Variations in milk lactose content and the mechanisms underlying in dairy cows

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Lactose has not often been the subject of specific research as it is rarely included in milk payment systems. However, milk lactose content has been proposed as a potential indicator of udder health and metabolic disorders in dairy cows. Since this data is easy and quick to collect in dairy farms at a large scale and at a moderate price (MIR analysis), it is of interest to better understand its variations in milk to use it as an indicator. Lactose is synthesized from blood glucose in the mammary epithelial cells. It is the main osmotic agent in milk and determines the amount of water transferred from the blood compartment into the mammary tissue lumen. Thus, its synthesis and secretion largely explain the volume of milk produced by the animals and, for this reason, its content in milk varies little compared with milk fat and protein contents. The lactose content in milk is the result of 3 main mechanisms: 1) the regulation of the metabolic activity of the mammary gland for the synthesis of milk constituents, mainly based on the quantity of glucose taken up by the udder and its partition between the intra-cellular metabolic pathways, 2) the regulation of the osmotic pressure of milk related to the relative concentration of the different osmotic agents in milk (lactose, Na+, K+, Cl-, proteins, citrate), and 3) the integrity of the mammary epithelium which, if altered, is accompanied by passive transfers of soluble molecules (lactose, minerals) between the alveolar lumen of the udder and the blood (and vice versa). The aim of this review will be to discuss the mechanisms underlying variations in milk lactose content regarding variations reported in commercial dairy farms in West of France and Canada. In particular, it will highlight the interactions between the factors of variation, whether these factors are intrinsic or extrinsic to the animals in relation to the rearing conditions (feeding, milking, and health).

Key words: milk lactose content, variations, mechanisms, dairy cow

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