Indian Journal of Animal Sciences **76** (1): 43–45, January 2006

Histochemical study on the mammary gland of Indian buffalo (*Bubalus bubalis*)

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Received: 27 September 2004; Accepted: 5 September 2005

Key words: Buffalo, Histochemistry, Mammary gland

India has the best dairy breed of buffalo in world, which play vital role in the economy of the farmers. Information on the histochemical study of buffalo mammary gland is very scanty (Katiyar 1982, Uppal *et al.* 1995). The present study was made to elucidate the distribution of neutral and acid mucopolysaccharides, basic protein and lipid in the mammary gland of lactating and non-lactating buffaloes.

The study was conducted on the mammary gland of 6 Indian buffaloes (lactating and non-lactating). The tissues were collected from different regions of the teat and udder and fixed into 10% neutral buffered formalin and Buins fixative. The samples were processed for paraffin block preparations by cedar wood oil schedule (Luna 1968). Sections of 5–7 μm thickness were obtained and stained for histochemical techniques (Table 1).

Table 1. Histochemical stains used in the study

Stains	Purpose	Reference
Periodic Acid Schiff and Alcian Blue (pH 2.5)	Neutral and Acid Muco-polysaccharides	Sheehan and Hrapchak (1973)
Mercuric Bromphenol Blue	Basic Protein	Pearse (1972)
Sudan Black B	Lipid*	Chayen *et al.* (1969)
Acid Haematin	Phospholipid*	Chayen *et al.* (1969)

*Cryostat sections from fresh and unfixed tissues were used to demonstrate lipid and phospholipid.

The streak canal of buffalo teat was lined by keratinised stratified squamous epithelium, which showed low content of neutral mucopolysaccharide. The acid mucopolysaccharide was moderate in the basal layers of the epithelium (Fig.1). The histochemical reaction for neutral and acid mucopolysaccharides is comparable to that reported by Uppal *et al.* (1995) in buffalo. Adams *et al.* (1961) reported that glycogen was localized in the stratum spinosum and basal layers of the stratum granulosum in sreak canal epithelium. The keratin layer had high content of neutral mucopolysaccharides and basic proteins. The stromal tissue had high content of neutral mucopolysaccharides and low basic proteins. The sudanophilic lipids were better demonstrated in nerve fibres and adipose tissue than the epithelium. Histochemical study of Adams *et al.* (1961) on bovine teat revealed lipid producing cells in the streak canal epithelium. The lipid was mainly phospholipid without cholesterol.

The folds of rosette had mosaic appearance in respect to distribution of neutral mucopolysaccharides which were more in epithelium whereas stroma had more acid mucopolysaccharide (Fig. 2) whereas Uppal *et al.* (1995) reported moderate activity of neutral and acid mucopolysaccharide in epithelium.

The epithelium of teat and gland sinus was moderately positive for acid mucopolysaccharides whereas stroma was strongly alcianophilic as reported earlier by Katiyar (1982). The ducts surrounding the gland sinus contained more neutral mucopolysaccharides. The gland sinus epithelium and blood vessels showed intense reaction for basic protein whereas stroma was moderately positive. Distribution of lipid was low in epithelium and high in mylenated nerve fibres and adipose tissue, whereas Katiyar (1982) failed to demonstrate lipid in gland sinus epithelium in buffalo mammary gland.

In lactating mammary gland, alveolar epithelium and secretory material was moderately positive for neutral mucopolysaccharides wheras the basement membrane showed strong activity. The stroma was moderately positive for acid mucopolysaccharides. In non-lactating buffalo, corpora amylacea showed intense reaction for neutral

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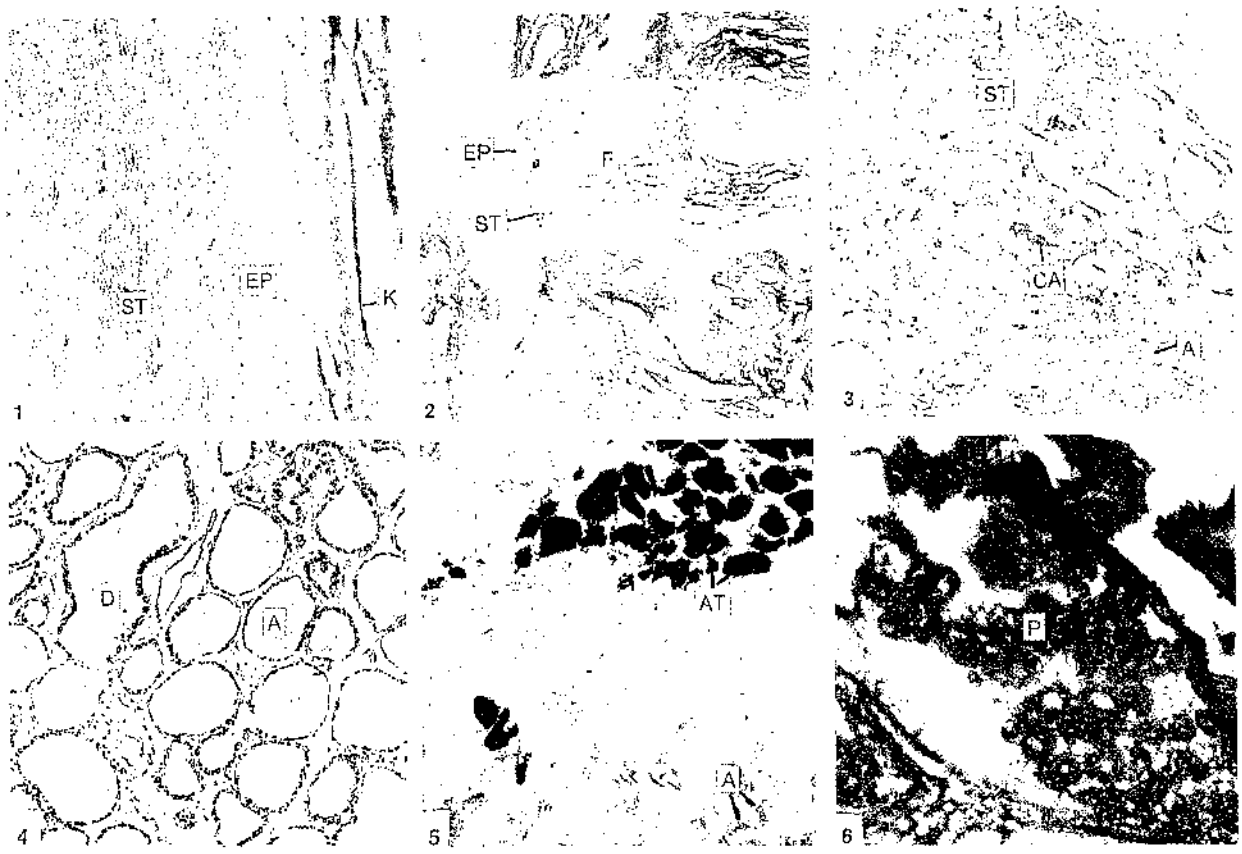

Figs 1–6. **1.** Section of streak canal showing higher content of acid mucopolysaccharides in basal layers of epithelium(EP) and neutral mucopolysaccharides in the keratin layer (K) and stromal tissue (ST). PAS/AB. × 140. **2.** Fold's (F) of rosette showing AB/PAS reaction in epithelium (EP) and stroma (ST). PAS/AB. × 70. **3.** Section of mammary gland from non-lactating buffalo showing AB/PAS reaction in alveoli (A), interlobular stroma (ST) and corpora amylacea (CA). PAS/AB. × 140. **4.** Section of mammary gland from a lactating buffalo showing distribution of basic protein in alveoli (A) and ducts (D). Mercuric Bromphenol Blue. × 70. **5.** Section of mammary gland from non-lactating buffalo showing distribution of lipid in alveoli (A) and adipose tissue (AT) Sudan Black B. × 70 **6.** Section of mammary gland from adult buffalo showing fine granules of phospholipids in parenchyma (P). Acid haematin. × 70.

mucopolysaccharides, but some of them have alcianophilic reaction at their periphery (Fig. 3) whereas Katiyar and Chandra (1994) observed that corpora amylacea were intensely reactive for periodic acid schiff stain and acid mucopolysaccharides in lactating buffalo and the reactions were mild in the non-lactating buffalo. Reid and Chandler (1973) mentioned that in the secretory alveoli, a minority of cells presented glycogen and the alveolar cells in the dry cows also contained some glycogen. They also observed that the lumina of ductules in the heifers mammary gland contained an amorphous substance which showed negative reaction for glycogen, acid and sulphated mucopolysaccharides and lipids. Katiyar (1982) observed spindle shaped myoepithelial cells between lining epithelium and basement membrane of alveoli, ducts and gland sinus in buffalo which exhibited mild to moderate reaction for acid mucopolysaccharides. Epithelium of alveoli and ducts was strongly positive for basic proteins in lactating mammary gland. The secretory product was moderately and stromal tissue was weak to moderately positive for basic proteins (Fig. 4). Swanson and Paffenberger (1979) showed that secretory material in the lumen of alveolis contain fat globule and proteins. The corpora amylacea showed intense reaction for basic protein in non-lactating mammary gland. Distribution of lipid was mild to moderate in alveolar epithelium and strong in adipose tissue in non-lactating mammary gland (Fig. 5). Michel (1981) reported reappearence of adipose tissue in dry udder after lactation. Phospholipids showed fine granular reaction in alveolar epithelium and no reaction in stromal tissue (Fig. 6). Dellmann (1971) reported the presence of lipid droplets in the alveolar cells of the ruminant mammary gland.

SUMMARY

The histochemical study on mammary glands of Indian buffalo revealed that neutral mucopolysaccharids and basic

proteins were more in the alveoli of lactating gland, whereas acid mucopolysaccharides were better demonstrated in stromal tissue of non-lactating gland. The sudanophilic lipid was better demonstrated in epithelium of alveoli and duct system of lactating buffalo. The corpora amylacea was strongly positive for neutral mucopolysaccharides and basic protein in non-lactating mammary gland.

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