Vitamin K₁ in Fetus and Human Milk

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Using high-performance liquid chromatography for determination of serum vitamin K₁ concentration, we carried out a series of investigations to determine some factors involved in possible vitamin K deficiency in the newborn infant.

Arterial and cord blood were first studied in 34 white healthy mothers and in their newborns, respectively. In 27 mothers, serum vitamin K₁ was (mean ± 1 SD) 9.03 ± 4.9 µg/liter versus 10.4 ± 5.3 µg/liter in cord blood. Six mothers exhibited high vitamin K concentrations (40-240 µg/liter) and these were also high in cord blood (40-240 µg/liter). One mother had a normal concentration (9 µg/liter), but vitamin K was not detectable in the cord blood of the fetus, who had low activity of factors II and VII + X. Thus, vitamin K seems to cross the placenta but not in every case. Further investigations are in progress in African mothers and their fetuses.

Placental transfer of vitamin K was investigated in 40 rats. After oral administration of 5 mg/kg vitamin K₁ to 20-day pregnant rats, peak plasma vitamin K₁ concentration was detected at 1 hr in the mother and 6 hr later in the plasma of the fetus. In pregnant rat liver the corresponding peak was at 4 hr after injection and at 8 hr in fetal liver. These data suggest that fetal transfer of vitamin K is delayed in rats, a finding in keeping with similar results by Wefring in humans (J Pediatr 1962;61:686).

Vitamin K₁ was measured sequentially in the milk of 10 lactating women. The median (and range) of concentration was 5.19 µg/liter (3.07-10.8) in colostrum at day 3, 8.9 µg/liter (6.35-15.7) in transitional milk at day 8 and 9.18 (4.85-12.76) in mature milk: the increase was significant at day 8 (p < 0.05). The concentrations were lower than in cow’s milk: 19.9 (7.46-36.8). In human milk, there was a significant negative correlation between vitamin K and cholesterol concentrations. These data show that colostrum provides low amounts of vitamin K₁; its concentration in milk seems to be related to the size of the fat globules. Since about 30% of vitamin K seems to be
absorbed by the neonatal intestine, human milk does not provide the required amount of vitamin $K_1$.

In conclusion, the transfer of vitamin $K_1$ to the fetus or neonate takes place through the placenta to breast milk; however, these processes are limited either by a delay in the placental transfer or by milk secretion. Consequently, these results suggest that neonates should be supplemented with vitamin $K_1$ to avoid the occurrence of hemorrhagic complications.