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Light microscopic observations of the corpus luteum in the ovary of goat (*Capra hircus*)

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ABSTRACT

Ovaries were collected from 20 (10 pregnant and 10 non-pregnant) apparently healthy, nondescript goats to take up light microscopic observations on the corpus luteum in ovary of goats. After fixation and routine paraffin embedding technique 5 to 7 micron thick sections were stained with haematoxylin and eosin, Wilder's reticulum, Masson's trichrome and Weigert's resorcin fuchsin stains. Generally, the corpus luteum occupied nearly whole of the cortical stroma and pushed the medulla towards the periphery. In few ovaries 2 corpora lutea were encountered. Collagen and reticular fibers formed the capsule of the corpus luteum, and trabeculae and septae radiating from the capsule divided the luteal parenchyma into lobes and lobules. The reticular fibers interspersing among the cellular component were relatively more in non-pregnant animals than pregnant group. The granulosa lutein cells, theca lutein cells and spindle shaped cells formed the parenchyma of the gland. The size of the granulosa lutein cells was largest among all 3 cell types followed by theca lutein cells and spindle shaped cells. The granulosa lutein cells predominated other cell types. In the non-pregnant animals theca lutein cells were encountered more than spindle shaped cells whereas in pregnant animals the picture was reverse.

Key words: Corpus luteum, Goat, Histology, Light microscopic, Ovary

Ovaries are the primary sex organs and formation of corpus luteum is a commonly occurring physiological phenomenon. The corpus luteum appeared as a multilobular gland in both pregnant and non-pregnant animals. Histological observations on the corpus luteum have been reported by various scientists in large ruminants. The literature relating to light microscopic observations in the ovary of small ruminants is scanty, hence the present work in non-descript goats has been undertaken.

MATERIALS AND METHODS

The present study was conducted on the ovaries of 20 normal, apparently healthy, non descript adult goats (10 pregnant and 10 non-pregnant). The pieces of left and right ovaries were fixed in 10% formalin, neutral buffered formalin, FAA (Lavdowsky's mixture of formalin, alcohol and acetic acid), Bouin's fluids and Zenker's fluid. The tissues were processed by paraffin embedding technique. Paraffin sections of 5 to 7μm thickness were stained by haematoxylin and eosin, Mallory's triple stain to differentiate connective tissue fibers (Crossman's modification 1937), Wilder's reticulum stain to demonstrate reticular fibers (Luna 1968) and Weigert's resorcin fuchsin elastic stain to demonstrate elastic fibers (Luna 1968). The micrometry was done with the help of calibrated ocular micrometer to elucidate the following parameters: size of the corpus luteum, thickness of the capsule of the corpus luteum, diameter of lutein cells along with the diameter of their nuclei.

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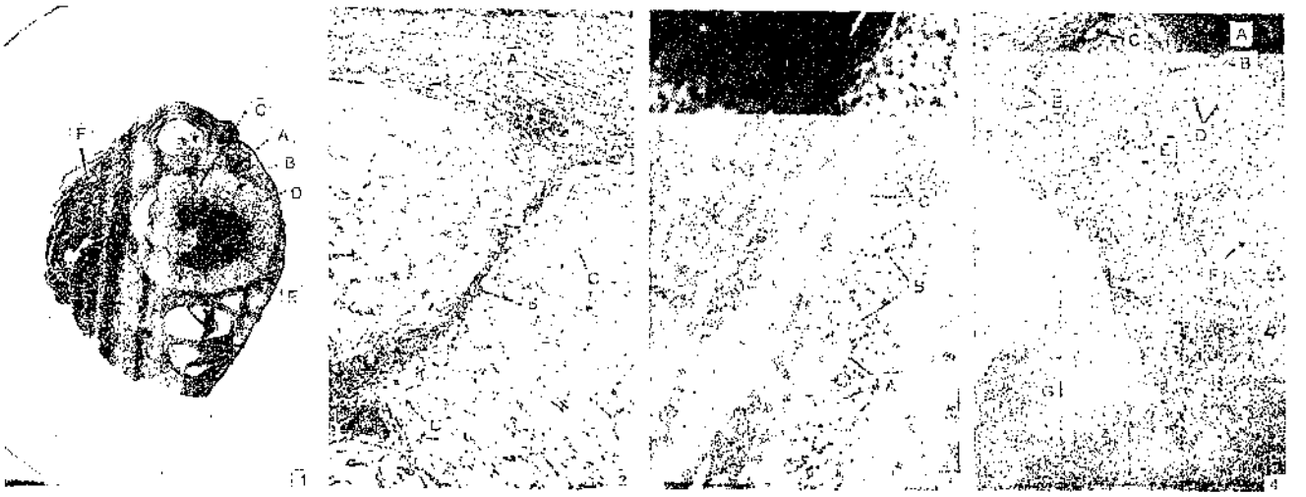
RESULTS AND DISCUSSION

The corpus luteum in goat was formed after the luteinization of the ruptured follicle as mentioned by Rajput and Sharma (1996) in Gaddi sheep. In goats the corpus luteum occupied nearly whole of the cortical stroma and pushed the medulla almost towards the periphery (Fig.1). It was spheroid to oval in shape as reported in Gaddi sheep (Rajput and Sharma 1996) and buffalo (El-Sheikh and Abdelhadi 1970). Generally one corpus luteum was present in 1 ovary (Fig. 1), however, in some adult animals 2 corpora lutea were also encountered. The cellular component of the corpus luteum was surrounded by a thick capsule made up chiefly of fine to coarse reticular fibers along with some collagen fibers (Fig. 2) as reported by Rajput and Sharma (1996) in Gaddi sheep



Figs 1–3. 1. Section of the ovary of non-pregnant goat showing different kinds of follicles and one corpus luteum having (A) capsule, (B) trabeculae, (C) stalk of lutein cell mass entering the antrum, (D) lutein cells, (E) cavity of corpus luteum, (F) shifted medulla. Wilder's reticulum stain ×5. 2. Sectin of the ovary of pregnant animal showing collagen fibers in capsule of corpus luteum (arrow). (A) granulosa lutein cells, (B) theca lutein cells, (C) spindle shaped cells, Mallory's triple stain ×70. 3. Sectin of the ovary of non-pregnant goat showing corpus luteum having (A) capsule, (B) trabeculae, (C) blood vessels (D) granulosa lutein cells (E) theca lutein cells, (F) spindle shaped cells, (G) fluid filled central cavity. H & E ×28.

and El-Sheikh and Abdelhadi (1970) in buffalo. The cellular component of the corpus luteum was divided into small lobes and lobules by the arborization of trabeculae and septae from the capsule (Fig 1,2). Consequently the corpus luteum appeard as a multilobular gland. The trabeculae and septae chiefly formed by fine to coarse reticular fibers (Fig. 1) along with some collagen fibres, were traversed by numerous congested blood vessels of varying size (Fig. 3). Fine reticular fibres interspersed among the cellular components of the corpus luteum and occasionally appeared to be encircling individual cells. The occurrence of these fibres was relatively more in non-pregnant animals than that in pregnant animals. Numerous congested blood capillaries were present in between the luteal cells.

Three types of luteal cells formed the glandular component of the corpus luteum in goats. These were large sized granulosa lutein cells, small sized theca lutein cells and spindle shaped cells (Fig. 2) as reported in Gaddi sheep (Rajput and Sharma 1996). However, the authors used the term large and small lutein cells for granulosa lutein and theca lutein cells, respectively. Trautmann and Fiebiger (1957), Banks (1981) and Priedkalns (1993) in domestic animals; El-Sheikh and Abdelhadi (1970), Prasad *et al.* (1970) and Singh and Roy (1999) in buffalo; Singh and Prakash (1988) in goat mentioned two types of lutein cells in the corpus luteum. Further, Banks (1981) and Priedkalns (1993) in domestic animals described that granulosa lutein and theca lutein cells were formed from the cells of membrana granulosa and theca interna after the process of luteinization; the process included hypertrophy and hyperplasia of both cell types. The size of the granulosa lutein cells was largest among all 3 cell types followed by theca lutein cells and spindle shaped cells, respectively (Figs 2, 3).

The granulosa lutein cells predominated other cell types and formed the major part of the cellular component (Figs 2, 3) as reported by Frandson (1970) in farm animals and Prasad *et al.* (1979) in Indian buffalo. The theca lutein cells were relatively more in number than spindle shaped cells in non-pregnant animals, whereas, in pregnant animals spindle shaped cells out numbered theca lutein cells. This difference in the pregnant animals may be attributed to the reduced level of estrogen during pregnancy as mentioned by Priedkalns (1993).

Similar to the description of Prasad *et al.* (1979) in Indian buffalo and Priedkalns (1993) in domestic animals the granulosa lutein cells were polyhedral or polygonal in shape (Fig. 2). The cytoplasm of these cells was light eosinophilic and stained lighter than the theca lutein cells (Fig. 3). Singh and Prakash (1988) observed that the cytoplasm of granulosa lutein cells was pale in goat. However, the eosinophilic cytoplasmic granules as reported by these authors could not be observed in our study. The nuclei of these cells were vesicular and either spherical or oval. Prasad *et al.* (1979) in Indian buffalo and Priedkalns (1993) in domestic animals reported spherical nuclei in granulosa lutein cells. According to Priedkalns (1993) the nuclei of these cells were vesicular. Occasionally, at some places few granulosa lutein cells contained 2 to 3 spherical nuclei.

The theca lutein cells were smaller in size than the granulosa lutein cells (Fig. 2) as reported by Trautmann and Fiebiger (1957), Prasad *et al.* (1979), Banks (1981), Singh and Prakash (1988) and Priedkalns (1993). These cells were

Table 1. Various micrometric observations on corpus luteum in the ovary of goat (mean±SE in μm)

Parameters	Pregnant animals	Non-pregnant animals	Overall average
Diameter of corpus luteum	6524.38 ±946.26 (4197.50–10585.00)	6526.85 ±675.19 (2956.50–9398.75)	6526.03 ±794.18 (2956.50–10585.00)
Thickness of capsule	113.93±14.19 (58.80–176.40)	80.85±14.96 (44.10–147.00)	91.88±10.98 (44.10–176.40)
Diameter of granulosa lutein cell	33.18±3.66 (24.55–41.87)	23.95±2.31 (16.10—32.20)	27.03±2.28 (16.10–41.87)
Diameter of nucleus of granulosa lutein cell	8.07±0.47 (6.44–9.66)	8.25±0.56 (6.44–9.66)	8.19±0.36 (6.44–9.66)
Diameter of theca lutein cell	19.22±0.97 (16.17–22.05)	11.67±0.85 (9.66–16.10)	14.19±1.12 (9.66–22.05)
Diameter of nucleus of theca-lutein cell	6.16±0.23 (5.15–6.62)	5.23±0.59 (3.22–6.44)	5.54±0.33 (3.22–6.62)

Figures given in parenthesis show range.

scattered among the granulosa lutein cells at several places in the gland, and predominantly in the close vicinity of the trabeculae. Singh and Prakash (1988) in goat and Prasad *et al.* (1979) in Indian buffalo reported that theca lutein cells were mainly distributed at the periphery. These cells were polygonal and oval in shape (Fig. 2). In agreement with the observations of Singh and Prakash (1988) in goats theca lutein cells had relatively dark eosinophilic cytoplasm as compared to granulosa lutein cells. The nuclei of these cells were spherical, oval and darkly stained. Prasad *et al.* (1979) also reported round and oval nuclei in theca lutein cells in Indian buffalo. The spindle shaped cells of the corpus luteum had light eosinophilic cytoplasm. These cells contained darkly stained oval to elongated nuclei (Fig. 2). Congested blood vessels were conspicuously present in the corpus luteum.

At some places in the ovary of non-pregnant goat the corpus luteum had a large central cavity filled with dark eosinophilic fluid (Fig. 3) and surrounded by a distinct continuous lining of the reticular fibers (Fig. 1). In such corpora lutea the cellular component was restricted between the capsule and the central cavity. Occasionally, mass of lutein cells with a stalk attached to the cellular component entered the cavity (Fig. 1), which may be indicative of the reduction of the cavity and finally forming a compact cellular gland.

The average diameter of the corpus luteum was measured 6526.03±794.18 μm (6.5 mm) with a range of 2956.5 to 10585.0 μm (Table 1). Singh and Prakash (1988) in goat measured corpus luteum up to 3.28 mm ×3.60 mm. In the present study it was observed that there was no remarkable difference between the average diameter of the corpus luteum in pregnant and non-pregnant animals (Table 1). According to Singh and Roy (1999) in buffalo the mean largest diameter of corpus luteum was 20.4±1.23 mm during early pregnancy and 19.48±0.65 mm in developed cyclic corpus luteum. The average thickness of the capsule in corpus luteum was measured 91.88±10.98 μm with a range of 44.10 to 176.40 μm (Table 1). According to Rajput and Sharma (1996) in Gaddi sheep the capsule was 60 to 450 μm thick. The capsule measured thicker in pregnant goat as compared to non-pregnant (Table 1).

The average diameter of the granulosa lutein cells was 27.03±2.28 μm with a range of 16.10 to 41.87 μm (Table 1). The size of the granulosa lutein cells was reported 40 μm in domestic animals (Priedkalns 1993). Singh and Prakash (1988) in goat reported that the polyhedral cells were 21.5 μm at their long and short axis, respectively. The granulosa and theca lutein cells in the corpus luteum of pregnant goat were relatively larger than in the non-pregnant goats. The size of these cells and the nuclei are given in Table 1.

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