RESEARCH ARTICLE

Histochemical Studies of Teat in Kosali Cow

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Abstract

The present study was conducted on mammary glands of 36 lactating and non-lactating Kosali cows divided into early, mid and late stages, respectively. Kosali, the first breed of cattle from Chhattisgarh, was registered as 36th breed of nation. Kosali cattle are smaller in size and are well adapted to the existing agro-climatic conditions of the region. Collagen fibers in teat were most abundant followed by reticular and elastic fiber. Their density was apparently increased with advancement of lactation from early to late stage. These fibers were more compact and denser in non-lactating/non-pregnant Kosali cows. Epithelium of teat cistern, rosette of Furstenberg and teat canal were positive for PAS and AB-PAS substance in variable range in lactating and non-lactating stage and the reaction was weak in non-lactating group.

Key words: Histochemistry, Kosali cow, Teat

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Introduction

Kosali a draft cattle breed is mainly concentrated in the central plain region of the Chhattisgarh state in India with 31.32 lakh estimated population spread in 68.49 lakh hectare geographical area. Average lactation length and dry period of Kosali cows are 230.7 ± 9.11 and 190.8 ± 8.19 days, respectively, under rural management conditions in the breeding tract (Jain *et al.,* 2019). The histochemical study of teat at different stage of lactation increases the background information in the physiology, reproduction, medicine, livestock production and management, genetics and pathology. Teat acts as main protective barrier against mastitis. Due to high mastitis resistance of Kosali breed of cattle and scarcity of literature on teat histochemistry present work was undertaken.

Materials and Methods

The histochemical studies were conducted at Department of Veterinary Anatomy, College of Veterinary Science & AH, Anjora, Durg (C.G.), India. The experiment was conducted on teats of 36 Kosali cows procured from central plain region of the Chhattisgarh. The samples were collected from animals immediately after death from farmers house, state veterinary hospitals etc. Tissue samples were collected from the teat cistern, Furstenberg's rosette and teat canal regions of teat and fixed in 10% neutral buffered formalin for 24-48 h. The fixed tissue samples were processed in alcohol-xylene sequence, embedded and blocked-in paraffin wax at 58-60°C melting point. Sections of 3-8 µm thickness were cut and stained with Van Gieson's method for collagen fibers, Verhoeff's method for elastic fibres, Gomori's method for reticular fibers, Periodic Acid Schiff's method for carbohydrates and Alcian Blue-Periodic Acid Schiff's method for acid mucopolysaccharides (Suvarna *et al.*, 2013). The teats were categorized into two groups (18 each) as lactating and non-lactating by ascertaining the status of mammary gland and dry period as below:

Group I: Lactating (n=18): 6 each, Early lactating (5-90 days), Mid lactating (> 90-180 days) and Late lactating (>180-230 days) stage.

Group II: Non-lactating/Non-pregnant (n=18): 6 each, Early non-lactating/non-pregnant (Date of dry - 60 days), Mid non-lactating/non-pregnant (>60-120 days), and Late non-lactating/non-pregnant (>120-190) stage.

Results and Discussion

The teats (*Papilla mammae*) of Kosali cow, like other cattle breeds, were consisted of teat cistern, Furstenberg's rosette and teat canal (streak canal or papillary duct). The wall of teat consisted of three layers, the outer layer was the skin formed by epidermis and dermis. The middle thick layer was the fibro-muscular-vascular. The inner layer, mucosa

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was superficial and deep layers of lamina propria and lining epithelium of the teat.

Collagen Fibers

Among all three connective tissue fibers, collagen fibers were abundant. The collagen fibers were oriented in circular manner at the middle layer and around the Glomus organs and longitudinally oriented in epithelial pegs of teat cistern, Furstenberg's rosette and teat canal in both the groups. The collagen fibers were circularly arranged around the lobules and also helped in formation of interalveolar septa in the lamina propria of teat cistern and Furstenberg's rosette regions in both groups. The collagen fibers were rich in teat canal region followed by Furstenberg's rosette and teat cistern regions, which could be attributed to strong structural integrity for complete closure of teat before and after milking. The density of collagen fibers was increased apparently with advancement of lactation from early stage to late stage of lactation. Collagen fibers were more compact and denser in non-lactating/ non-pregnant Kosali cows (Fig. 1, 2, 3, 4). This may be attributed to increased amount of connective tissue in dry stage in absence of suckling stimulus and lactogenic hormone. Similar findings were also reported by Atyia (2009) in small ruminants, Naik *et al.* (2015) and ALsadi and Fadeal (2018) in cows.

Elastic Fibers

These fibers were noticed apparently in Glomus organs, at the base of fibro-muscular vascular layer and tunica media of blood vessels in teat cistern, Furstenberg's rosette and teat canal in all the stages under study. In subepithelial stroma, elastic fibres were less in number in both the groups. Elastic fibers were also noticed around the lobules and interalveolar septa in lamina propria of teat cistern and Furstenberg's rosette regions of both groups. Comparatively elastic fibers were more abundant in the teat canal region to regulate milk flow and leakage. The concentrations of the elastic fibres increased with the advancement of lactation and were most abundant in non-lactating/ non-pregnant Kosali cows (Fig. 5, 6). This is because of elastic fibers combined with smooth muscle that creates a musculo-elastic system, which actively seals the teat canal preventing milk leakage and guarding against infection as structural defence mechanism. The density of elastic fibers was less than collagen and reticular fibers. These observations also confirmed the earlier reports by Atyia (2009) in small ruminants, Naik *et al.* (2015) and ALsadi and Fadeal (2018) in cows.

Reticular Fibers

The reticular fibers were seen at the basement membrane of epidermis, reticular and papillary layer of dermis in scattered manner, in circular manner around the Glomus organs and longitudinally oriented in epithelial pegs of teat cistern, Furstenberg's rosette and teat canal in both the groups. The reticular fibers were circularly arranged around alveoli and lobules in the lamina propria of teat cistern and Furstenberg's rosette regions of both groups. Comparatively a greater number of reticular fibers were noticed in teat canal region, which structurally provided tight closure of teat lumen. The density of reticular fibers was increased apparently with advancement of lactation from early stage to late stage of lactation. Increased concentration of the reticular fibres was marked in non-lactating group as compared to lactating group (Fig. 7, 8). It is due to their role in forming a protective barrier and supporting tissue structure. These findings were in accordance with the earlier report of Naik *et al.* (2015) in cows.

PAS Positive Substances

The inner mucosal epithelium, basement membrane of epithelium, connective tissue core, tunica media of blood vessels and stratum lucidum of teat cistern, Furstenberg's

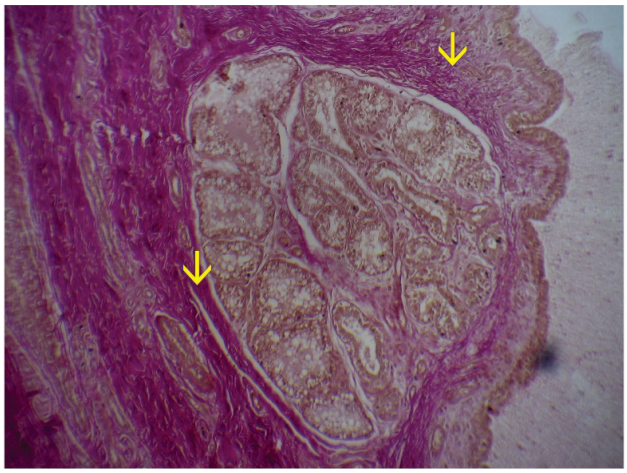

Fig.1: Photomicrograph of collagen fibers present in teat cistern at early lactating stage in Kosali cow (Van Gieson's, 100X).

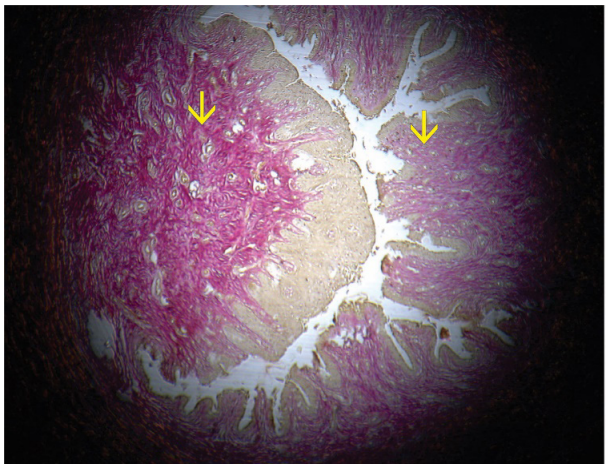

Fig.2: Photomicrograph of collagen fibers present in rosette of Furstenberg at early non-lactating stage in Kosali cow (Van Gieson's, 40X).

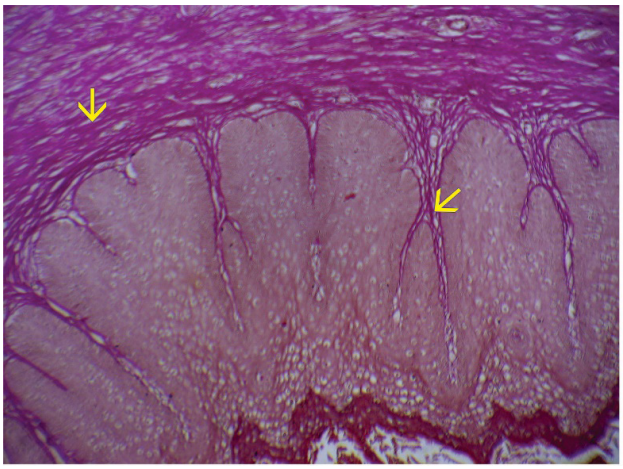

Fig.3: Photomicrograph of collagen fibers present in teat canal at latelactating stagein Kosali cow (Van Gieson's, 100X).

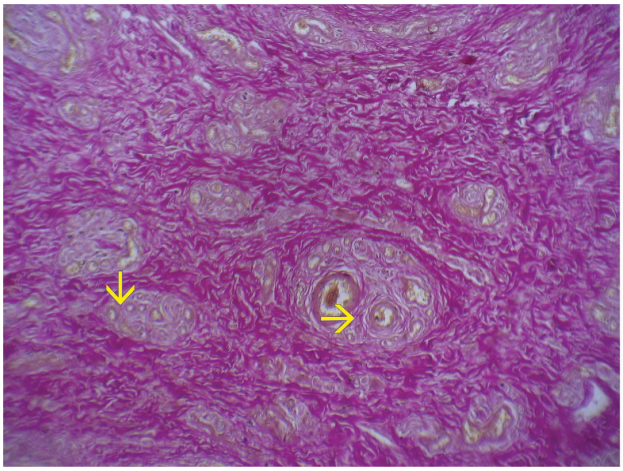

Fig.4: Photomicrograph of collagen fibers present in Glomus organ of teat at early non-lactating stage in Kosali cow (Van Gieson's, 100X)

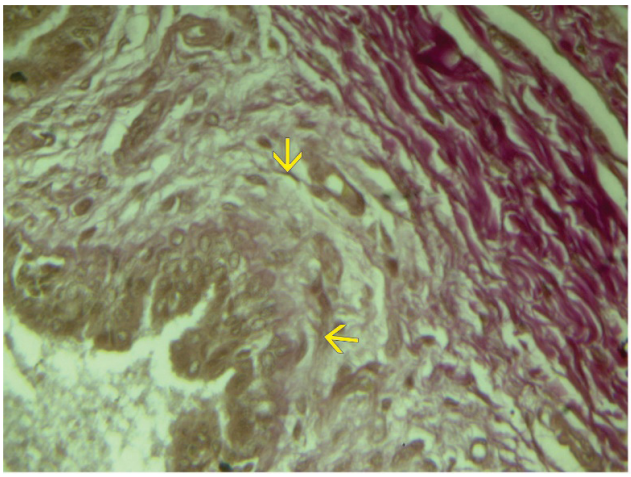

Fig.5: Photomicrograph of elastic fibers present in teat cistern at early lactating stagein Kosali cow (Verhoeffss 400X).

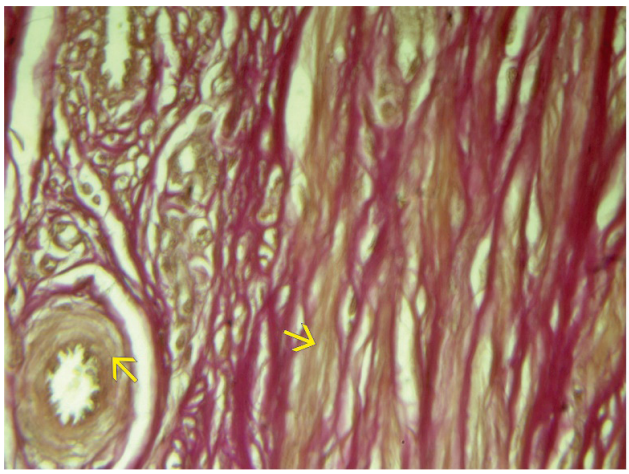

Fig.6: Photomicrograph of elastic fibers present in teat canal at mid non-lactatingstaage in Kosali cow (Verhoeff's, 400X).

rosette and teat canal were positive for PAS reactive substance in both the groups, reaction was comparatively weak in non-lactating group (Fig. 9, 10). These could be attributed to relatively large amount of glycogen in lactating gland due to active functional status of mammary gland to synthesize lactose, protein and lipid content of milk in lactating Kosali cows. Similar justification was provided by Peterson *et al.* (1941). The PAS activity became weak with advancement of lactation from early lactating stage to late lactating stage, it might be due to decrease milk synthesis and relatively low lactose content. PAS positivity was recorded in smooth muscles of interalveolar connective tissue in the teat cistern and Furstenberg's rosette regions in lactating and non-lactating stage and was moderate and mild, respectively. The intense PAS reaction was seen in teat canal region as compared to teat cistern and Furstenberg's rosette because of presence of keratin plug required for teat closure.

AB-PAS Positive Substances

Intense to moderate AB-PAS activity was seen in the inner mucosal epithelium, basement membrane of epithelium, connective tissue core, tunica media of blood vessels and lucidum of teat cistern, Furstenberg's rosette and teat canal of lactating cows, whereas mild to moderate reaction was noticed in non-lactating stage (Fig. 11, 12). These observations were in corroboration with the findings of Naik *et al.* (2015) in cows. The higher concentration of acid mucopolysaccharides in the epithelium and connective tissue in lactating stage may be attributed to the high energy requirement for cellular differentiation. AB-PAS activity was also seen in smooth muscles of alveoli of lamina propria in the teat cistern and Furstenberg's rosette regions of both groups. The strongest AB-PAS activity was noticed in early lactating Kosali cows as compared to mid and late lactating cows due to its functional milking physiology. In teat canal region, strongest AB-PAS

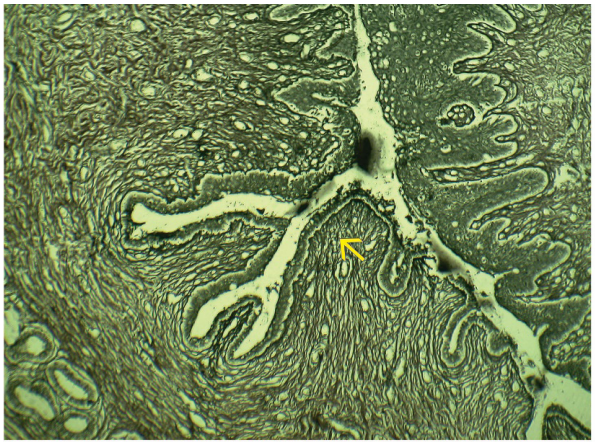

Fig.7: Photomicrograph of reticular fibers present in rosette of Furstenberg at mid non-lactating stage in Kosali cow (Gomori's100X).

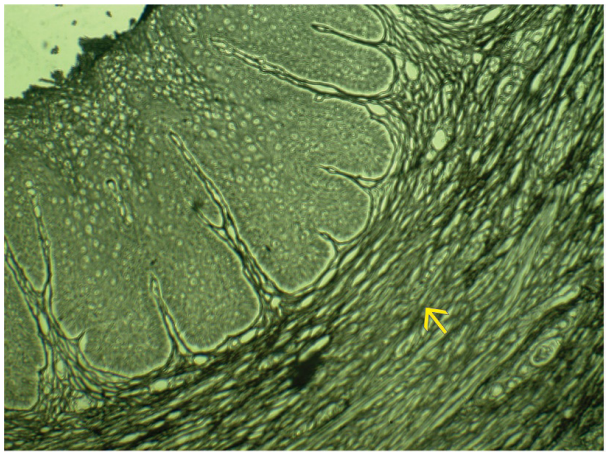

Fig.8: Photomicrograph of reticular fibers present in teat canal at late lactating stage in Kosali cow (Gomori's 100X).

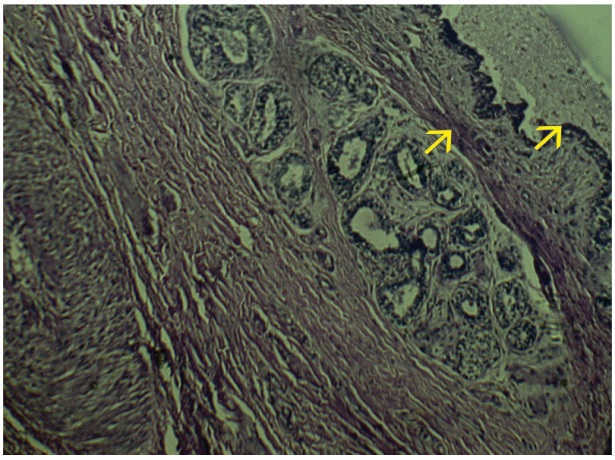

Fig.9: Photomicrograph of PAS activity seen in teat cistern at early lactating stage in Kosali cow (PAS, 100X).

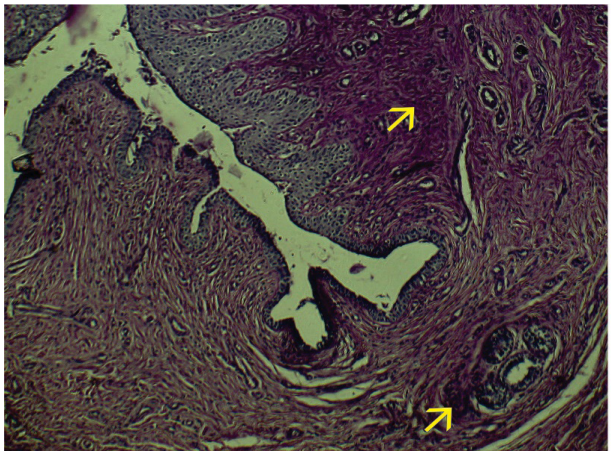

Fig.10: Photomicrograph of PAS activity seen in rosette OT Furstenberg atmid non-lactating stage in Kosali cow (PAS, 100X).

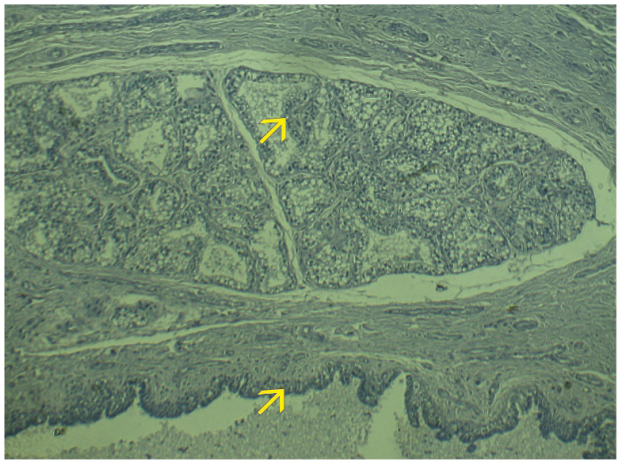

Fig.11: Photomicrographof.B-PAS activity seen in teat cistern of Furstenbergatmid actating stage in Kosali cow (AB-PAS, 100X).

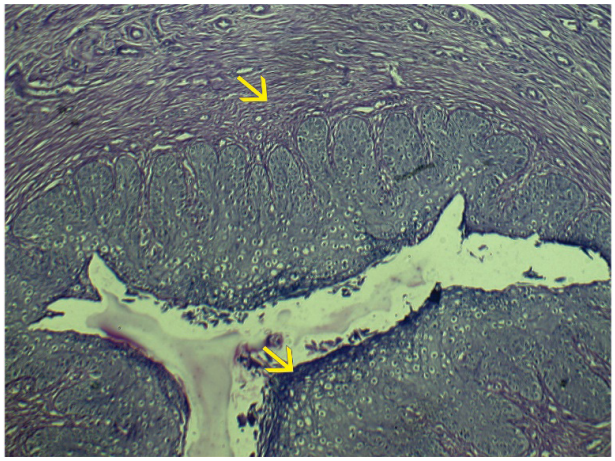

Fig.12: Photomicrograph of AB-PAS activity seen in rosette of Furstenberg al late non-lactating stage in Kosali cow (AB-PAS, 100X).

reaction was noticed as compared to other part of teat in both the groups, which controlled the opening and closing of teat canal. These findings were confirmed by Singh and Roy (2006) in buffalo.

Conclusion

The collagen, elastic and reticular fibers were more compact and denser as well as PAS and AB-PAS activity became weak in non-lactating/non-pregnant Kosali cows compared to lactating cows, due to decrease milk synthesis and involution process. The collagen, elastic and reticular fibers were rich in teat canal region as well as strongest PAS and AB-PAS reaction was also noticed in this region followed by Furstenberg's rosette and teat cistern regions. It might be due to tight closure of teat canal before and after the milking.

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Announcement - I

XII Annual Convention and International Conference of SVSBT-2025

XII Annual Convention of the Society for Veterinary Sciences & Biotechnology (SVSBT) and International Conference on "Bridging Science and Society: Biotechnology for Sustainable One Health" will be organized by College of Veterinary Sciences, LUVAS, Hisar-125004, Haryana, India, during 3rd to 5th December, 2025. The detailed Brochure cum Final Announcement showing Theme Areas / Sessions, Registration Fee, Bank Details for online payment and deadlines, etc. has been floated on the **society's website: https://www.svsbt.com/conference/registration.php** and also on the Whatsapp group and e-mails. The organizing committee invites abstracts of original and quality research work on theme areas of any of the eight technical sessions of seminar limited to 250-300 words for oral and poster presentations through conference website: https:www.svsbt.com//conference/ on or before 30th October, 2025 or, by e-mail to: svsbt2025@gmail.com for inclusion in the Souvenir cum Compendium to be published on the occasion.

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