"Bed Side" Human Milk Analysis in the Neonatal Intensive Care Unit

A Systematic Review

Gerhard Fusch, PhD[a], Celia Kwan, BHSc[a], Gynter Kotrri, BHSc[a], Christoph Fusch, MD, PhD, FRCPC[a,b,*]

KEYWORDS

• Infrared spectroscopy • Fortification • Preterm • Method validation • Growth • Nutrition • Macronutrient

KEY POINTS

- Currently, there is an increase in human milk analyzers usage to measure the macronutrient content in breast milk before supplementation with fortifiers.
- These devices allow for a rapid analysis of milk, serving as a means to overcome the variability of nutritional content in breast milk and improve growth outcomes.
- It is crucial to introduce good laboratory and clinical practice when using these devices; otherwise their use can affect the growth outcomes of preterm infants.

INTRODUCTION

Optimal protein, fat, and lactose content in breast milk is crucial to the healthy growth of neonates, especially those with a very low birth weight.[1] Specifically for very low birth weight infants, macronutrient content in native breast milk is insufficient and needs to be fortified to meet their caloric and nutritional needs.[2] However, human milk shows a large variation in its macronutrient content.[3] The content varies between mothers, within the same mother, through the lactation period, during the same day, and even during feeds.[3] The current practice to fortify breast milk with standard amounts of fat, protein and carbohydrates may, therefore, not be adequate to overcome this variability in macronutrient content and meet the nutritional needs of preterm infants.[4]

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[a] Division of Neonatology, Department of Pediatrics, McMaster University, 1280 Main Street West, Hamilton, Ontario L8S 4L8, Canada; [b] Department of Pediatrics, Paracelsus Medical School, General Hospital of Nuremberg, Breslauer Straße 201, Nuremberg 90471, Germany
* Corresponding author. Division of Neonatology, Department of Pediatrics, 1280 Main Street West, Room HSC-4F5, Hamilton, Ontario L8S 4K1, Canada.
E-mail address: fusch@mcmaster.ca

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Currently, there is a trend in using infrared (IR) human milk analyzers to measure the macronutrient content in breast milk to tailor fortification.[4,5] These devices allow for a rapid analysis of milk, thus serving as a means to individually fortify breast milk to overcome the variability of nutritional content in breast milk and improve the quality of growth in infants.[4,5] Currently, there are 2 types of IR milk analyzers on the market: the mid-IR and the near-IR human milk analyzers. Owing to the complexity of milk composition, IR analyzers need to make certain assumptions about the composition of the substrate measured, the so-called matrix. For reliable analysis, it is assumed that the composition of this matrix is constant within certain limits. However, these IR devices were developed originally for the use in dairy industry.[5] They must, therefore, be validated using a sufficient number of human milk samples and principles of good laboratory practice should be applied.[5]

However, there is currently no agreement on standard procedures to validate or calibrate these devices.[5] There are also no human milk sample standards available for those interested in calibrating their devices.[6] Different devices also have different features and sample preparation requirements. Hence, this article reviews the current evidence about the use of human milk analyzers to improve neonatal nutrition.

METHODS

A literature search was conducted in PubMed, Embase (1974 to August 2, 2016), Ovid Health Star (1966 to August 2, 2016), Ovid MEDLINE(R) In-Process and Other Non-Indexed Citations, Ovid MEDLINE(R) Daily, and Ovid MEDLINE(R) (1946 to August 2, 2016). The following keywords were searched: “Miris” OR “human milk analyzer” OR “((Unity) OR Spectra Star) AND human milk” OR “Calais analyzer” OR “breast milk spectroscopy macronutrients” OR “Miris analyzer” OR “breast milk macronutrient” OR “energy content breast milk” OR “breast milk formula AND fortif* AND low birth weight infants” OR “near-infrared-reflectance-analysis” OR “human milk anal* macronutrient” OR “breast milk anal* macronutrient” OR “milkoscan” OR “Lactoscope.” Titles and abstracts were screened to identify if studies were relevant for full-text screening, after which full texts were included if they met the prespecified inclusion criteria.

Selection Criteria

Article titles and abstracts were screened for full-text review. Only original studies in English, German, French, and Chinese were included. Duplicates of articles found in each database, as well as abstracts for conference proceedings were excluded. Studies were considered eligible during title and abstract screening if (1) human milk analyzers were mentioned in the title or the abstract, (2) measurement of macronutrient content was mentioned, or (3) the study investigated variability of macronutrient content in human milk.

Information Collection

Two authors (G.K. and C.K.) screened titles and abstracts independently. Disagreements for full-text article review were resolved through discussion between the 2 authors. When necessary, a third party (G.F.) was consulted to reach a consensus. Articles considered eligible at the title and abstract screening stage were evaluated at the full-text review stage independently by the 2 authors, using identical inclusion and exclusion criteria.