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ORIGINAL ARTICLE

Retinol and Alpha-tocopherol in the Colostrum of Lactating Tunisian Women Delivering Prematurely: Associations with Maternal Characteristics

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Key Words
colostrum;
preeclampsia;
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Background: This study aims to assess vitamin A and E concentrations in the premature colostrum of lactating Tunisian women and to identify maternal characteristics that may affect these concentrations.
Methods: Human colostrum was obtained from 105 mothers who gave birth prematurely in the Centre for Maternity and Neonatology of Tunis (Tunisia). Retinol and alpha-tocopherol were analyzed in the colostrum and in plasma by high-performance liquid chromatography.
Results: Retinol and alpha-tocopherol concentrations were 57.5 ± 50.1 μg/dL and 1222 ± 772 μg/dL in the colostrum, respectively, and 51.7 ± 20.0 μg/dL and 1351 ± 772 μg/dL in plasma, respectively. Concentrations of each vitamin in the colostrum were positively correlated with their respective concentrations in plasma ($r = 0.415$, $p = 0.001$ for retinol and $r = 0.392$, $p = 0.003$ for alpha-tocopherol). In multivariate analysis, colostrum vitamin A was associated with plasma vitamin A and preeclampsia, while colostrum vitamin E was associated with plasma vitamin E, gestational age, and preeclampsia.
Conclusion: In Tunisian women, colostrum vitamin A and E levels are close to the average values reported in the literature. The levels are too low to cover the needs of very low birth weight (VLBW) infants, particularly in women with plasma vitamin deficiencies, preeclampsia, or very premature delivery. Given the undeniable beneficial effects of human colostrum,

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whenever feasible, VLBW infants should be fed colostrum. Infant vitamin A and E requirements should be met by milk fortification or supplementation.

1. Introduction

Retinol and alpha-tocopherol are the most important forms of vitamins A and E. These fat-soluble vitamins are vital nutrients for the growing newborn.[1] Very low birth weight (VLBW) infants usually have low plasma and store levels of vitamin A and E.[2,3] Given that they are exposed to a high risk of infection and oxygen exposure, VLBW infants should receive ample doses of these vitamins to stimulate their immune systems and protect them from oxygen toxicity. Human milk is considered the ideal feeding choice for preterm infants,[4] however, it does not contain enough fat-soluble vitamins to meet the needs of VLBW infants.[5–7] Thus, recommendations have been made to supply these infants with fat-soluble vitamins from preterm formula or parental nutrition.[8,9] The quality of breast milk and its vitamin content may vary according to lactation stage. Colostrum, the milk secreted in the first few days following delivery, contains a larger percentage of fat-soluble vitamins than mature milk.[10–13] Breast milk composition also varies according to the term of birth. Preterm milk may be more apt to meet the nutritional requirements of premature infants than term milk.[14,15] The nutrition of preterm infants fed milk from their own mothers result in better growth and nutritional status, including levels of vitamins A and E, compared with nutrition observed in infants fed formula.[16,17] Finally, breast milk composition may be affected by maternal characteristics, such as age, parity, dietary intake, and perhaps gestational diseases.[18–20] To test how the premature colostrum covers the needs of vitamins A and E in VLBW infants, we assessed retinol and alpha-tocopherol in colostrum from lactating women who gave birth prematurely. We also tested the effects of some maternal characteristics that may influence colostrum vitamin A and E content.

2. Methods

2.1. Participants and sample collection

The study included 105 Tunisian lactating women who delivered prematurely (from 28 weeks to 37 weeks of gestation). The women included were mothers of VLBW infants (birth weight $<$ 1500 g and gestational age $<$ 37 weeks) who were hospitalized in the service of Neonatology at the Centre of Maternity and Neonatology of Tunis, Tunisia. The Centre is an inner-city tertiary-care hospital that caters mainly to the needs of a socioeconomically compromised population. Lactating mothers with chronic and acute diseases and those using supplements containing vitamin A or E during pregnancy were excluded. Fresh human colostrum was obtained from lactating mothers between the 2nd day and 7th day postpartum. The mothers expressed one breast in total with a manual breast pump and the colostrum was collected in a sterile glass vial. One milliliter of mixed colostrum was recuperated for the needs of the study, with the remaining portion fed to the infant (whenever possible). In parallel, fasting blood samples from 57 women were collected into tubes containing ethylenediaminetetraacetic acid. Samples were protected from light and transported on ice to the laboratory within 2 hours of collection. Blood samples were centrifuged at 1500*g*, and plasma and colostrum samples stored at -80°C until analysis (within 6 months). Relevant information was collected from the mothers and their medical records, including maternal age, medical and obstetrical history, course of current pregnancy and term, and mode of delivery. Preeclampsia and gestational diabetes are defined according to the American College of Obstetricians and Gynecologists criteria.[21,22] All included mothers had been consuming habitual Tunisian food during pregnancy and none had adopted special diets or had received vitamin A or E supplements. The study protocol was approved by the Ethics Committee of the Maternity Center and informed consent was obtained from each woman.

2.2. Analytical methods

Retinol and alpha-tocopherol were assessed using reverse-phase high-performance liquid chromatography to analyze the colostrum and plasma according to the method described by Driskell et al.[23] Colostrum samples were saponified in ethanolic potassium hydroxide. Colostrum or plasma samples were deproteinized in the presence of ethanol containing butylated hydroxytoluene as an antioxidant and retinol acetate as an internal standard. After extraction with hexane and evaporation under nitrogen, residues were dissolved in ethanol and injected onto a C18 reverse-phase column (Shimpack ODS-M, Shimadzu, Kyoto, Japan). The mobile phase consisted of a methanol gradient (Merck, Darmstadt, Germany) at a flow rate of 1.5 mL/min, and vitamins were detected at 290 nm. The sensitivity was 5 μg/dL for retinol and 50 μg/dL for alpha-tocopherol. The long-term (n = 30) imprecisions (CVs) were 6.1% and 5.6% at concentrations of 47 μg/dL and 360 μg/dL and 5.8% and 5.1% at concentrations of 1145 μg/dL and 1445 μg/dL for retinol and alpha-tocopherol, respectively.

2.3. Statistical analysis

Statistical computations were performed using SPSS version 15.0 for Windows (SPSS Inc., Chicago, IL, USA). The data of continuous variables were examined for normality using the Kolmogrov-Smirnov test. Continuous variables were