

Scanning electron microscopy of chemical elements of goat milk associated with lactose in goats induced subclinical mastitis by *Staphylococcus warneri*

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Milk is a complex aqueous mixture containing a variety of solid constituents, notably minerals, lipids, carbohydrates, proteins, and more recently, its rich microbiota. The composition of milk's chemical constituents can vary due to diverse sources and may be influenced by the health status of the animals. Lactose, a predominant carbohydrate in milk, can serve as an indicator of bacterial activity through its degradation. Mastitis, characterized as an intramammary infection (IMI), significantly affects the milk composition of goats and various other mammals and is primarily caused by bacterial pathogens. In goats, Coagulase-Negative Staphylococci (CNS), including *Staphylococcus warneri*, are among the agents commonly implicated in IMI. This study aimed to investigate the effects of induced IMI by *S. warneri* on the chemical composition of milk, focusing on the concentrations of selected elements and lactose. The concentrations of the chemical elements were assessed using energy dispersion spectroscopy (EDS) with a Scanning Electron Microscope Leo 1430VP. Ten chemical elements (Na - Sodium, Mg - Magnesium, P - Phosphorus, Cl - Chlorine, K - Potassium, Ca - Calcium, Fe - Iron, Cu - Copper, Zn - Zinc, and Mo - Molybdenum), along with CNO (Carbon, Nitrogen, and Oxygen), were quantified in terms of intensities (counts/second). Lactose levels were determined by Fourier-transform infrared (IR) spectroscopy. Eight primiparous Parda Alpina goats were used in this study. IMI was induced in six animals by inoculating the right teat (RT) of the udder, with two animals serving as controls. Among the control goats, one received saline solution inoculation in the RT and the other remained unaltered. The study periods encompassed phases of infection induction: Period - P0 (two days before inoculation) and Period - P8 (seven days after infection). Statistical analyses were performed using the GraphPad Prism V10 software. In control animals, Cu, Zn, and Mo exhibited no significant differences, whereas Ca and CNO displayed noteworthy alterations. Conversely, all elements showed significant variation in the infected group, with the exception of Fe. The lactose levels remained consistent across the evaluated samples. The observed fluctuations in Cu, Zn, and Mo levels during IMI underscore their nutritional and microbiological significance in the context of *S. warneri* infection, in contrast to the absence of lactose variation.

Key words: Bacteria; MEV; Milk.

Microscopia eletrônica de varredura de elementos químicos do leite caprino associados a lactose em cabras induzidas a mastite subclínica por *Staphylococcus warneri*

O leite é uma combinação de diversos elementos sólidos em água, sendo a lactose um dos principais carboidratos. Os componentes químicos no leite podem ter diferentes fontes e serem alterados por estados clínicos diferentes dos animais. O objetivo deste trabalho foi investigar os efeitos da indução da infecção intramamária por *S. warneri* em elementos químicos e na concentração da lactose do leite. A lactose mensurada não apresentou diferença. As flutuações significativas de cobre, zinco e molibdênio demonstram ter um papel fundamental na infecção, e ausência de alterações da lactose indica que ela não tem papel importante nesse estado do animal.

Palavras-chave: Bactérias; MEV; Leite.

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