

Effect of the season on the histology and histochemistry of the male genital organs of Gaddi goat and Gaddi sheep

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Received: 16 November 2008; Accepted: 12 August 2009

Key words: Goat, Histochemistry, Histology, Male genitalia, Seasons, Sheep

Gaddi goat and Gaddi sheep are among the important breeds of small ruminants of Himachal Pradesh. These animals are economically important for the local tribes who obtain wool and meat by rearing these animals. Both sheep and goat attain sexual maturity around 1 year of age but are best suited for the breeding purposes at 2½ years (Jagdish Prasad 1998). In both species, the sexual activity is reported to be the highest in autumn (fall) and is influenced by the day length (Hafez 1993). The present study deals with the histological and histochemical observations, in the different seasons of the years, on the testis, epididymis and vas deferens of sexually mature Gaddi breed. The entire male genitalia was collected from these animals in the different seasons of the year from the local slaughterhouse. Only apparently healthy animals in the age range of 2–2½ years were selected for the collection of the organs (the age of the animals was estimated through dentition). The seasons of the year were divided as follows: spring (March to February), summer (June to August), autumn (September to November) and winter (December to February). In each season, 6 animals of each species were utilized for the study. Immediately after the slaughter of the animals, the male genital organs, viz. testes and penis were collected. The genitalia so collected were washed in normal saline. The tunica vaginalis (visceral layer) of the testes was removed by cutting it open to expose the epididymis and vas deferens. Two fixatives (10% buffered neutral formalin and 90% alcohol) in the chilled condition were utilized for preserving all the tissues of the male genital system. Before the fixation, the gross measurements (length, breadth and weight) of the organs of the male genital system were recorded using scale for the linear measurements and balance for the weight. The micrometrical measurements of the various parameters like epithelial height, nuclear dimensions, diameter of the tubules, alveoli etc. were all

measured using a calibrated ocular micrometer.

Tissues fixed in neutral formalin were used for the study of the general histomorphology and the cholesterol histochemistry purposes while those preserved in the 90% alcohol were utilized for the histochemical localization of glycogen. Small pieces (2–3 mm) of testis, epididymis and vas deferens were taken for the histological processing (Luna 1968). After processing and preparing the block, the paraffin sections were cut at 5–7 µm using the rotary microtome. The cryostat sections were utilized for the histochemical demonstration of the cholesterol.

For the histological and histochemical (glycogen and cholesterol) studies, Harris haematoxylin and eosin stain for the routine histomorphology; Van Gieson's method for collagen fibers; Gomori's method for reticular fibers; Verhoeff's method for elastic fibers using Van Gieson counter stain; Schultz method for cholesterol (Luna 1968); and PAS technique using enzyme (diastase) extraction for glycogen and other polysaccharides (Bancroft and Stevens 1996) were used.

Gross studies: The male genitalia (testes and penis) of Gaddi goat and Gaddi sheep were more or less similar. The testes were oval in shape and measured 9.70 ± 1.46 cm length, breadth 4.31 ± 0.50 cm thick and weighed 98.00 ± 3.04 g in Gaddi goat. The corresponding value of Gaddi sheep were 4.26 ± 0.10 cm and 99.75 ± 2.12 g respectively. The penis measured 30.12 ± 0.1 cm long, 1.23 ± 0.03 cm broad and 1.00 ± 0.01 cm thick in Gaddi goat. The 3 values were 30.13 ± 0.91 cm, 1.17 ± 0.05 cm and 1.02 ± 0.03 cm, respectively in Gaddi sheep. The penis of both the animals showed a distinct sigmoid flexure in which 4–5 cm of the organ was present.

According to Schummer *et al.* (1979) the testis weighed 200–300 g in sheep and 145–150 g in goat while the length of the penis in these species was 30–50 cm. Sisson (1975) recorded the length (10 cm) and weight (250–300 g) of the testis of sheep. The length of the testis of Gaddi sheep and Gaddi goat is in agreement with the measurements given by

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the earlier authors but the weight of the organ is much lower than those reported by them; the age of the animals (being 2 to 2.5 years), medium size of breed and the nutritional status of the animals (being selected from the slaughterhouse) might be the factors for the lower weight of the testis. Similarly the length of the penis of the animals of those 2 breeds fell in the range given by these authors.

Histological and histochemical studies: The histological and histochemical studies on the testis, epididymis and vas deferens of Gaddi goat and Gaddi sheep were more or less similar. The micrometrical observations of the organs of both the species are given in Table 1.

From the micrometrical observations, it is evident that generally all the values like capsular thickness, diameter of the seminiferous tubules, density of the Leydig cells of the testis epithelial height of epididymis and vas deferens of Gaddi goat and Gaddi sheep were maximum in autumn and least in summer. This indicates that their sexual activity is

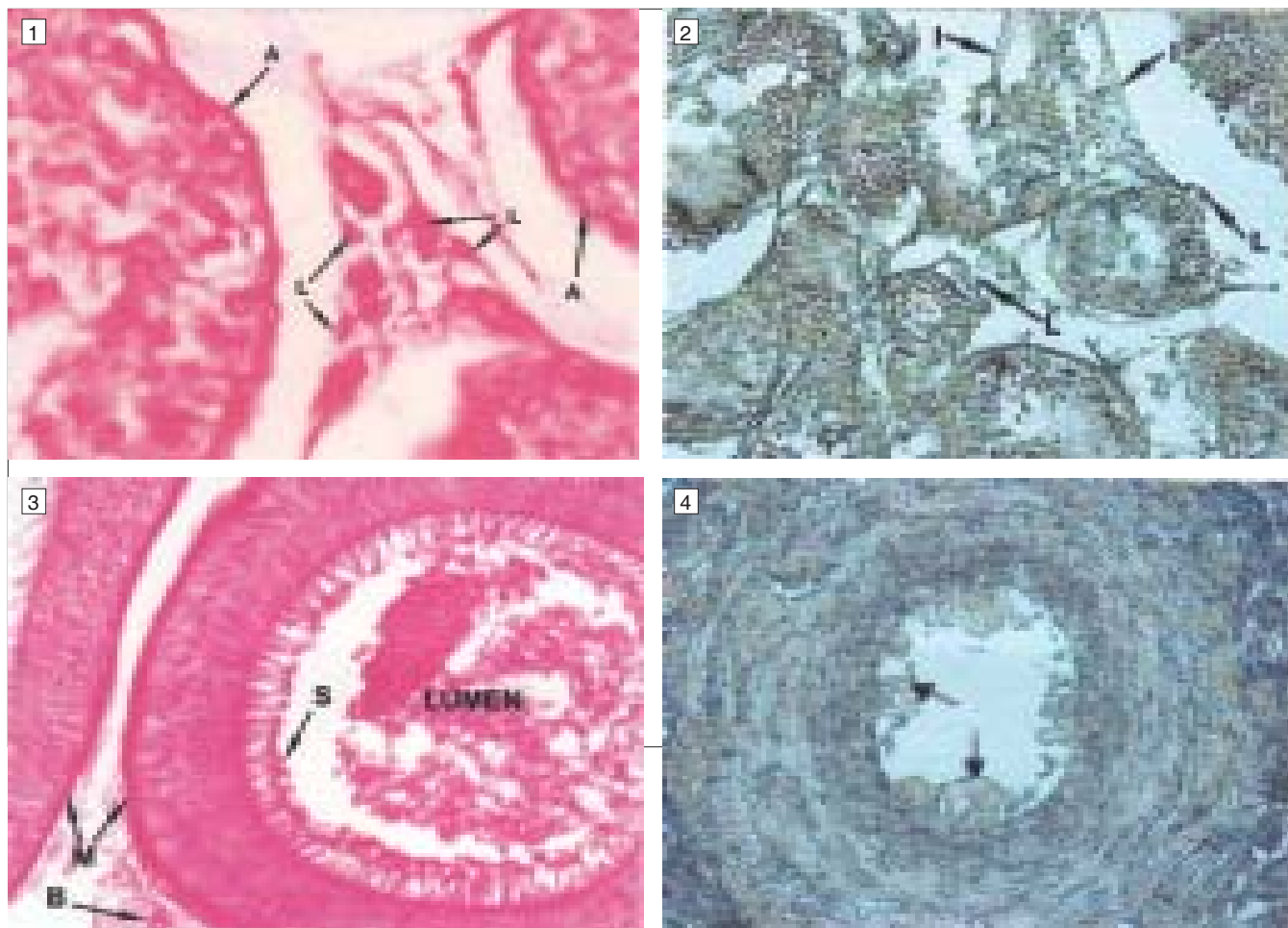
highest in autumn as stated by Hafez (1993).

The interstitial cells of Gaddi goat and Gaddi sheep were polyhedral cells located in small groups. Their cytoplasm showed strong reactions for the glycogen (Fig. 1) whose intensity did not vary in different seasons. The Leydig cells also showed reaction for the cholesterol (Fig. 2) and the intensity was maximum in autumn and minimum in summer (Table 3). As the Leydig cells secrete the male sex hormone (testosterone) and cholesterol is the precursor for the hormone, intense reaction for the cholesterol in autumn season and least reaction in summer might indicate the sexual activity of the Gaddi small ruminants is more in the former season and less in the latter season. Dellmann and Wrobel (1976) stated that the Leydig cells in the testis of ox, horse and cat contained varying amount of glycogen. These authors also opined that these cells were considered to store cholesterol in their cytoplasm. The histochemical observations on the interstitial cells of Gaddi goat and Gaddi

Table 1. Micrometrical observations (mean $\pm$ SE in microns) on testis, epididymis and vas deferens of Gaddi goat and Gaddi sheep in the different seasons of the year

Organ	Parameter	Spring	Summer	Autumn	Winter
Testis	(i) Capsular thickness	A) 132.00 $\pm$ 2.07	122.40 $\pm$ 1.92	136.20 $\pm$ 2.08	130.20 $\pm$ 1.32
		B) 133.80 $\pm$ 2.41	123.60 $\pm$ 2.53	136.80 $\pm$ 2.11	130.80 $\pm$ 2.10
	(ii) Diameter of seminiferous tubules	A) 157.20 $\pm$ 2.67	138.60 $\pm$ 1.99	165.00 $\pm$ 2.46	153.60 $\pm$ 1.88
		B) 155.80 $\pm$ 2.83	138.60 $\pm$ 2.17	165.00 $\pm$ 2.60	153.00 $\pm$ 1.99
	(iii) Leydig cells				
		A) 247.36 $\pm$ 5.34	201.57 $\pm$ 6.95	283.56 $\pm$ 5.94	244.21 $\pm$ 6.67
		(No. of cells/mm ²) B) 251.99 $\pm$ 5.11	202.70 $\pm$ 6.88	289.35 $\pm$ 5.97	247.69 $\pm$ 7.03
		(b) Nuclear diameter			
Epididymis	(i) Epithelial height	A) 18.82 $\pm$ 0.27	15.60 $\pm$ 0.32	21.30 $\pm$ 0.18	17.03 $\pm$ 0.26
		B) 17.33 $\pm$ 0.29	14.55 $\pm$ 0.25	21.38 $\pm$ 0.17	16.43 $\pm$ 0.50
	(ii) Muscular layer thickness	A) 121.20 $\pm$ 2.16	115.20 $\pm$ 1.92	132.60 $\pm$ 2.74	119.40 $\pm$ 2.19
		B) 124.80 $\pm$ 2.87	116.40 $\pm$ 2.16	134.40 $\pm$ 3.23	122.19 $\pm$ 2.80
	Body				
		A) 17.55 $\pm$ 0.27	14.70 $\pm$ 0.27	20.03 $\pm$ 0.39	16.05 $\pm$ 0.30
		B) 17.03 $\pm$ 0.30	14.33 $\pm$ 0.24	19.65 $\pm$ 0.43	15.83 $\pm$ 0.46
		A) 125.40 $\pm$ 2.70	118.80 $\pm$ 2.19	135.60 $\pm$ 2.80	122.40 $\pm$ 2.58
		B) 128.40 $\pm$ 2.97	119.40 $\pm$ 2.51	138.00 $\pm$ 3.36	125.90 $\pm$ 3.00
	Tail				
		A) 16.43 $\pm$ 0.29	13.88 $\pm$ 0.19	18.68 $\pm$ 0.44	15.40 $\pm$ 0.26
		B) 16.80 $\pm$ 0.29	14.10 $\pm$ 0.22	19.05 $\pm$ 0.44	15.23 $\pm$ 0.36
		A) 130.80 $\pm$ 2.97	121.20 $\pm$ 2.76	139.80 $\pm$ 3.60	127.20 $\pm$ 2.95
		B) 133.20 $\pm$ 2.91	122.40 $\pm$ 2.85	141.00 $\pm$ 3.70	129.00 $\pm$ 3.04
Vas deferens	(i) Epithelial height	A) 16.13 $\pm$ 0.31	14.10 $\pm$ 0.34	18.15 $\pm$ 0.28	15.06 $\pm$ 0.23
		B) 16.35 $\pm$ 0.34	14.48 $\pm$ 0.34	18.40 $\pm$ 0.20	15.36 $\pm$ 0.21
	(ii) Nuclear diameter	A) 3.53 $\pm$ 0.21	3.08 $\pm$ 0.16	3.93 $\pm$ 0.23	3.38 $\pm$ 0.20
		B) 3.60 $\pm$ 0.22	3.15 $\pm$ 0.17	4.05 $\pm$ 0.23	3.45 $\pm$ 0.20

A-Gaddi goat; B-Gaddi sheep.



Figs 1–4. **1.** Basement membrane of seminiferous tubules (A) and Leydig cells (L) in the interstitial tissue, showing strong affinity for PAS. Testis of Gaddi goat (winter season). PAS $\times 100$; **2.** Leydig cells (L) showing strong cholesterol reaction. Cholesterol positive secretions in the interstitial space (I) are also seen (spring season). Testis of Gaddi sheep (cryostat section). Schultz method $\times 100$; **3.** Supranuclear zone of the epithelium, muscles (M), stereo cilia (S) and sperms in the lumen showing glycogen. Blood vessel (B) can also be seen in the connective tissue. Epididymis of Gaddi sheep. (winter season). PAS $\times 100$; **4.** Epithelial cells (arrow) showing moderate reaction for the cholesterol in autumn season. Vas deferens of Gaddi goat (cryostat section). Schultz method $\times 100$.

sheep are nearly in agreement with the findings of these authors.

Both the epididymis and the vas deferens of Gaddi goat and Gaddi sheep were lined with pseudostratified columnar epithelium. The supranuclear zone of the tall columnar cells and the masses of the sperms in the lumen of both the organs showed strong reaction for glycogen (Fig. 3). The reaction did not vary much in the different seasons of the year.

Cholesterol was also found in the tall columnar cells of epididymis and vas deferens in both the species of the Gaddi animals though the reaction varied in these organs. In the epididymis the reaction was mild to intense while moderate reaction was observed in the vas deferens. Meeta *et al.* (1998) studied the effect to seasons on the biochemical and electrolyte components of epididymis of buffalo. They detected the cholesterol content which was lower in summer

than in autumn. The present histochemical findings on the cholesterol content of the epididymis of Gaddi goat and Gaddi sheep are in agreement with the qualitative studies of Meeta *et al.* (1998) in buffaloes.

SUMMARY

Histological and histochemical studies were conducted in the testis, epididymis and vas deference of Gaddi goats and Gaddi sheep in different seasons (spring, summer, autumn and winter) of the year. In each season, 6 animals of each species were utilized. The studies of these organs in both the species of Gaddi breed were more or less, similar. The capsular thickness, diameter of the seminiferous tubules, density of the Leydig cells, epithelial height of the epididymis and vas deferens were maximum in autumn and minimum in summer. The cytoplasm of the interstitial cells showed strong reaction for the glycogen whose intensity did not vary

in the different seasons. The Leydig cells also exhibited reaction for cholesterol whose intensity was maximum in autumn and minimum in summer. The glycogen histochemistry of the epididymis and vas deferens was similar to that observed in the Leydig cells. The cholesterol reaction of the epididymis also resembled that observed in the cytoplasm of the interstitial cells but no seasonal variation was found for this component in the vas deferens (being of moderate reaction in all the seasons).

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