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Histo-chemical Variation in the Mammary Gland of Sheep (*Ovis aries*) and Goat (*Capra hircus*)

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ABSTRACT: The present study was carried out to understand the histo-chemical aspect and differences if any, present in the mammary gland of sheep and goat to investigate the variation present if any in the two species. The observations recorded showed, that in the present study, lamina propria of ducts, basement membrane of the alveoli, alveolar and ductal secretions as well as corpora amylacea were strongly positive for PAS, in both the species. The alveolar secretions and lamina propria of ducts were even seen to be very strongly positive for proteins in both the sheep as well as goat. Strong positive reaction for proteins was noted in blood vessels and corpora amylacea. The alveoli present in the mammary gland of both sheep and goat, showed homogenous fat droplets, within the lumen. However, the calcium deposits were also noted in the lumen of some alveoli and in the lumen of few ducts in the lactating gland and more number in non-lactating stages of the mammary gland in both the species.

Keywords: Mammary gland, Teats, Muco-polysaccharides, Proteins, Fats.

INTRODUCTION

Mammary gland, which is know as an exocrine epithelial tissue specified to the mammalians which is adapted to the growth requirements in each species, is considered as a compound organ as far as its configuration and occupation is considered. The mammary gland develops on the onset of pregnancy and early lactation, and regresses quickly after dry-off. The overall structure of mammary gland and teats such do influence milking and has direct effect on the milking management as well (Caja *et al.*, 2001). Many interactions between several peptide and steroid hormones are responsible to control the milk protein synthesis in the mammary gland (Oka and Topper 1971). The actual secretion of proteins and other organic substances is under the influence of milk-borne negative feedback regulatory system (Silanikove *et al.*, 2006). Increased protein synthetic activity of the gland occurs, with the onset of gestation, the gland proliferates and development of the endoplasmic reticulum occurs (Tucker and Reece 1970; Oka and Topper 1971). The thorough knowledge of normal histo-chemistry and general architecture of mammary gland helps in identifying the pathological lesions in the various diseases affecting the mammary glands specifically in the production point of view. Therefore, the present study was conducted to record the occurrence of muco-polysaccharides, proteins, fats and calcium in the mammary gland of small ruminants.

MATERIALS AND METHODS

The present study was conducted on mammary glands of sheeps and goats, 15 number each which were in their lactating and non-lactating stages of sheep and goat. The freshly collected tissue samples of mammary gland under the present of both the species were collected immediately after their slaughter from local abattoir located in Mumbai city. Various regions of the mammary glands collected after slaughter, were considered for taking the tissue samples for the histo-chemical study. The tissue samples of mammary gland were taken at different regions of the gland. The tissue samples were then fixed in 10 % neutral buffered formalin and Bouin's fluid (Singh and Sulochana, 1996). The fixed tissues were subjected to routine processing and then paraffin blocks were prepared. The tissue samples were cut in sections of 4-5 µm thickness were taken and these were stained by Periodic acid Schiff method for neutral muco polysaccharides (Bancroft and Gamble 2008), PAS-AB method for acid muco-polysaccarides (Bancroft and Gamble 2008), mercury bromphenol blue method for proteins. (Singh and Sulochana 1996).

RESULTS AND DISCUSSION

The various histo-chemical parameters under consideration for the present histo-chemical variation in Sheep and Goat's mammary gland reveled following results.

A. Observations related to Protein content

In the present study the alveolar secretions were seen to be strongly positive for proteins the mammary gland of both sheep as well as in goat (Fig. 1). Similar observations were noted by Singh and Roy (2006) in Indian buffalo and El Sayed *et al.* (2009) in Damascus goats. However**,** Urmila *et al.* (2021), recorded similar

findings in various domestic animals including buffalo, pig, sheep, goat and dog but recorded that cattle, had shown moderately positive reactions. In the present comparative of the mammary gland in both the species, showed that the lamina propria of ducts was strongly positive for proteins. Urmila *et al.* (2021) recorded similar findings in various domestic animals including cattle, buffalo, sheep, goat and pig but observed that it was moderately positive in dog.

The present investigation showed that the secretions of the ducts were strongly positive in both the species. These findings corroborates with the findings of Urmila *et al.* (2021) who had stated that pig and dog showed strong reactions for protein but, were weakly positive in cattle. The present comparative study carried out in both the small ruminant species, it was recorded that the blood vessels and corpora amylacea were strongly positive for proteins. In corroboration to the present findings, Singh and Roy (2006); Naik *et al.* (2015) reported strong activity of proteins in corpora amylacea in Indian buffalo and Malnad Gidda cows respectively.

In teats of both the sheep as well as goat, the epidermis, hair follicles, smooth muscle fibers, blood vessels and epithelial lining of teat sinus were seen to be strongly positive for proteins. Sweat glands as well as Sebaceous glands showed strong reaction for proteins in both the sheep as well as goat. The intensity of proteins was however more in sheep as compared to that of goat. Similar findings were recorded by Urmila *et al.* (2021), in her studies done on mammary gland of various domesticated animals.

B. Observation related to Muco-polysaccharides

In the present comparative study, it was recorded that the basement membrane of the alveoli, alveolar and ductal secretions, lamina propria of ducts, blood vessels and corpora amylacea showed strong activity for PAS in both, sheep as well as goat (Figs.3). Similar observations were recorded by Parekh (2002); Singh and Roy (2006) in buffalo, Naik *et al.* (2015) in Malnad Gidda cows and Senthil kumar *et al.* (2019) in Madras Red ewes. Present study reveled that the alveolar epithelial cells and the secretions present within it, did not show any PAS-AB activity in sheep but in contrary to this, in goat, some secretions showed strong PAS-AB activity. However, the lamina propria of ducts showed strong PAS-AB activity in goat (Fig. 4). Whereas the PAS-AB positive secretions were seen in intra-lobular ducts sheep as well as in goat. These observations recorded, corroborates with the observations recorded but Naik *et al.* (2015) in Malnad Gidda cows.

During present comparative investigation it was noticed that the blood vessels were seen showing strong PAS-AB activity in sheep but on the contrary, mild activity was observed in that of goat. The present findings corroborates with that of the findings of Panchal and Vyas (2005) done in buffalo, who recorded that it showed mild activity of acid mucopolysaccharides. However, Naik *et al.* (2015) noted strong activity in blood vessels in lactating gland of Malnad Gidda cows.

The Corporal amylacea were seen to be strongly basophilic but were found negative for mucopolysaccharides. The present observation recorded during the present research investigation, is not in agreement with Sulochana *et al.* (1990) who recorded neutral polysaccharides in these bodies. However, Urmila *et al.* (2021), in her studies done on mammary gland of various domesticated animals**,** observed that Corpora amylacea was strongly positive for PAS-AB in cattle and mild to moderate in other animals. Similarly, Naik *et al.* (2015) noted that there was strong activity of PAS-AB in corpora amylacea in Malnad Gidda cows.

C. Observations recorded in Non- Lactating stage

In the mammary gland in its non-lactating phase, of both sheep as well as goats, PAS and PAS-AB activity was weak than that of in their lactating stage. These recordings match with that of the one recorded by, Parekh (2002) in buffalo and Senthil kumar *et al.* (2019) in Madras Red ewes. However, in contrary to this, Singh and Roy (2006) in their study done in buffalo recorded that, in non-lactating gland, strong activity for acid mucopoly-saccharides was seen in the stromal tissue. The present study revealed, that the sebaceous glands and sweat glands were strongly PAS positive only in sheep compared with that of goat. It was even observed that, PAS activity was strongly positive in the smooth muscle fibers and blood vessels of teats of both the small ruminants. The epidermis of teat, was moderately PAS positive in both the species. However, PAS-AB activity was recorded to be mild in goat. These findings corroborates with findings of Urmila *et al.* (2021), in various domestic animals. Strong PAS activity was in recorded in inner epithelial root sheath of hair follicle of both sheep as well as goat.

D. Observations related to presence of Fat

The present comparative study revealed that the amount of fat was more in sheep as compared to goat. In both the species the alveolar epithelial cells and epithelial cells of ducts showed strong reaction for fats. Lumen of the alveoli was seen to have throughoutly dispersed fat droplets. However, were the large fat droplets were numerous and were placed at the distal part of the alveoli, whereas the small fat droplets which were less in number, were present with in the centre of the lumen of the alveoli (Fig. 2). Similar findings were also reported by Hatziolos *et al.* (1954) in cows. Homogenous fat material was noticed within the lumen of the alveoli as well as in some ducts. Similar recordings are done by Singh and Roy (2006) in Indian buffalo and Naik *et al.* (2015) in Malnad Gidda cows.

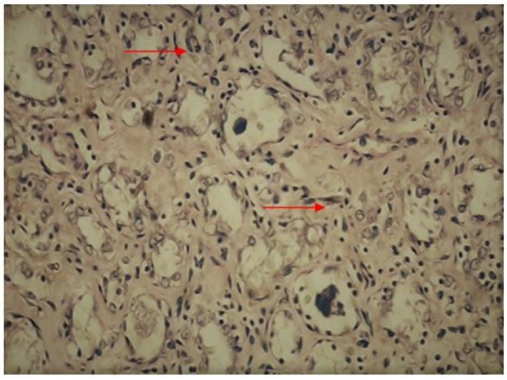

Plate 1. Microphotograph of udder of sheep in non-lactating stage (Best Carmine Stain 400X) Arrow showing A) Glycogen B) Corpora amylacea.

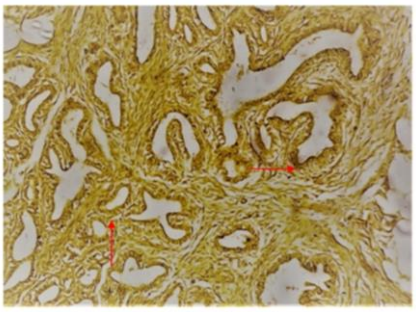

Plate 2. Microphotograph of udder of goat in non-lactating stage showing glycogen (Beat Carmine Stain 100X).

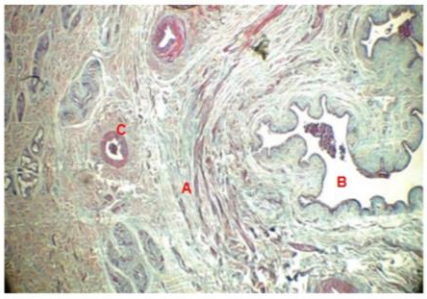

Plate 3. Microphotograph of goat teat in lactating stage (Mallory's Triple stain 100X) showing A) collagen fibers B) streak canal C) vessel.

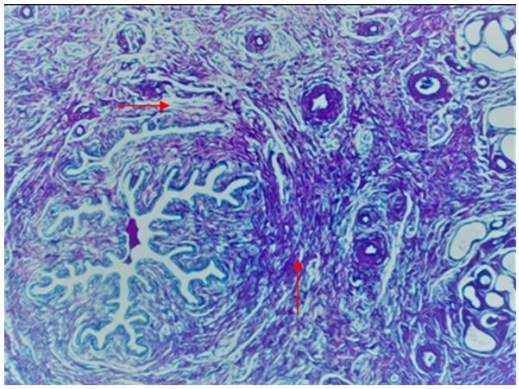

Plate 4. Microphotograph of teat of sheep in non-lactating stain (Gomori's Acid Phosphatase 400X) Arrow showing acid phosphatase reaction.

The number of small fat droplets was recorded more in goat but overall distribution of fats, were comparatively less in goat than that of the sheep. It was even noticed that there was presence of neutral lipids, in alveoli and duct of sheep and goat.

CONCLUSIONS

Various modifications which occur in the mammary gland throughout the lactation period in production animals, particularly in the small ruminants, sheep (*Ovis aries*) and goat (*Capra hircus*) will serve as a tool to understand its functionality as a milk production organ. The progressive increase in the importance of small ruminants in milk production, it is very essential to understand the modification pattern of mammary gland. It is very essential to improve dairy production, which can definitely achieved by understanding the changes in histo-chemical composition of various structures in the mammary gland throughout lactation.

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