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Characterizing the mammary epithelial cell exfoliation process during milking in dairy cows

L. Herve[12], V. Lollivier[12], P. Lamberton[12], S. Wiart[12], S. Philau[12], H. Quesnel[12], M. Boutinaud[12]
[1]*INRA, UMR1348 PEGASE, F 35590 Saint-Gilles, France*
[2]*Agrocampus Ouest, UMR1348 PEGASE, F 35000 Rennes, France*

The presence of mammary epithelial cells (MEC) in milk indicates that some MEC are shed from the mammary epithelium. The MEC exfoliation process in dairy cows likely participates in the regulation of MEC number in the udder and thus in milk yield variations. The mechanisms that regulate the exfoliation process are not known. However, we can hypothesize that milking, through its mechanical pressure on the mammary epithelium, is a special time for exfoliation of the MEC. In order to characterize MEC exfoliation during milking, 9 multiparous cows were milked and milk samples were collected each minute for composition analysis. The samples collected at the beginning (after 1 and 2 min), in the middle and at the end of milking were used for MEC purification using an immune-magnetic method. Tight junction opening was assessed by plasma lactose concentration and Na:K ratio in milk. Data were analyzed using the mixed procedure of SAS. Milk flow increased until the 3rd minute and then decreased as the milking progressed ($P<0.001$). Milk composition changed during the course of milking: the milk fat content increased ($P<0.001$) while the milk protein content decreased ($P<0.001$). At the end of milking, the somatic cell count increased ($P<0.001$) whereas the percentage of MEC in total somatic cells decreased ($P<0.05$), suggesting an influx of immune cells. The concentration of MEC in milk decreased between the 1st and the 2nd minute of milking suggesting that the milk of the 1st minute of milking contained MEC which were exfoliated before milking started. The milk MEC concentration then increased from the 2nd minute to the end of milking. A decrease in the Na:K ratio in milk ($P<0.01$) and an increase in plasma lactose concentration ($P<0.01$) during milking indicated a disruption of mammary epithelium integrity. The results of this study show that MEC are exfoliated before milking but also during milking. The exfoliation process during milking is concomitant with the disruption of mammary epithelium integrity.