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ORIGINAL ARTICLE

Evaluation of human milk titratable acidity before and after addition of a nutritional supplement for preterm newborns☆,☆☆

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Abstract
Objective: To evaluate the initial Dornic acidity in raw human milk, after pasteurization and after heating and dilution of a dietary supplement for preterm infants.
Methods: A quantitative, descriptive, and experimental study was carried out with a convenience sample at the human milk bank at a Brazilian public maternity, with specialized care for pregnant women and newborns at risk. The eligibility criteria for the study sample included 93 frozen raw human milk in suitable containers with volumes ≥100 mL and initial Dornic acidity ≤8° Dornic (°D). Milk acidity of human milk was measured in four stages: in raw human milk (initial); after pasteurization; after the heating of pasteurized milk and dilution of the supplement; and after thirty minutes of supplementation.
Results: The initial acidity was 3.8° D ± 1.3 (95% CI: 3.56–4.09) with no significant difference in Dornic acidity in pasteurized milk, which was 3.6° D ± 1.2 (95% CI: 3.36–3.87). The dilution of the supplement in pasteurized milk that was heated significantly increased mean Dornic acidity to 18.6 °D ± 2.2 (95% CI: 18.18–19.11), which remained high after thirty minutes of supplementation at 17.8 °D ± 2.2 (95% CI: 17.36–18.27), considering $p < 0.05$.
Conclusions: The study observed no significant differences in Dornic acidity of raw human milk and pasteurized human milk; however, the dilution of a human milk supplementation caused a significant increase in acidity. Further investigations are necessary on the influence of this finding on the quality of supplemented milk and its consequences on the health of preterm infants.

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PALAVRAS-CHAVE
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Acidez titulável;
Suplementos nutricionais;
Doenças ósseas metabólicas

Avaliação da acidez titulável do leite humano antes e após adição de um suplemento nutricional para recém-nascido pré-termo

Resumo

Objetivo: Avaliar a acidez Dornic inicial no leite humano cru, após pasteurização e após aquecimento e diluição de um suplemento nutricional para recém-nascidos prematuros.

Métodos: Estudo quantitativo, descritivo, experimental com amostragem por conveniência, realizado no Banco de Leite Humano de uma maternidade pública brasileira, com assistência especializada às gestantes e recém-nascidos de risco. Os critérios de elegibilidade das 93 amostras do estudo incluíram leites humanos crus congelados em embalagens apropriadas, com volumes $\geq$ 100 mL e acidez Dornic inicial $\leq$ 8°Dornic (°D). A acidez Dornic dos leites humanos foi mensurada em quatro momentos: no leite humano cru (inicial); após pasteurização; após aquecimento do leite pasteurizado e diluição do suplemento; e após transcorridos trinta minutos de suplementação.

Resultados: A acidez inicial foi de 3,8°D $\pm$ 1,3 (IC 3,56–4,09) não apresentando diferença significativa em relação à acidez Dornic no leite pasteurizado, que foi 3,6°D $\pm$ 1,2 (IC 3,36–3,87). A diluição do suplemento no leite pasteurizado e aquecido aumentou significativamente a média da acidez Dornic a 18,6°D $\pm$ 2,2 (IC 18,18–19,11), a qual se manteve elevada em 17,8°D $\pm$ 2,2 (IC 17,36–18,27) após 30 minutos da diluição, considerando $p < 0,05$.

Conclusões: O estudo demonstrou que a acidez Dornic do leite humano cru e do leite humano pasteurizado não apresentaram diferenças significativas entre si, porém, a diluição do suplemento de leite humano promoveu elevação significativa da acidez. Maiores investigações da influência desse achado sobre a qualidade do leite suplementado e suas consequências na saúde de prematuros são necessárias.

Introduction

The technological advances of the 20th century in the area of Neonatology allowed for the creation of Neonatal Intensive Care Units and favored the survival of preterm and very low birth weight (VLBW) newborns.[1] This reality has imposed several challenges on the care of this population, which requires greater attention in relation to growth, development, and nutrition.[2]

Regarding the dietary aspects, the World Health Organization recommends the use of the mother's own milk also for preterm infants, as in addition to being better tolerated due to its easy digestibility, it also has high nutritional quality and benefits the mother–child binomial through breastfeeding.[3] It also aids the immune protection against infections, sepsis, and necrotizing enterocolitis, favors the preterm infant's mental development,[4] and appears to modulate risk factors for cardiovascular diseases in the long term,[4] constituting a powerful option among the strategies to reduce child mortality.[5]

As for the nutritional composition, the human milk (HM) of a preterm infant's mother initially has a higher concentration of protein, lipids, minerals (such as sodium, calcium and phosphorus), electrolytes, and immunological properties, when compared to the milk of a full-term newborn's mother; but at the end of the first month, these differences decrease, making the milk of a preterm infant's mother resemble that of a full-term infant's.[6,7] With a decrease in the nutritional reserves of preterm infants, in contrast with their high metabolic demands, inadequate nutritional support can lead to adverse and permanent effects on their growth and development.[3]

Therefore, HM supplementation has been indicated to meet the nutritional requirements of this population, and to prevent or treat metabolic bone diseases in these individuals,[3,8] a well-established nutritional practice in neonatology.[9] Among the HM supplements used in Brazil, those based on bovine whey protein hydrolysates, combined with several vitamins and minerals (especially calcium, phosphorus, and potassium), are most commonly used.[10]

In spite of recommendations for supplementation of the preterm mother's own milk, if the nursing mother cannot meet the baby's requirements, the administration of milk from a HM bank (HMB) is proposed.[5,11] In this case, it undergoes strict quality control before distribution, among which is the measurement of Dornic acidity (DA). Variations within the range of 1.0–8.0 Dornic degrees (° D) classify the food for consumption, whereas higher values disqualify it from the microbiological point of view and may also influence the biological availability of nutrients, such as calcium,[12,13] which is essential for bone mineralization in preterm infants.[14,15]

The initial DA of HM is determined by its chemical composition, with special contribution of proteins, phosphates, citrates, and carbon dioxide,[16,17] in addition to organic acids[17]; when a supplement containing these components is added, it can cause changes in that acidity by changing the concentrations of such components in HM.[16] However, there are no studies on the assessment of DA in supplemented HM; moreover, aspects about the effectiveness and safety of nutritional supplements for HM for preterm infants are