follicle activity may be marginally higher in the left ovary than in the right, despite the left ovary's size. Research indicates that both ovaries may experience ovulation. (7) stated that because of frequent ovulation, the right ovary is larger than left, has more noticeable yellow bodies, and contains ovarian follicles. Since the right ovary is near the aorta and posterior vena cava, it receives more blood nutrition,

which increases its activity. Additionally, some research indicates that this right is more sensitive to hormonal stimulation, which increases its ability to produce eggs. These factors contribute to its higher blood perulation. The right ovary In comparison to the left ovary, it is frequently more active. It has been shown that the majority of ovulations happen more frequently in the right ovary. (9) found that besides to gonadotropins; FSH and LH, the ovary also releases survival factors that are necessary for follicles to successfully develop.

Table, (1): Measurements each of ovary; left and right in female camel, µm

Measure Part	Cortex layer thickness	Mature follicles diameter
Left ovary	13.71±1.2[a]	28956.7±119.5[a]
Right ovary	12.14±1.04[a]	256.14±109.6[a]

Values with small letters in same columns denote to significant differences (P>0.05)

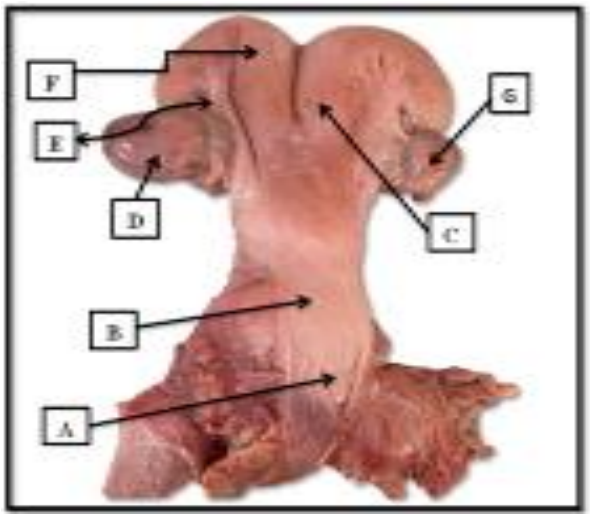


Fig.1. Gross section of the uterusin camel showing: A-cervix of uterus,B-body of uterus,C-right horn of uterus, D- left ovary,E-ovarian ligament,F-left horn of uterus,G-right ovary

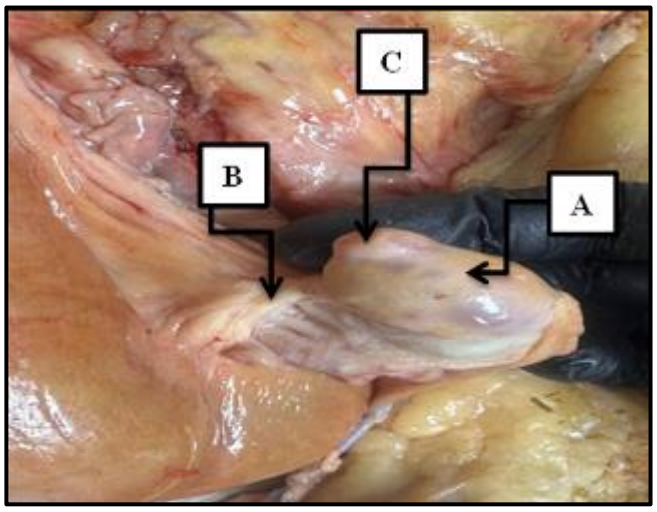


Fig.2. Gross section of the ovariesin camelshowing: A- the left ovary, B-fallopian tube or ovarian tube cover by suspensory ligament,C- corpus luteum

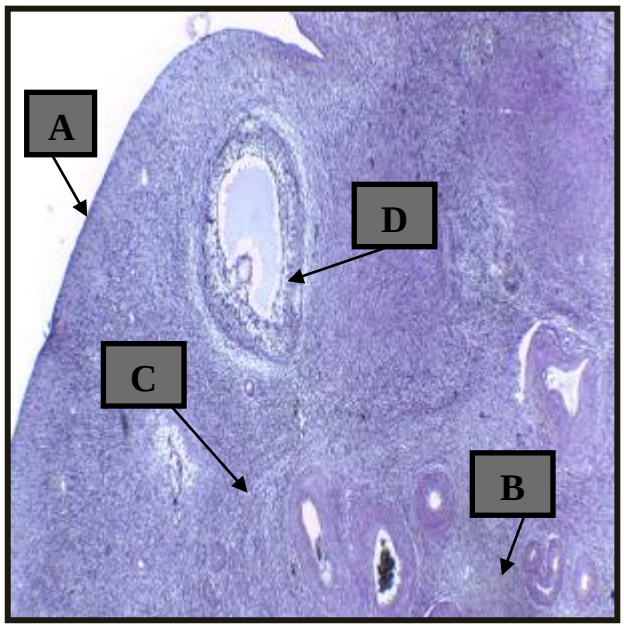


Fig.3. Microscopic section of the right ovaryin camel showing: A-cortex layer,B-medulla layer,C-stromal cortex,D-mature follicle H&E stain X10.

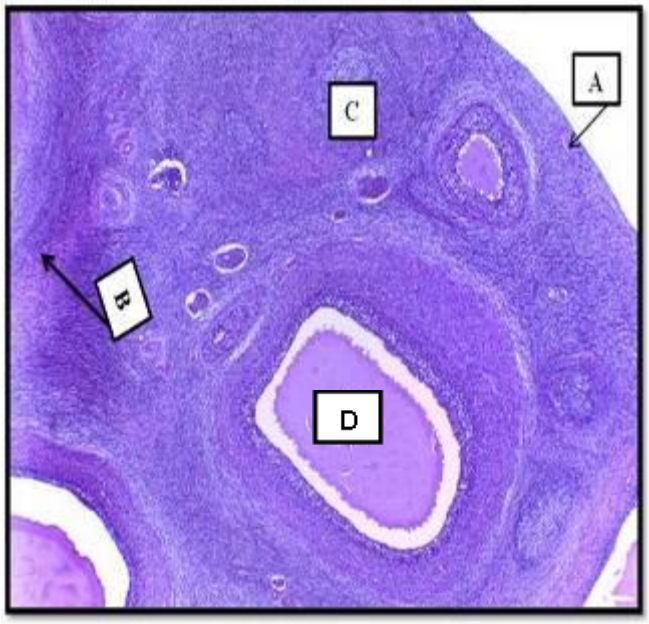
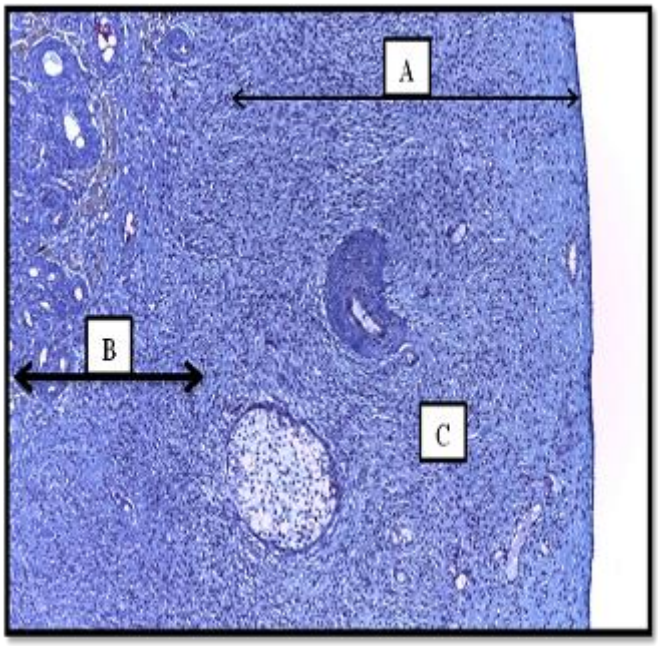


Fig.4. Microscopic section of the left ovary in camelshowing: A-cortex layer, B-medulla layer,C-stromal cortex, D-mature follicle PASstain X10.



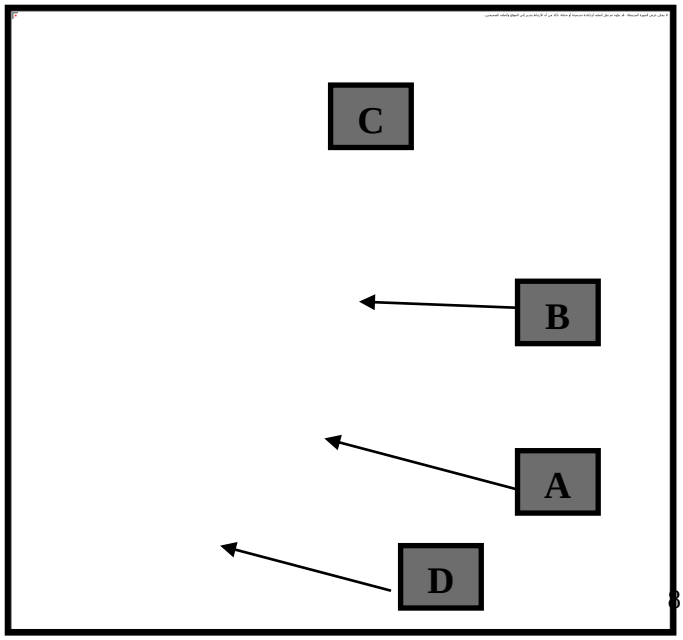
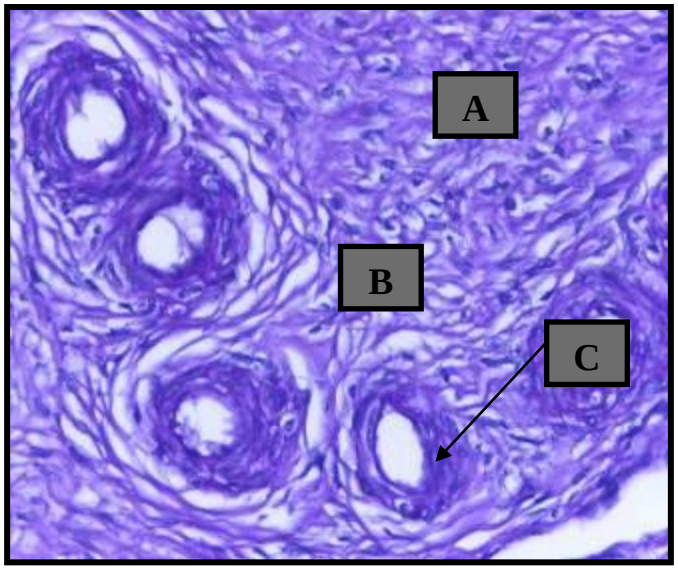


Fig.5. Microscopic section of the left ovaryin camel showing: A-cortex layer,B-medulla layer,C- stromal cortex**,** ABX10.

Fig.6. Microscopic section of the right ovaryin camel showing :A-Oocyte,B-zona pellucida, C-granulosa cells layer, D- oophorus cumulus Masson's trichrome X40



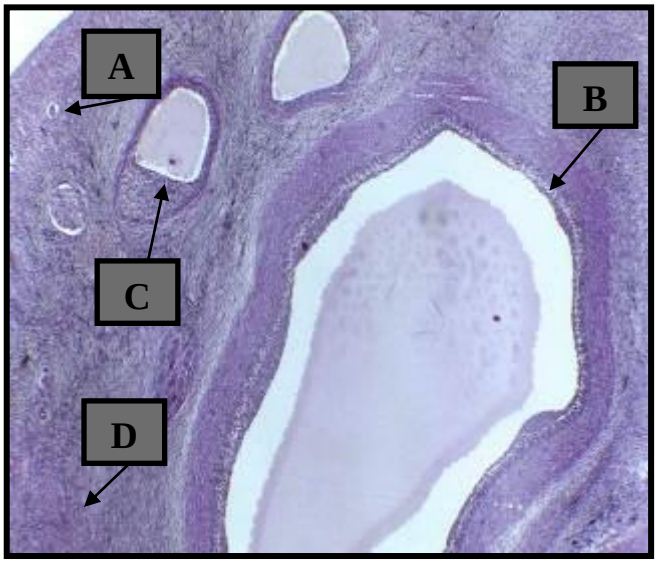


Fig.8. Microscopic section of the right ovaryin camel showing: A-Medulla layer,B-vascular zone,C-convoluted arteriole, PASstain X40.

Fig.7. Microscopic section of the left ovary in camel: showing A-primary follicle,B-tertiary follicle,C-mature follicle, D-stromal cortex
H&E stain X40

Conclusion

, this present concluded that follicular growth in she- camels occurred in follicular wave, The ovulation may occur in both ovaries, while the follicular activity in left ovary can be slightly larger than that of the right ovary.

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Conflict of interest: The manuscript's authors have said that there were no conflicts of interest during the drafting process.

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