Universitat Autònoma de Barcelona

Laura Simón Martínez
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THERMAL PROCESSING OF DONATED HUMAN MILK

Introduction

Human milk is considered the standard food for the newborn, recommended as the **exclusive source of nutrition** during the first six months of life (Bertino et al., 2009). It **defends the organism**, contributes to **sensory-neuronal development**, influences the maturation of the **digestive system**, as well as enriching it nutritionally . Milk **protects** in infancy and childhood from infectious diseases such as **necrotizing enterocolitis** (Morales & Schanler, 2007).

In the event that breastfeeding is interrupted due to pre-existing diseases, hypogalactia or other factors, the baby can be fed with **donor milk** (Bertino et al., 2009). There are so-called **milk banks** responsible for the **collection, processing, quality control and distribution of milk** from donor mothers, guaranteeing a microbiologically **safe** product (Castro et al., 2021).

Objective

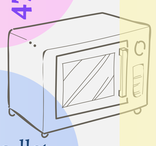
The main objective of this work is to carry out a **bibliographical review** on the methods of **thermal processing of donated human milk** that ensure the **safety and microbiological quality** and to know their **effects** on the **bioactive components of human milk**.

Material and Methods

It has been fundamentally based on the search for scientific documents in the ***Scopus***, ***Pubmed*** and ***Google Scholar*** databases.
The keywords used have been:

- "human milk"
- "breast milk"
- donor human milk
- heat treatments
- Holder treatment
- HTST treatment
- microwave treatment
- ohmic treatment

47 final papers selected



Main references

- *Banco de leche materna de Barcelona*, https://www.bancsang.net/donants/banc-llet-materna/
- Bertino, et al. (2009). Early Human Development, 85(10), S9-S10.
- Castro, et al. (2021). Research, Society and Development, 10(12), Article 12.
- Malinowska-Pańczyk, et al. (2020). Trends in Food Science & Technology, 101, 133-138.
- Martysiak-Żurowska, et al. (2022). Food Chemistry, 374, 131772.
- Morales, et al. (2007). Seminars in Perinatology, 31(2), 83-88.
- Oliveira, et al. (2020). Breastfeeding Medicine, 15(12), 803-808.
- Peila, C., et al. (2017). Journal of Pediatric Gastroenterology and Nutrition, 64(3), 353.

Results

Milk reception, mother identification and date, and temperature status check → Milk storage at −20 ºC < 3 months from expression → Thawing at T<8 ºC → Milk pool from the same mother and portioning in small volumes → Microbiological test <10^5 ufc/mL for viable m.o. or <10^4 ufc/mL for *Enterobacteriaceae* or <10^4 cfu/mL for *Staphylococcus aureus* → Pasteurization at 62,5 ºC for 30 min y fast cooling at 4 ºC → Milk storage at −20 ºC < 6 months from expression → Thawing at T<8 ºC

Figure 1: Procedure applied for the treatment of human milk in milk banks (Malinowska-Pańczyk, 2020)

Figure 2: Bag with breast pump, instructions for extraction and sterile bottles for the donor; Holder pasteurization; human milk from different mothers in the fridge (Picture captured at the Barcelona Milk Bank).

LTLT (Holder) Oliveira et al. (2020)	HTST Peila et al. (2017)	Microwave Martysiak-Żurowska et al. (2022)
Batch	Continuous	Batch
62 ºC, 30 min	72 ºC, 15 s	62,5 ºC, 5 min (or equivalent)

Immune factors: sIgA, IgA, IgG, IgM, Lactoferrin, Lysozyme, Cytokines, Bactericidal capacity

IMPORTANT ↓ ↑ ↑

Microbiologycally safe: *Cytomegalovirus*, *Escherichia coli*, *Staphylococcus aureus*, coliforms and lipid enveloped viruses

Conclusions

- Holder pasteurization, HTST pasteurization and microwave treatment in human milk **contribute satisfactorily** to the assurance of the **microbiological quality** of milk, but affect in different ways, the **bioactive components** of the human milk.
- **Holder pasteurization**, currently applied in **banks**, allows **processing a smaller** amount of milk (discontinuous), it is the main responsible for a series of **losses** of **bioactive compounds** and immunological factors, which significantly reduces the benefits of breast milk itself.
- **HTST treatmentment** better **preserves bioactive compounds** and allows to process a **larger** volume of milk, heating time is reduced. **Microwave** significantly **reduces processing time**, but it can be cold spots in the food, which may not achieve adequate microbiological inactivation.
- **Ohmic, infrared, and radio frequency heating** need more **future research**, are in a very early stage compared to other dairy matrices such as bovine milk.