Gross and Microscopic Anatomy of Teat in Madras Red Sheep*

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In tropical countries, sheep milk is used for consumption and could be an important diet for small and marginal farmers and landless labourers. Anatomy of teat plays major role in the protection against mastitis in animals (Mansfield and Tinsan, 1996). A complete anatomical picture of the teat of sheep may be helpful to understand the pathological lesions in sheep. The present study was conducted to investigate gross and microscopic anatomy of teat in Madras Red sheep comprising prepubertal, pubertal, pregnant, lactating and dry animals.

Materials and Methods

The gross and microscopic anatomical studies on the teat of the sheep were conducted on 35 Madras red ewes of different age groups. The ewes used were divided into five age groups viz. prepubertal, (4 to 6 months), pubertal (7 to 18 months), pregnant (1.5 years to 2.5 years), lactating (2 to 4 years) and dry (4 to 8 years) with 7 animals in each group. The gross anatomical parameters of teats viz. teat length (distance between base and tip), teat diameter at base and tip, inter-teat distance at base were recorded just before the slaughter of the animals.

Prior to the slaughter of the sheep, their health status, normal body structure, age, parity and condition of external genitalia were observed. The determination of age was ascertained based on the eruption of teeth (Noden and de Lahunta, 1985).

The tissue pieces were collected from base and apex of the teat and processed by routine Alcohol-Benzene schedule and paraffin blocks were made. Sections were cut at 5-7 µm thickness for histological study. The sections were stained with the standard Haematoxylin and Eosin (H&E) method, Masson's trichrome method for collagen and muscle fibres, Phosphotungstic acid haematoxylin (PTAH) method for glial cells, nerve fibres and myoepithelial cells, Crossman's modification of Mallory's triple staining for connective tissue fibres, Mallory-Azan (Heidenhain's) method and Periodic acid Schiff (PAS) technique for mucopolysaccharides (Bancroft and Gamble, 2006). The observations were tabulated and subjected to statistical analysis.

Results and Discussion

The two teats in the mammary gland of sheep were symmetrical in size and shape. They appeared as cone shaped with the tip pointed towards the ground in prepubertal sheep whereas, in well developed gland during lactation they were directed laterally. The length, base diameter, and tip diameter of the teat increased from prepubertal animal upto lactating stage but reduced in dry stage. Similarly the inter-teat distance in prepubertal animals was 3.56 ± 0.06 cm which increased gradually upto 9.65 ± 0.35 cm in lactating animals. However, it was decreased to 8.16 ±

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Table. Gross morphometry of teat through various physiological status in Madras Red Sheep (Mean±SE)

<table>
<thead>
<tr>
<th>Parameters (cms)</th>
<th>Prepubertal</th>
<th>Pubertal</th>
<th>Pregnant</th>
<th>Lactating</th>
<th>Dry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>0.68±0.03</td>
<td>1.16±0.07</td>
<td>1.31±0.08</td>
<td>1.91±0.09</td>
<td>1.71±0.08</td>
</tr>
<tr>
<td>Diameter at base</td>
<td>0.63±0.02</td>
<td>0.88±0.04</td>
<td>0.95±0.06</td>
<td>1.46±0.04</td>
<td>1.38±0.05</td>
</tr>
<tr>
<td>Diameter at Tip</td>
<td>0.28±0.01</td>
<td>0.46±0.04</td>
<td>0.48±0.03</td>
<td>0.66±0.04</td>
<td>0.36±0.02</td>
</tr>
<tr>
<td>Inter-teat distance</td>
<td>3.56±0.06</td>
<td>5.58±0.41</td>
<td>6.81±0.58</td>
<td>9.65±0.35</td>
<td>8.16±0.30</td>
</tr>
</tbody>
</table>

Column-wise group means (±SE) with different superscript differ significantly (P<0.01).

0.30 cm in dry animals.

The wall of the teat consisted of epidermis, dermis, subcutaneous tissue and mucous membrane. On epidermis, the stratum lucidum was indistinct in lactating sheep. The teat of sheep comprised of teat canal, Furstenberg’s rosette and streak canal as reported in buffalo (Singh, 2000). Hair follicles, sebaceous glands and sweat glands surrounded by myoepithelial cells were seen as the main features of the dermis. The number of glands increased greatly in the teats of pregnant and lactating sheep.

The gland sinus appeared as branching ducts which were lined by stratified cuboidal epithelium during different age groups of sheep. It continued downwards as teat canal, which was fully formed and lined by stratified cuboidal epithelium in pubertal animals which further transformed into stratified columnar epithelium during pregnant and lactating animals. It appeared as stratified cornified squamous epithelium close to the tip of teats. Sulochana (1983) observed that teat canal was lined by stratified cornified squamous epithelium surrounded by a vascular zone in the lamina propria in ewes. The subepithelial stroma contained connective tissue cells and the elastic fibres became much coarser in stromal tissue in pregnant and lactating sheep.

The accessory lactiferous glands and

Fig 1. Cross section of teat in pubertal sheep showing the epidermis (ED) lined by keratinized stratified squamous epithelium. The dermis showing hair follicles (HF), sebaceous glands (SB) and sweat glands (SW). Masson’s Trichrome x 100

Fig 2. Cross section of teat canal (C) close to the tip lined by keratinized stratified squamous epithelium (K) in pubertal sheep. Haematoxylin and Eosin x 100
ducts were also observed in stromal tissue and they reached down close to the streak canal during pregnant and lactation periods in sheep as reported in pregnant and lactating sheep. These accessory compound tubule-alveolar glands resembled the mammary tissue and were well developed only in lactating teats. They were identified in the tunica propria, mainly in the wall of the teat canal and teat cistern in lactating sheep.

The streak canal constituted the distal part of duct system and was lined by the epithelium extending from the epidermis of the teat. The streak canal was lined by stratified squamous keratinized epithelium (Kausar et al. 2001).

The epithelium lining the streak canal changed from stratified squamous keratinized to two cell layered cuboidal epithelium on the Furstenberg’s rosette. The subepithelial stroma of the rosette was thrown into primary and secondary folds projecting into the lumen. Celik and Asti (1992) also observed a remarkable increase in plasma cell population in the epithelium and subepithelial connective tissue of Furstenberg’s rosette. Nickerson and Paukely (1983) reported 6 to 10 connective tissue folds in the Furstenberg’s region in bovine teats. The authors further stated that the plasma cell was the most abundant cell type in subepithelial stroma at squamocolumnar junction which even migrated into the epithelial lining. In addition, mast cell and polymorphonuclear leukocytes were also reported. They suggested that the rosette area might play an important role in protecting mammary tissue from invading pathogens.

The subepithelial stroma of streak canal in pregnant, lactating and dry sheep was composed of collagen fibres with few elastic and recticular fibres. The reticular fibres mainly formed the basement membrane of epithelium.

The epithelium was surrounded by sphincter made up of thick smooth muscle bundles in pregnant and lactating sheep. The smooth muscle fibres were also seen as isolated fibres around streak canal, but were not organized as a sphincter in prepubertal and pubertal animals. It is believed that better developed muscle sphincter in teat canal in lactating and pregnant sheep help in maintaining the tight closure of teat canal thus limiting intramammary infection through teat canal.
Summary

The gross and microscopic anatomical studies on the teat of the sheep were conducted on 35 Madras Red ewes of different age groups. The teats of sheep were symmetrical in size, cone shaped and uniformly smaller than those of the goat. The length, base diameter, and tip diameter of the teat increased from prepubertal animal upto lactating animals but reduced in dry animals. The teat of sheep comprised of teat canal, Furstenberg’s rosette and streak canal. Hair follicles, sebaceous glands and sweat glands surrounded by myoepithelial cells were seen as the main features of the dermis. The teat canal was lined by stratified cuboidal epithelium in pubertal animals which further transformed into stratified columnar epithelium during pregnant and lactating animals. It appeared as stratified cornified squamous epithelium close to the tip of teats. The epithelium lining the streak canal changed from stratified squamous keatinized to two cell layered cuboidal epithelium on the Furstenberg’s rosette. The accessory lactiferous glands were well developed in lactating teats.

References


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