

Comparison of Holder Pasteurized (Frozen) and Retort Processed (Shelf-Stable) Human Milk

As a NICU nurse, neonatologist, lactation consultant, or related medical professional, you may be making purchasing decisions about human milk products for your hospital. Understanding the impact of different processing methods on the quality of human milk is an important aspect of the decision-making process.

When medically fragile infants don't have access to their mother's milk, the goal is to provide human milk that has been processed to eliminate pathogens while maximizing retention of nutrients and unique bioactive factors. These include:¹⁻³

- **Lactoferrin** – A multifunctional protein that facilitates iron absorption and inhibits bacterial growth; present in quantities 100x greater than found in bovine milk.
- **Lysozyme** – An antibacterial protein that kills gram-positive and gram-negative bacteria; present in quantities 3000x greater than found in bovine milk.
- **IgA** – An antibody custom to pathogens in the maternal environment; present in quantities 4000x greater than found in bovine milk.
- **Human Milk Oligosaccharides (HMOs)** – Indigestible, short chain sugars that serve many functions in the intestinal tract, including pathogen binding and promotion of microbiome development; third most abundant factor in human milk compared to trace amounts found in bovine milk.

Overview of Milk Processing Methods

Holder Pasteurization for Frozen Human Milk

Holder pasteurization is the most common processing technique used globally by milk banks to eliminate bacteria and viruses.⁴ In this low-heat method of processing, milk is warmed to 62.5 degrees Celsius, held for 30 minutes, rapidly cooled, and then frozen until use. While there are no changes in the overall macronutrient profile of human milk during Holder pasteurization, retention of bioactive factors varies (*Table 1*). Nonprofit milk banks in the Human Milk Banking Association of North America (HMBANA) network use Holder pasteurization to process donor human milk.

Table 1. Select factors in human milk and impact of Holder pasteurization⁵

Factor	Impact of Holder pasteurization
Macronutrients	No effect
Bile salt stimulating lipase	Complete loss
Immunoglobulin A	0 to 50% loss
Lactoferrin	60 to 80% loss
Lysozyme	0 to 60% loss
Oligosaccharides	No effect

Retort Processing for Shelf-Stable Human Milk

An older technology called retort processing, which is similar to canning, is currently being used to produce a commercially available, shelf-stable human milk product. Retort processing (hereafter referred to as shelf-stable human milk) uses high temperature (115 to 145 degrees Celsius) under pressure for several minutes to sterilize human milk. Recent research has been published that looks at bioactive retention in shelf-stable human milk.

Emerging Methods

Several promising food science technologies are being investigated for use with human milk. These include high pressure processing, ultraviolet radiation, and high-temperature short-time processing. A 2016 review on emerging human milk processing technologies concluded that fundamental knowledge is lacking and extensive research is still required before using these processing methods with human milk.⁶

Holder Pasteurized -vs- Shelf-Stable Human Milk

Two recently published peer-reviewed studies examine the retention of bioactive factors in Holder pasteurized and shelf-stable human milk. These studies are summarized in Table 2.

Table 2. Difference in Holder pasteurized versus shelf stable human milk^{7,8}

Study Attributes	Meredith-Dennis (2017) ⁷	Lima (2017) ⁸
Types of Milk	Holder; shelf-stable	Raw; Holder; shelf-stable
Sample Size	N = 3 per milk type	N = 12 per milk type
Study Design	Cross-sectional (each milk type was from different donors)	Cross-over (each milk type was from a combined milk pool from 60 donors)
Lactoferrin	*Higher in Holder vs shelf-stable	Not measured
Immunoglobulin A	*Higher in Holder vs shelf-stable	Holder retained 87%; shelf-stable retained 11%
Lysozyme	*No difference between Holder vs. shelf-stable	Holder retained 54%; shelf-stable retained 0%
Bacteria Levels	Not measured	B. Cereus detected in 3 Holder samples; no bacteria detected in shelf-stable.
Other	Holder was higher in HMO, protein, and other factors, likely due to the fact that Holder milk was from preterm donors.	Not measured
Conclusions	Difference in processing and pooling of milk may contribute to differences in nutrient and bioactive composition and warrant further research.	Significant loss of bioactive proteins in shelf-stable milk compared to Holder. Holder requires post pasteurization testing for B. Cereus and HMBANA milk banks do not dispense milk with B. Cereus or other pathogens detected.

**This study was a cross-sectional study, so difference in composition may be attributed to different donors and different stages of lactation; therefore, the scale of differences was not assessed due to lack of control.*

Summary

There is a high loss of bioactive factors in shelf-stable human milk which may translate into different health outcomes in the medically fragile infant. More research is warranted before use of retort processed milk can be recommended for fragile infants. Meanwhile, nonprofit milk banks, such as those within the Human Milk Banking Association of North America's network, continue to use Holder pasteurization for human milk.

References:

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