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Histomorphological and correlative histophysiological studies on the gonadotrophs of Gaddi sheep

S. PARAMASIVAN[1] AND D.N. SHARMA[2]

Department of Anatomy and Histology, College of Veterinary and Animal Sciences,
CSK HPKV, Palampur - 176 062 (H.P.)

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ABSTRACT

Histomorphologial and histophysiological studies were correlative on gonadotrophs of Gaddi sheep. The folliculotrophs were oval (7.80-8.28 µm dia), triangular or polygonal in shape. The number of FSH-cells was 231±13.80 cells/mm² in summer season. It increased considerably (330±14.22 cells/mm²) during autumn season. The population of luteotrophs was also maximum during the autumn (446±22.45 cells/mm²) and minimum during summer (242±10.04 cells/mm²) seasons. The minimum diameter (8.04±0.13 µm) also occurred during summer season. The decreased size and population of the gonadotrophs during summer was correlated with the increased follicular atresia and decreased leuteinization of the follicles leading to anestrous (summer anoestrous). Increased population was associated with increased ovulation and leuteinization of the follicles during the autumn season when most ovulations occur.

Key words: FSH, gonadotrophs, histomorphology, LH, sheep

The regulation of FSH and LH output from the gonadotrophs of the pituitary gland is dependent upon the hypothalamic control (GnRH), which is part is a feedback control mechanism involving the gonadal hormones. The normal histology of the gonadotrophs has been reported in cattle, goat and buffalo (Bassett. 1951; Bhattacharya and Saigal, 1986 and Khan, 1995) but the correlative histophysiology of the gonadotrophs in relation to the ovarian activity is lacking particularly in sheep. Hence the present study was carried out to record the seasonal changes in the gonadotrophs in relation to the reproductive behaviour of the cyclic Gaddi sheep

MATERIALS AND METHODS

Pituitary glands from 44 apparently healthy, adult (around 2.5-4.0 years of age) cyclic, non pregnant pleuriparous Gaddi sheep were collected for the present study. Immediately after the sacrifice of the animal the tissues were collected and preserved in standard fixatives like 10% neutral buffered formalin, chilled alcohol and Zenker's solution and subject to routine paraffin embedding (Luna, 1968). Longitudinal, transverse and sagittal sections were cut at 5-7 µm thickness. The sections were stained with Haematoxylin and Eosin (Luna, 1968) for routine fibrocelluar architecture, Crossman's modification of Mallory's triple stain (Crossman, 1937) for connective tissue and pituitary gland cells, Periodic Acid Schiff (PAS) reaction (Bancroft and Stevens, 1996) for glycogen, luxol fast blue and neutral red method (Lockard and Pearse, 1962) and aldehyde fuchsin method (Cameron and Steele, 1959) for carbohydrates. The sagittal sections of adenohypophysis were divided into six regions for descriptive and quantitative cytoanalysis purposes viz. rostro-dorsal rostro-ventral, mid-dorsal, miod-ventral, caudo-dorsal and caudo-ventral parts. The transverse sections were also divided into six regions viz. dorso-peripheral, mid-peripheral, ventro-peripheral, dorso-medial, mid-medial and ventro-medial parts. Differential cell count was conducted in special stained sections for various gonadotrophs (2 types) in randomly selected 5 fields from each region of both transversely and sagitally sectioned adenohypophysis. The average diameter of at least 12 cells of each type for each animal was recorded. Values were averaged season wise then subjected to

[1]Research Associate.
Corresponding author - [2]Professor and Head, Department of Anatomy and Histology, College of Veterinary and Animal Sciences, Palampur

Tukey-Krammer multiple comparison test (Instat Graph pad software).

RESULTS AND DISCUSSION

Gonadotrophs were round, oval or angular cells distributed throughout the pars distalis adenohypophysis. The cells were arranged along the periphery of the parenchymal cords and close to sinusoids. These cells stained purple with Periodic Acid Schiff technique and Crossman's modification of Mallory's triple stain. The nuclei of the gonadotrophs were generally spherical and placed contrally or sometimes eccentrically. One or two nucleoi lay among the sparsely granulated chromatin network.

Folliculotrophs of Gaddi sheep were oval, triangular or polygonal in shape (Fig. 1), found mostly scattered and rarely grouped as has also been reported by Bastings *et al.* (1991). These cells were distributed in the central region of the pars distalis adenohypophysis, but could also occur scattered in other parts of the gland. In contrast, these cells were destributed more peripherally in the goat (Singh, 1973) and rat (Purves and Griesbach, 1954) pituitary gland. Folliculotrophs stained intensely purple with PAS technique and revealed the coarse cytoplasmic granules, which were aniline blue reactive in Mallory's triple stain. Singh *et al.* (1991) stated that these cells, stained violet after PAS technique as also confirmed in the present study. The large and round nuclei or the FSH cells occupied an eccentric position in the cytoplasm.

The number of FSH cells increased significantly from 231±13 cells/mm^2 to 330±14 cells/mm^2 during summer to autumn season, respectively. This is similar to the findings of Hifny *et al.* (1983) who reported that the FSH and ACTH cells increased significantly with highest activity during autumn season in goats. The average diameter of FSH cells and their nuclei showed no significant difference during seasons (Table 1). The might be due to the periodic emergence of waves of large follicles in synchrony withthe endogenous rhythm of FSH secretion, even during anestrous seasons (Bartlewski *et al.*, 1998).

Luteotrophs were oval or slightly angular and rounded cells (Fig. 1) distributed throughout the gland. In the rostroventral region of the pars distalis adenohypophysis they occurred in clusters. But these cells were concentrated in the central region with preponderance in the restro-median zone of goats' pituitary (Singh, 1973). Luteotrophs were comparatively larger than the folliculotrophs. Their cytoplasmic granules were finer, strongly PAS positive (Fig. 2) and stained purple. These cells could be easily identified as violet round cells in Crossman's modification of Mallory's triple stain.

The population of the leteotrophs increased to the maximum during autumn (446±22 cells/mm^2) and decreased to the minimum during summer (242±10 cells/mm^2) season (Table 2), during which the ovarian activity was also minimal. During summer season the long days suppress LH secretion and lead to the sexually inactive state characteristic of the non-breeding season. Cotea and Arseni (1979) suggested that the altered FSH/LH cells ratio might lead to the follicular involution. In male goats (Hifny *et al.*, 1983) during spring and summer LH-cells showed a moderate degree of cellular activity and their percentage (of cell population) increase which is contrasting because of the sex differences in the reproductive behaviour.

The reduced size of LH-cells and their secretary activity during summer season coincided with the higher

Table 1. Histomorphometry of folliculotrophs of parts distalis adenohypophysis of sheep

Seasons	Cells/mm^2	Cell Diameter	Nuclear Diameter
Spring	270±17.02^{ab}	7.86±0.12	4.63±0.10
Summer	231±13.80^{a}	7.80±0.11	4.59±0.09
Monsoon	272±16.16^{a}	8.13±0.13	4.59±0.07
Autumn	330±14.22^{b}	8.28±0.12	4.73±0.10
Winter	290±13.69^{b}	8.10±0.08	4.68±0.08

Values (Mean ±SE) bearing different superscript very significantly

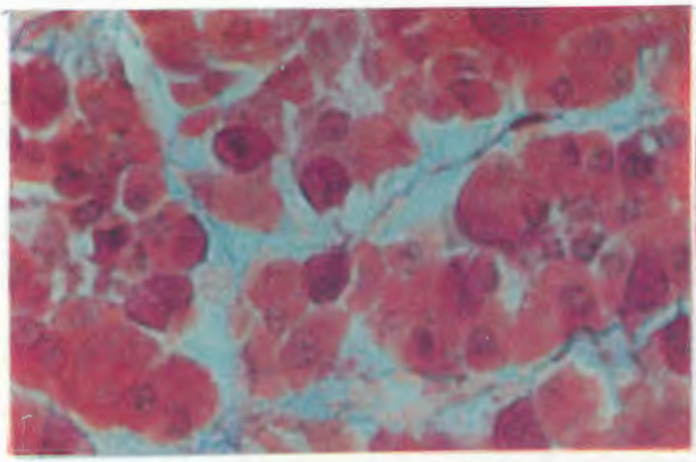

Fig. 1. Parenchymal cells cords in the pars distalis adenohypophysis showing thyrotrophs (T), folliculotrophs (F) and luteotrophs (L). Crossman's modification of Mallory's triple stain x 400

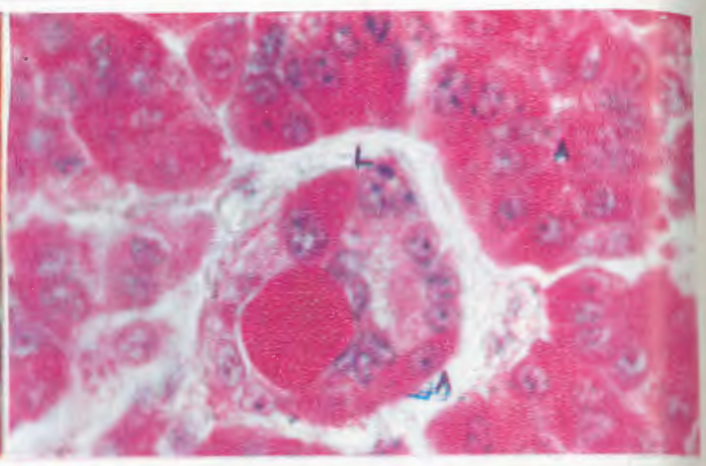

Fig. 2. Pars distalis adenohypophysis showing PAS positive ACTH (A) and LH-cells (L) surrounding a cyst. The cavity is filled with PAS positive colloid. PAS x 400.

Table 2. Histomorphometry of luteotrophs of parts distalis adenohypophysis of sheep

Seasons	Cells/mm^2	Cell Diameter	Nuclear Diameter
Spring	295±27.00^a	8.52±0.14^{ab}	4.86±0.10
Summer	242±10.04^a	8.04±0.13^a	4.81±0.12
Monsoon	384±17.94^{ab}	8.73±0.18^b	4.92±0.10
Autumn	446±22.45^b	8.83±0.17^b	5.04±0.10
Winter	347±36.60^{ab}	8.85±0.09^b	4.95±0.07

Values (Mean ±SE) bearing different superscript very significantly

atretic follicle count and absence of ovulations in the ovary during the same season. Oglivie and Stetson (1997) observed that the gonadotrophi surge was prevented during dioestrus that might be due to the increased serotonergic activity of the suprachiasmatic nucleus.

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