The Value of Human Milk in the NICU: Reducing Morbidities and Necrotizing Enterocolitis

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Introduction

Breast milk is very important if your baby is born early or is sick. Breast milk can help your baby get better faster and develop properly. The nurses or lactation consultant can help you learn how to pump your milk if your baby cannot breastfeed.

Recently, the Joint Commission joined professional organizations, the CDC and the US Surgeon General, in publically promoting the benefits of human milk for all infants, including preterm infants. The evidence supporting the use of human milk in the NICU is both extensive and compelling: laboratory and clinical research demonstrate the value of human milk in reducing multiple disease states of the preterm infant including necrotizing enterocolitis, chronic lung disease, retinopathy of prematurity, and infections. Against this backdrop of information and data, it is easy to lose sight of the most critical and consistent element in all of these diseases: the interface of human milk with the infant gastrointestinal system.

Human milk has evolved to meet the unique needs of human infants. Providing species-specific macro- and micronutrients, human milk is the most appropriate source of infant nutrition. Beyond nutrition, human milk has a significant immunoprotective role, particularly important in preterm infants. By stimulating gut mucosal growth, ensuring intact mucosa barriers and delivering multiple immune factors to the intestine, human milk protects infants from environmental pathogens.

In addition, human milk contains immunomodulatory and anti-inflammatory factors that extend protection beyond the gastrointestinal system to distant organ systems. By downgrading inflammation at the level of the gut, human milk can prevent systemic inflammatory responses associated with necrotizing enterocolitis (NEC) as well as distal organ injury of the brain, lungs, and eyes. Immunomodulatory aspects of human milk impact the immediate health of infants by programming immune responses, but at the same time, establish foundations for healthy immune responses in later life.

In this essay we will explore 3 research studies related to the use of human milk in the neonatal intensive care of preterm infants. The first article for review is a study of the effects of human milk on immature gut permeability. Commentary following a summary of the article focuses on factors in human milk that facilitate maturation of the gastrointestinal system. The second article investigates the role of human milk in reducing of the risk of NEC and death. In the subsequent commentary, we will examine the anti-inflammatory and immunomodulatory aspects of human milk in relation not just to NEC but also to other diseases common in preterm infants. The third article compares the incidence of NEC in preterm infants receiving a human milk-based human milk fortifier to those receiving a standard bovine-based human milk fortifier. Commentary relates study outcomes to the physiology of NEC and the effects of a non species-specific diet.
Key Points

Human milk provides multiple layers of protection to the preterm infant, all beginning at the level of the immature gastrointestinal system.

Human milk contains factors which affect:
- Infant growth and development
- Gastrointestinal maturation
- Gastrointestinal mucosal protection
- Gut microbiota development
- Anti-inflammatory responses of the gut and distal organs
- Immunomodulatory responses to program short and long-term immune responses.

Human milk significantly decreases preterm gut permeability during the first month of life. This benefit occurs in a dose-response manner; that is, higher doses of human milk are associated with greater tight junction closure.

Research evidence suggests a relationship between increased gut permeability associated with formula feeds and an increased risk of NEC.

Human milk feedings during the first two weeks of life can reduce the risk of NEC in preterm infants. As the amount of human milk increases during this brief window of time, the risk of NEC decreases.

Bovine-based products - infant formula and fortifiers - contain proteins that may contribute to the development of NEC in preterm infants.

Extremely premature infants fed an exclusively human milk-based diet have significantly lower rates of medical and surgical NEC and death when compared to infants fed a mother’s milk-based diet that also includes bovine milk-based products.

One hundred percent human milk-based diets are now possible with commercially available human milk-based human milk fortifiers. An initial study of this product suggests potential benefits for preterm infants including reduction of the risk of NEC and death.

While additional study of a 100% human milk-based diet for preterm infants is needed, a preliminary cost analysis of the use of human milk-based human milk fortifiers indicates significant clinical benefits could also produce substantial cost benefits.