Mammary Gland Histological Structure in Relation with Milk Production in Sheep

Mirela Cadar, Vioara Mireşan, Augusta Lujerdean, Camelia Răducu

Faculty of Animal Science and Biotechnologies Cluj-Napoca, 400372-Cluj-Napoca, Mănăştur, 3-5, Romania

Abstract
There were collected samples of mammary gland tissue from Ţurcana breed sheep, nearly aged, in lactation stage and with similar mammary gland volume/conformation. By histological and stereological evaluation were determined the relative areas of glandular parenchyma (mammary alveoli, excretion canaliculli system) and stroma (connective tissue, blood vessels, nerves). Before histological sample collecting was determined the average milk production resulted from three successive milking days.
The results revealed positive correlations between average milk production and glandular parenchyma area and negative correlations between average milk production and connective stroma area from mammary gland.

Keywords: histology, mammary gland, milk production, Ţurcana breed sheep

1. Introduction

The mammary gland development during all stages is influenced by some factors, which certainly are the endocrine hormones that interact with the different growth factors and the epithelial and mesenchymal constituents [1].
For lactation, the final stage involves the functional differentiation process during pregnancy-associated lobuloalveolar development, followed by involution when nursing or milking ceases [1].
It was observed that the pattern of mammary gland organogenesis is similar in rodents, ruminants and humans [2].
During selection action, to increase the milk production in ovine, were followed certain appreciation criteria, which regard especially the relation between mammary gland morphostructure and its productive capacity [3].
Until present, the investigations proved that for milk production the valuable performances could be also correlated with some mammary gland anatomic particularities such as conformation, volume, vascularization etc. [3, 4].
The aim of this study was to estimate, with a technique described by us in a previous work paper [5], the possible correlation between the quantity of connective stroma and that one of mammary gland parenchyma and the milk production in some sheep of Ţurcana breed.

2. Materials and methods

The study was done on 10 sheep of Ţurcana breed, in the 3rd and 4th lactation, in good state of health, bred in a private farmstead from Sibiu County. Also, was determined the average milk production from three successive milking days on each lactation and sheep.
The collection of mammary gland tissue was done by assisted surgical biopsy, after registering each milk production per sheep and milking day. The samples' collection does not let unwelcome secondary effects on animals and does not put in danger their life or health.
The fresh collected biological samples were fixed in 10% formaldehyde *pH* 7, then were included in

*Corresponding author: Cadar Mirela,
Email: mirela.cadar@usamvcluj.ro

paraffin and sectioned, and finally stained with Masson method Goldner variant [6].
The microscopic preparations were evaluated with *"target method*" using the Zeiss-Opton integration eyepiece.
From each biological sample were obtained six sections, which were microscopically evaluated using an integration network with 100 targets uniformly dispersed and superimposed on the mammary gland section images. On each section were evaluated ten microscopic fields and on each microscopic field were counted the targets that covered the structural components of mammary gland [7].
Finally, we used only the average values to calculate the relative areas of mammary glandular parenchyma (secretory alveoli and excretion canaliculli system) and stroma (connective-vascular-nervous tissue).

3. Results and discussion

The microscopic examination reveals in all samples an evident glandular lobulation due to relatively thin connective walls.
The mammary alveoli, because of reciprocal compression, appear of polygonal shape. They have non-homogenous aspect because some of them contain large alveoli filled with secretion, and other adjacent ones contain small alveoli with almost drained lumen.
This alternation of the functional stage is basis of a continuous and constant milk secretion assurance [8, 9].
The size, shape and aspect of mammary alveoli cells also depend on the secretory cycle [10]. Thus, the secretory cells, from evicted alveoli, are prismatic, with colorless intercellular limits and large euchromatic nucleus with sizable nucleoulus.
The sub-nuclear cytoplasma is intense basophilic and forms small rounded prominences to apical pole. In rest of cytoplasma there are numerous small and clear vacuoles, which became smaller and smaller towards the apical pole determining the mentioned apical prominences.
It is about the vesicles with lipid secretion product, whose content was dissolved by the organic solvents used for inclusion and staining. Alongside these vesicles, the cellular apical pole is filled with a granular material extremely fine, basophilic, certainly represented by secretion granules with protein content.
These cytological aspects put into evidence the apocrine mechanism of secretion in mammary gland admitted by the majority of authors [10, 4].
The alveolar content is acidophilic, granular, filled with clear vesicles, similar to those ones described in alveolar cells, as well as with cellular nuclei (of alveolar cells and lymphocytes) in different karyolysis stages.
In sizable alveoli, filled with secretion product, the alveolar cells appear low, with flattened nucleus.
The apical pole is lacked of cytoplasmic prominences, and the secretion vesicles are small and few as number. Between these extreme situations we observed transition phases.
In all mammary alveoli we observed an equal number of nuclei, which seems to belong to myoepithelial cells, by their location between basal lamina and secretory epithelium.
It is unanimously accepted their role in the milk ejection, their endocrine conditionality and their proliferation during lactation [11, 12].
The connective-vascular-nervous stroma is present as interlobular septum, and especially as fine perialveolar walls, formed by a network of collagen fibers.
The cellular population is numerous being represented by fibroblasts, histio-macrophages and many lymphocytes and plasmocytes. It is admitted their relation with IgA presence in the milk [13, 1].
The blood vascular-capillary network reaches an imposing development. The process is done under endocrine induction [14, 1] and ensures the blood irrigation of the organ during lactation.
In cow, the blood irrigation of mammary gland was estimated at 400 liters of blood in 24 hours for secretion of one liter of milk [15].
Marinescu I. [3] observed in the cows in lactation that percentage ratio between parenchyma and stroma was decided for the first one (80%), and inside connective stroma the vascularization occupied the largest area.
From our analysis of stereological determinations (Figure 1) comes out a constant correlation between the milk average quantity obtained after three milking days and the stroma - parenchyma proportion, which means that milk average production was directly proportional with relative area of mammary gland parenchyma.

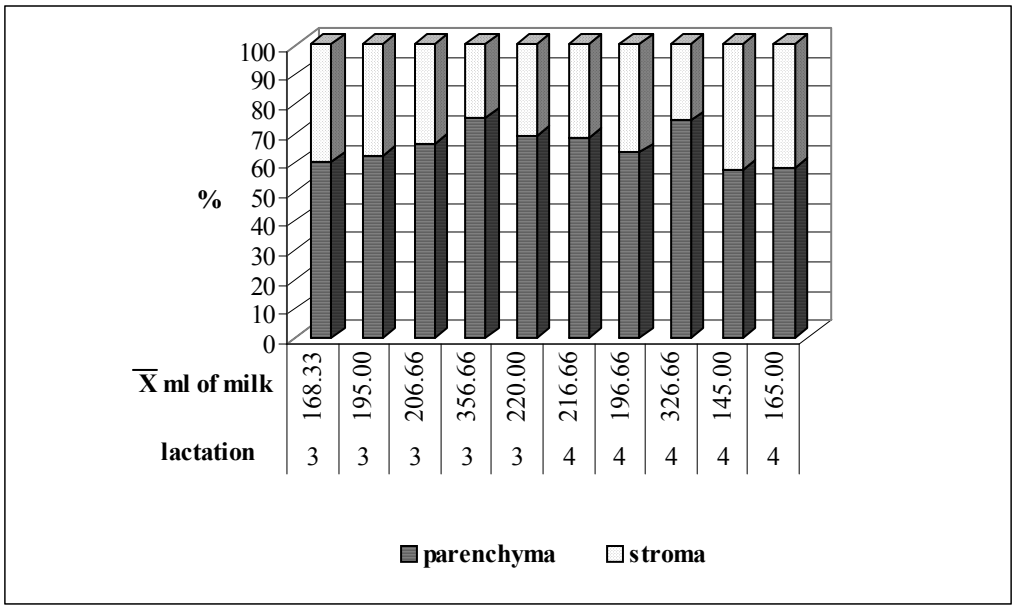

Figure 1. Microscopic evaluation of mammary gland structure depending on individuals, lactation and milk average quantity from 3 milking days in Ţurcana breed sheep

4. Conclusions

Our obtained data suggest the use possibility of mammary gland biopsy followed by the stereological analysis of biological samples as part of improvement process by selection in ruminants.

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