β-Carotene Transfer into Colostrum in Cows: Evidence of Temporary Increase in Low-Density Lipoprotein Receptors in Mammary Gland During Formation of Colostrum

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In cattle, owing to the type of placentation, the transfer of immunoglobulins and other substances from dam to calf via colostrum is of the utmost importance to the health of the newborn. Although specific receptors have been postulated for the transfer of immunoglobulins, the transfer mechanism of lipophilic substances, such as vitamin A and E, β-carotene, and cholesterol to colostrum, is still unknown.

The concentration of β-carotene in serum and colostrum and the distribution of β-carotene in the lipoprotein fractions were investigated in 12 cows near parturition. Both β-carotene and vitamin A concentrations in maternal serum began to drop 2 or 3 weeks before parturition, reaching a minimum at parturition. Three to four weeks were required before the concentrations of both substances returned to their former levels. In colostrum, concentrations of β-carotene and vitamin A were 14 and eight times higher than in milk, respectively. Normal milk values were reached after less than 1 week.

In the dry season the relative concentration of β-carotene in very low density lipoproteins (VLDL) and low-density lipoproteins (LDL) increased significantly, reaching 1% and 15% of serum concentration, respectively. β-Carotene concentration in VLDL remained at this elevated level until the first milking and then dropped abruptly to normal lactation values (0.2%). In contrast, the relative concentration of β-carotene in LDL began to decline 2 to 3 weeks before parturition, reaching its minimum (5%) at parturition. Normal lactation values (13%) were reached within 4 weeks. Similar conditions prevailed for cholesterol and protein in the lipoprotein fractions. This
decrease in LDL shows that in cows the transfer into colostrum of lipophilic substances, such as cholesterol and β-carotene in blood occurs through an LDL-specific receptor system, similar to the mechanism postulated for immunoglobulins. This is the first evidence that the mammary gland might possess LDL receptors and that their number is increased around the time of parturition, probably by the action of steroids.