



Histomorphological study of uterus of adult non-descript goat (*Capra hircus*) during various stages of folliculogenesis

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Histomorphological and histochemical changes during various reproductive phases in general and folliculogenesis in particular would provide the basis for the application of reproductive techniques, diagnosis and treatment of infertility in goats. In spite of wide significance of goat farming there is lack of literature on the several aspects of female reproductive organs during various stages of folliculogenesis.

The reproductive organs of 30 adult non-descript female goats (free from gross pathological lesions) were collected from the Government Slaughter House, Supela, Bhilai (Chhattisgarh). It was assured that organs of 30 goats belong to various follicular stages, viz. up to 4 mm (group A), 4–6 mm (group B) and more than 6 mm (group C) by gross examination. All samples were processed by routine alcohol-benzene schedule and processed for paraffin embedding technique (melting point 58°C–60°C and 60°C–62°C). Thin section (3–7 µm) were stained with haematoxylin and eosin (Luna 1968) for fibrocellular architecture, Masson's trichome method (Masson 1929) for connective tissue, Toluidine blue for acid mucopolysaccharides, Periodic acid schiff method (Bancroft and Stevens 1996) for glycogen; Van Gieson's

method (Mallory 1961) for collagen fibres and Weigert's method for elastic fibres. Micromorphological measurements were recorded by calibrated ocular micrometer for height of the epithelium, height of the folds, height of glandular epithelium and number of glands per field.

The uterine wall was made up of 3 usual layers as in all mammals, the endometrium, myometrium and perimetrium. The endometrium was formed by tunica mucosa and tela submucosa, myometrium by tunica muscularis and perimetrium by tunica serosa.

Horn of uterus: The mucous membrane was lined by pseudo stratified columnar epithelium. Its average height in group A, B and C is given in Table 1. The mucous membrane was folded, the average mucosal fold height in group A, B and C, were recorded. The average diameter of glands, average height of glandular epithelium, and number of gland/field were also recorded in group A, group B and group C and are given in Table 1.

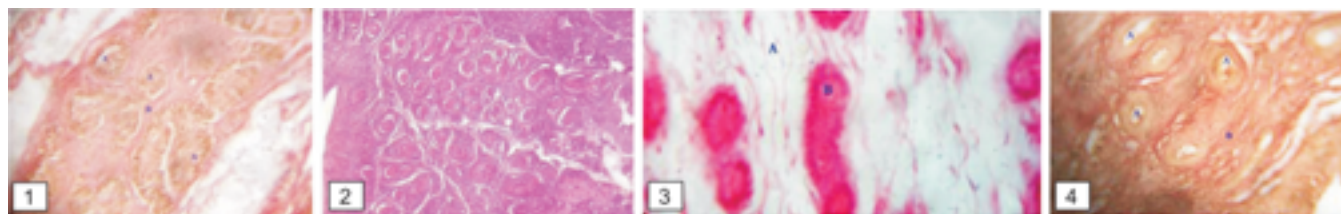
In superficial layer, the density was less whereas in deep layer it was high in group A (Fig.1). They were separated by connective tissue septae. They were lined by pseudostratified

Table 1. Histological characteristics of horn of uterus (µm) in goat

Parts uterus/ Group/ Parameter	Horn of uterus					
	A		B		C	
	Mean±SE	Range	Mean±SE	Range	Mean±SE	Range
Height of epithelium	39.00±4.60	24.8–46.01	40.34±4.44	35.52–47.04	44.06±11.5	38.40–6.08
Height of fold	140.00±20.36	96.00–182.4	148.20±19.07	119.00–180.50	171.2±19.83	132.50–05.40
Diameter of gland	46.016±6.01	39.04–53.76	68.80±7.26	63.36–99.20	94.91±4.27	84.48–112.00
Height of glandular epithelium	16.32±2.49	14.44–19.20	26.85±2.02	24.00–28.32	35.90±1.83	31.20–7.92
Number of gland/Field	35.00±1.46	30.40–43.00	36.20±1.28	24.20–53.00	39.40±1.47	30.60–30.60

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columnar epithelium. The propria submucosa was highly vascular. The thickness of the propria submucosa was more in group B than group A and C. The number of glandular units in the propria submucosa increased from group A to C.



Figs 1–4. **1.** Photomicrograph through the horn of uterus of group A showing A. glands and B. collagen fibres (Van Gieson, $\times 100$); **2.** Photomicrograph of body uterus of group A showing moderate PAS-Alcian blue (2.5 pH) activity in moderate epithelium and intense activity in glandular epithelium; **3.** Photomicrograph of section through cervix of uterus group A showing A.; **4.** Photomicrograph of section through cervix of uterus of group B showing A. glands in proprin submucosa and B. collagen fibres (Van Gieson, $\times 400$).

The concentration of collagen fibres was highest in group C among the 3 groups. The PAS- Alcian blue (2.5 pH) activity was moderate to intense (Fig. 2).

Body of uterus: The mucous membrane was slightly folded with lining of pseudostratified columnar epithelium. The average height of epithelium, average height of folds, average diameter of glands, average height of glandular epithelium, average number of glands per field were recorded in group A, B and C, and are given in Table 2. The propria submucosa was made up of loose connective tissue. In group C, mucosal folds had a core made up of loose connective tissue. The glands were less in number but their diameter was large.

PAS- Alcian blue (2.5 pH) activity was moderate in mucosal and glandular epithelium (Fig.3). The general organization of wall of the horn and body of uterus resembled to the reports of Joshi (1974), Dhale (2001). The epithelium resembled to the findings of Dhale (2001). However Agrawal and Bhattacharya (1980) reported simple columnar

epithelium with patches of pseudostratification. Whereas Bhattacharya and Saigal (1984) found its base simple columnar only.

Cervix of uterus: The folded tunica mucosa was lined by pseudostratified columnar epithelium. The average range for height of epithelium is given in Table 3. The mucous membrane showed circularly oriented folds in group B. In group C, the mucosal folds were tall in height with secondary and tertiary branching. The average height of fold, average height of tall columnar epithelium lining glands in group A, B and C were recorded and are given in Table 3.

The secretion was observed in the lumen of glands (Fig.4). The average diameter of the glands and average number of gland/fields in group A, B and C were recorded and are given in Table 3. In group A, the circular muscle layer of tunica muscularis was separated from the outer thick longitudinal muscle layer by number of blood vessels. Very few elastic fibres were observed in above areas. In group B the vascularity was characteristically increased

Table 2. Histological characteristics body of uterus (μm) in goat

Parts uterus/ Group/ Parameter	Horn of uterus					
	A		B		C	
	Mean $\pm$ SE	Range	Mean $\pm$ SE	Range	Mean $\pm$ SE	Range
Height of epithelium	36.2 0 ± 4.06	28.00–43.20	39.55 ± 3.03	35.52–47.04	42.52 ± 2.08	14.40–48.00
Height of fold	339.8 ± 79.11	174.70–401.30	374.00 ± 75.94	211.20–566.40	459.0 ± 74.06	240.00–601.00
Diameter of gland	39.06 ± 4.94	33.28–54.40	73.09 ± 4.40	48.00–124.80	110.70 ± 5.44	95.36–119.68
Height of glandular epithelium	160.1 ± 1.91	12.48–23.04	25.50 ± 1.66	14.40–36.96	33.22 ± 1.69	23.04–36.96
Number of gland/Field	29.00 ± 0.87	21.40–32.60	30.80 ± 1.05	24.40–39.00	33.60 ± 1.19	27.8 0–42.00

Table 3. Histological characteristics cervix of uterus (μm) in goat

Parts uterus/Group/Parameter	Horn of uterus					
	A		B		C	
	Mean $\pm$ SE	Range	Mean $\pm$ SE	Range	Mean $\pm$ SE	Range
Height of epithelium	27.60 ± 4.05	21.1 0–30.70	30.24 ± 3.36	25.92–35.52	34.65 ± 1.80	30.72–36.48
Height of fold	340.00 ± 79.11	175.00–499.00	367.00 ± 78.54	186.00–540.00	275.52 ± 43.09	179.00–576.0
Diameter of gland	35.58 ± 4.66	25.60–45.44	81.92 ± 5.48	64.00–102.40	99.84 ± 5.31	92.80–126.80
Height of glandular epithelium	17.76 ± 3.77	12.00–21.12	26.85 ± 1.71	22.08–32.16	36.14 ± 1.85	31.68–41.28
Number of gland/Field	29.40 ± 0.87	26.00–43.00	36.10 ± 1.31	30.40–33.12	37.40 ± 1.56	31.00–48.60

with number of large blood vessels. Collagen fibre distribution was similar to group A, however their density was high. In group C, the core of the folds was occupied by dense connective tissue with more cellularity as compared to group B. The deeper part of the propria submucosa was comparatively loose in composition. The collagen and elastic fibre distribution was similar to group A. Intense activity was recorded in glandular and mucosal epithelium for PAS - Alcian blue (pH 2.5). However, the general organization of the wall of cervix resembled to reports of Dellman and Dieter (1987), Bacha and Bacha (1990) Banks (1993), Aughey and Frye (2001).

SUMMARY

The uterus of goat at 3 stages of folliculogenesis were investigated for their histomorphological organization. The wall of uterus was consisted of endometrium, myometrium and perimetrium. The endometrium was lined by pseudo-stratified columnar epithelium. It was folded, the height of epithelium and folds increased in all the 3 region of the uterus (horn, body and cervix) from group A to C. Endometrial branching of the folds was maximum in cervix region of the uterus. The glands were distributed in superficial and deep zones and their density was maximum in deeper zone. Caruncular area of the endometrium was devoid of gland.

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