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Myoepithelial cell contraction participates in mammary epithelial cell exfoliation in cow milk

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A varying proportion of mammary epithelial cells (MEC) is exfoliated through shedding from the mammary epithelium into milk, which might influence MEC number in the udder and thus milk yield. We hypothesized that myoepithelial cell contraction induced by oxytocin (OT) release at milking might stimulate MEC exfoliation through mechanical forces. Therefore, to investigate the role of myoepithelial cell contraction in MEC exfoliation, we inhibited or induced myoepithelial cell contraction by injecting the OT receptor antagonist Atosiban (Ato) or exogenous OT, respectively. Eight multiparous cows were assigned to 2 treatments during 2 milkings according to a crossover experimental design of 2 periods: 1) Control + OT and 2) Ato + OT. For the Control + OT treatment, cows were first milked to recover standard milk and then received an i.v. injection of OT (5 IU) to collect residual milk through a second milking. For the Ato + OT treatment, cows were injected with Ato (50 µg/kg of BW), milked to recover the cisternal milk, and then received 5 IU of OT before a milking to collect the alveolar milk. For each type of collected milk, MEC were purified using an immuno-magnetic method and the percentage of apoptotic MEC was assessed by flow cytometry. Tight junction opening was assessed by plasma lactose concentration determination. Data were analyzed using an ANOVA procedure. Inhibiting myoepithelial cell contraction by Ato injection induced a decrease in MEC number in milk ($P < 0.01$). In contrast, OT injection after standard milking increased the concentration of MEC in milk ($P < 0.05$) and decreased the percentage of apoptotic MEC in milk ($P < 0.01$) while OT injection during Ato + OT treatment increased the number of MEC in milk ($P < 0.01$). During the milking after the Ato injection, plasma lactose concentration was on average lower than during standard milking whereas in both treatments, OT injections increased the lactose concentration in plasma ($P < 0.001$). These results together showed that myoepithelial cell contraction associated with a loss of mammary epithelium integrity stimulates MEC exfoliation into milk.