Histomorphology of Alveolar Epithelium of Mammary Gland in Madras Red Sheep

S. Paramasivan¹, Geetha Ramesh, S. Ushakumary, C. Balachandran and K. Kulasekar

Department of Veterinary Anatomy and Histology, Madras Veterinary College, Tamilnadu Veterinary and Animal Sciences University, Chennai 600 007, Tamil Nadu

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Reports are available on histological and histochemical features of bovine (Weber, 1977) and buffalo mammary glands (Uppal et al., 1994). However, literature on the histology and histochemistry of the mammary gland of the sheep are scanty. Available literature on the growth and development of mammary gland have been centered on pregnant and lactating sheep. However, studies on growth and development of mammary gland during prepubertal, pubertal and dry animals are meager. The present study is focused to interpret the histological changes in the alveolar epithelium in the mammary gland of Madras Red sheep during different age groups.

Materials and Methods

30 Madras Red ewes of different age groups were included in the current study. 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 6 animals in each group. The tissue samples collected from mammary glands of all these animals were fixed in various standard fixatives viz., 10% neutral buffered formalin, Zenker’s fluid, Carnoy’s fluid, Bouin’s fluid and Telly’s fixative. All tissues collected as above were processed by routine Alcohol-Benzene schedule and paraﬁn blocks were cut at 5-7 mm thickness (Luna, 1968) for histological study.

The sections were stained with standard Haematoxylin and Eosin, Masson’s trichrome method for collagen and muscle fibres, Verhoeff’s method for elastic fibres, Periodic acid Schiff (PAS) technique for mucopolysaccharides, Mercury-Bromophenol blue method for basic proteins, Gomori’s calcium method for alkaline phosphatase activity, Gomori’s lead method for acid phosphatase activity, Von Kossa method for calcium, Oil red O in propylene glycol for lipids (Bancroft and Gamble, 2003).

Results and Discussion

The mammary parenchyma in prepubertal sheep was rudimentary and consisted of poorly defined lobes. These comprised of branching ducts surrounded by abundant connective tissue and adipose tissue. The development of lobules and further branching of smaller ducts were seen during the pubertal mammary glands. Shortly after conception the duct system and new generations of lactiferous ducts were formed by the division and growth of the epithelial outgrowths as noticed in other domestic animals (Konig and Liebich, 2004). The lobulo-alveolar development of mammary gland occurred during pregnancy and lactation which was followed by the regression of secretory alveoli at involution as reported in pigs (Gayer et al., 1986).

The alveoli were developed completely in the mammary glands of pregnant sheep. They were mostly laminated and lined by cuboidal cells with strongly basophilic nuclei. Most of the alveoli were lined by foamy cells with granular eosinophilic secretion and larger fat vacuoles projecting at the luminal end in the

¹Corresponding author: paramanatomy@rediffmail.com

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mammary gland of pregnant sheep. The alveolar size was 39.88 ± 1.39 μm in pregnant sheep, 106.05 ± 14.70 μm in lactating sheep but decreased significantly to 32.45 ± 1.64 μm in the mammary glands of dry sheep. The increased size of the alveoli in lactating mammary gland may be correlated with its active secretion that fills the lumen and distension of the alveoli when compared to other age groups of animals.

The epithelial height of alveoli was 13.28 ± 0.51 mm in pregnant and 12.32 ± 0.55 mm in dry, which reduced significantly to 7.89 ± 0.50 mm during lactation periods. The nuclear size of alveoli in the mammary glands was the lowest in lactating mammary glands (4.94 ± 0.16 μm), whereas in pubertal animals it increased significantly (6.48 ± 0.21 μm). The lower height of epithelial cells in lactating mammary glands might be due to the higher synthetic activity of alveolar epithelial cells.

The internuclear distance in the branching ducts of mammary gland in prepubertal and pubertal sheep was 1.57 ± 0.10 and 1.01 ± 0.07 μm, respectively. The values increased in mammary gland of pregnant sheep to 5.11 ± 0.42 μm and in the lactating sheep to 8.38 ± 1.03 μm. However, in dry animals the internuclear distance was reduced to 2.21 ± 0.27 μm. Sinowatz et al. (1980) also opined that marked changes took place in the fine structure of the secretory cells of canine mammary glands during pregnancy and lactation. Differences were characteristically noticed in cellular height, shape and size of the nuclei as the pregnancy advanced.

The developing alveoli could be distinguished from alveoli of lactating glands of ewes since the latter showed intracellular accumulation of small lipid droplets, whereas the developing alveoli had accumulations of large lipid droplets (Bentivoglio, 1986). In the current study, the glandular alveoli became larger with their epithelium often folded and their cell height increased in the pregnant age groups. However, they were hypertrophied and tensed with full of secretion in the mammary glands of lactating sheep. The alveoli of the dry mammary glands showed the alveolar degeneration. Only alveolar remnants and small ducts were seen with one or two layers.
of closely packed cuboidal epithelial cells with deeply stained nuclei. The occurrence of corpora amylacea both in alveoli and connective tissue was frequent in these glands. The alveoli in the mammary glands of pregnant and lactating sheep showed affinity to oil red O and Schiff's reagents. The lumen of alveoli in the mammary glands during pregnancy and lactation showed positive reaction for calcium. The alkaline phosphatase activity was seen along the basal and luminal regions of the cells lining the alveoli. Parmar et al. (1986) also identified the distribution of alkaline phosphatase activity in alveolar and duct epithelium. Activity was higher in lactating mammary tissue than in non-lactating goat.

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References