Histological Study of the Teat of Sarabi Cattle

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Keywords: Cattle, Histology, Sarabi, Teat

Introduction
Sarabi cattle are found in Iran and Azerbaijan. Individuals of this breed are typically red. They are used for both dairy and meat production. The average milk yield in this breed is 10 kilograms daily with an approximately 4.5% fat. Also production up to 20 kg. daily is seen individually. Mastitis is one of the major problems in dairy herds all over the world. The teat especially teat conformation, the teat orifice morphology and teat canal connective tissue is considered to be one of the important parts of the cow’s defense mechanisms against IMI. So a close study of the teats can be very useful to realize the physiology and pathology of mammary gland. For the first time in Iran, histology of the teat of Sarabi Cattle was performed in this study.

Materials and Methods
In order to histological study of the teat of Sarabi cattle, five adult and healthy cows were selected and after slaughtering, tissue samples were taken from different parts of the teat. After fixation in 10% formalin, they were transfered into the tissue processor. Paraffin blocks were made and thin sections of 6 µ, were cut. The sections were subjected to stain by Hematoxylin and Eosin. They were studied under the light microscope and photo micrographs were taken.

Results and Discussion
Each quarter has a separate teat with 7-8 cm length and 3 cm diameter. The teats vary in shape from cylindrical to conical. The results show that the teat consists of teat sinus, teat wall, teat canal and teat orifice.

Teat wall includes three separable strata: skin, middle layer and mucosal layer. *Teat skin* contains an epidermis and dermis, but there is no evidence of hypodermis existence in contrast with the other parts of the body. Epidermis consists of keratinized stratified squamous epithelium and the thickness increases towards the teat orifice (Fig. 1). Dermis is formed from networks of collagen fibers, blood vessels, circular smooth muscle and nerve fibers (Fig. 2). Dermal papillae projects into the epithelial undulations at the dermoeipidermal junction (Fig. 1). Meissner’s corpuscles are found in the dermal papillae particularly in the connective tissue of teat canal (Fig. 2). Myelinated nerve fibers are also seen in this region (Fig. 3).

*Middle layer* (Second layer) is the thickest layer of the teat wall that contains numerous smooth muscle bundles, developed vascular plexus and peripheral nerve fibers (Fig. 4). A subdivision of the middle layer is sometimes made. Middle portion of the middle layer has a higher density of the smooth muscle and lower density of the collagen fibers compared to the superficial and deep portion. Middle portion also contains many veins. High density circular smooth muscle can also be seen in the middle layer surrounding teat canal that is oriented parallel to the long axis of teat near the teat canal epithelium. *Mucosal layer* is the innermost layer of the teat wall. Teat sinus is lined with stratified cuboidal epithelium continues to the cornified stratified squamous epithelium in the teat canal. Teat canal epithelium was thicker than teat skin epithelium (150 vs 110 µ) with a remarkable increase in keratin and stratum granulosum.

The teat cistern is lined with numerous longitudinal and circular folds in the mucosa which tend to overlap and turn to the oblique folds, when the milk fills teat cistern. Thus, teat cistern can hold 15-40 ml of milk in different breeds (6, 12).

A series of longitudinal folds known as Furstenburg’s Rosette is located just above the teat canal, where the stratified squamous epithelium of the teat canal changes to stratified cuboidal epithelium of the teat cistern. The teat canal is composed of 5 to 7 cornified epithelial projections that form a star-shaped slit. An involuntary sphincter muscle serves to constrict the opening, thereby, inhibiting entry of microorganisms and also preventing leakage of milk from the mammary gland. Increase in the thickness of teat canal epithelium, as well as notable increase in the keratin contents in this area compared to the teat skin epithelium, shows the more protective role of teat canal. It is reported that the outermost layer of the teat skin is composed of keratin cells that contains sulfated proteins and prevents bacterial growth (9).

A well developed vascular system observed in the middle layer especially in the distal portion of the teat indicates the higher blood flow in this region. There is no difference in histological structure of teat vessels among cattle breeds and variations are limited to size, location and number of vessels, especially in veins (2, 5).

Numerous sensory nerve fibers in the middle layer conduct impulses to the CNS and oxytocin is released from neurohypophysis. It was indicated that
there are mechanical receptors in the teat of rabbits (8, 11). As well, histochemical techniques show that middle layer of the teat includes high amounts of glycoproteins in the matrix of connective tissue, particularly in the distal portion of the teat (3). Glycoproteins in the connective tissue cause cells to be attached tightly. Thus, teat canal connective tissue prevents the distribution of the microorganisms that pass the epithelium (10).

In the distal portion of the teat, there is a high density of circular smooth muscle surrounding the teat canal. It was indicated that the aggregation of muscular tissue in this area in heifers is less than the delivered cows (12).

References

Figure 1: Teat skin. H&E × 400
1. Stratum basale
2. Stratum spinosum
3. Stratum granulosum
4. Stratum lucidum
5. Stratum corneum

Figure 2: Teat dermis. H&E × 100
Arrows: Blood vessels

Figure 3: Dermal papillae. H&E × 400
Arrow: Meissner’s corpuscle

Figure 4: Middle layer. H&E × 400
Arrow: Peripheral nerves