

Difference in Holder Pasteurized Versus Shelf Stable Human Milk (Retort)

Attributes	Meredith-Dennis (2017) ⁷	Lima (2017) ⁸	Lima (2018) ⁹
Types of Milk	Holder; shelf-stable	Raw; Holder; shelf-stable	Raw; Holder; shelf-stable
Sample Size	N = 3 per milk type, each type received from a different milk bank	N = 36 total from the same pool 12 samples raw, 12 Holder, 12 shelf stable	N = 36 total from the same pool 12 samples raw, 12 Holder, 12 shelf stable
Study Design	Cross-sectional (each milk type was from different donors and had a different pool size)	Cross-over (each milk type was from the same combined milk pool of 60 donors)	Cross-over (each milk type was from the same combined milk pool of 60 donors)
Lactoferrin	*Higher in Holder vs shelf-stable	Not measured	Not measured
Immunoglobulins	*Higher IgM and IgG in Holder vs shelf-stable	Holder retained 87% sIgA; shelf-stable retained 11% sIgA	Not measured
Lysozyme	*No difference between Holder vs. shelf-stable	Holder retained 54%; shelf-stable retained 0%	Not measured
HMO	*Higher in Holder vs shelf-stable	Not measured	Not measured
Lysine	Not measured	Not measured	Raw= 0.85mg/100mL Holder=0.77 mg/100mL shelf-stable=0.68mg/100m
Thiamine	Not measured	Not measured	Raw= 0.24 mg/L Holder=0.26mg/L shelf-stable=0.14 mg/L; p<0.01
Bacteria Levels	Not measured	B. Cereus detected in 3 Holder samples; no bacteria detected in shelf-stable.	Not measured
Other	Holder was higher in protein, fat, caseins (α , β , κ), α -1-antitrypsin, α -lactalbumin, and osteopontin, likely due to the fact that Holder milk was from preterm donors.	Not measured	Not measured
Conclusions	Differences in processing, pooling of milk, and stage of lactation may contribute to differences in nutrient and bioactive composition, warranting further research.	Significant loss of bioactive proteins in shelf-stable milk compared to Holder. Holder requires post pasteurization testing for B. Cereus. HMBANA milk banks do not dispense milk with B. Cereus or other pathogens detected.	Macronutrient content is relatively unaffected by processing. Lysine and thiamine were significantly decreased in shelf stable milk but not by Holder. Thiamine losses are clinically significant and fortification may be necessary.

**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.*

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. 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. At this time, fundamental knowledge is lacking and extensive research is still required before using these processing methods with human milk. Meanwhile, non-profit milk banks, such as those within the Human Milk Banking Association of North America's network, continue to use Holder pasteurization for human milk.