



Procesamiento de la leche materna en la unidad neonatal

Bogotá 2017

Leche Materna



Importancia Clave















Extracción de leche



La extracción de leche es una tarea difícil

Extracción de leche

La extracción de leche es clave para el mantenimiento de la lactancia

- Es una tarea compleja que a veces debe mantenerse durante mucho tiempo
- Requiere apoyo profesional
- Se dispone de poca información sobre cual es el mejor método de extracción para obtener mayor volumen de leche y se ha valorado poco el confort de las madres.

Extracción de leche



Journal of Human Lactation

<http://jhl.sagepub.com/>

Volume of Milk Obtained in Relation to Location and Circumstances of Expression in Mothers of Very Low Birth Weight Infants

Juliana Acuña-Muga, Noelia Ureta-Velasco, Javier de la Cruz-Bértolo, Rosa Ballesteros-López, Rocio Sánchez-Martínez, Eugenia Miranda-Casabona, Almudena Miguel-Trigoso, Lidia García-San José and Carmen Pallás-Alonso

J Hum Lact 2014 30: 41 originally published online 8 November 2013

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The online version of this article can be found at:



Hospital Universitario
12 de Octubre



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<u>Far from the infant</u>					
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Manejo de la leche materna



Manejo de la leche materna

- Las consecuencias del manejo de la leche materna en la unidad neonatal se han estudiado muy poco
- Muy poco acuerdo sobre como se debe manipular la leche materna en la unidad neonatal

Manejo de la leche materna



Calidad

Seguridad

Los nutrientes no son el único problema...

Ausencia de estandarización



BREASTFEEDING MEDICINE
Volume 3, Number 3, 2008
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DOI: 10.1089/bfm.2007.0033

Breastmilk Handling Routines for Preterm Infants in Sweden: A National Cross-Sectional Study

Soley Omarsdottir,¹ Charlotte Casper,^{1,2} Agneta Åkerman,³ Staffan Polberger,³ and Mireille Vanpée¹



Hospital Universitario
12 de Octubre

Comunidad de Madrid

Ausencia de estandarización

TABLE 4. NUTRITIONAL ANALYSIS AND MAXIMUM FREEZING TIME OF DONOR MILK AND MATERNAL MILK IN THE NEONATAL UNITS

	<i>Donor milk</i>	<i>Maternal milk</i>
Nutritional analysis		
Before pasteurization	14	
After pasteurization	2	
Once per week		7
Every other week		15
When needed	1	3
No analysis	10	11
Maximum freezing time		
3 months	4	11
4 months		1
6 months	23	24

Omarsdottir S. Breastfeeding Medicine. 2008

Ausencia de estandarización



TABLE 3. DURATION OF FREEZING AND GESTATIONAL AGE OF INFANTS ONLY RECEIVING FREEZE-THAWED MATERNAL MILK

<i>Hospital</i>	<i>Duration of freezing (–20°C)</i>	<i>Gestational age</i>
Västervik Hospital	At least 3–4 hours	≤32 weeks
Kalmar Hospital	1 day	≤32 weeks
Norrköping	1 day	≤32 weeks
Linköping University Hospital	1–3 days	≤32 weeks
Karlskrona Hospital	2 days	≤30 weeks
Umeå University Hospital	2 days	≤32 weeks
Östersund Hospital	2 days	≤32 weeks
Jönköping Hospital	3 days	≤32 weeks
Växjö Hospital	3 days	≤30 weeks
Örebro University Hospital	3 days	≤32 weeks
Lund University Hospital	7 days	≤32 weeks

Omarsdottir S. Breastfeeding Medicine. 2008

Puntos claves



1. ¿Que ocurre con la leche durante la congelación?
2. ¿Que ocurre con la descongelación?
3. ¿Que ocurre durante la administración?

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Original Article

Effect of Freezing Time on Macronutrients and Energy Content of Breastmilk

Nadia Raquel García-Lara,¹ Diana Escuder-Vieco,^{1,2} Oscar García-Algar,^{2,3}
Javier De la Cruz,⁴ David Lora,⁴ and Carmen Pallás-Alonso^{1,2}



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1. ¿Que ocurre con la leche durante la congelación?



MACRONUTRIENT AND CALORIC CONTENTS OF BREASTMILK ADJUSTED FOR FREEZING TIME, TYPE OF HOMOGENIZATION, AND STAGE OF LACTATION

Content	Reference group ^a	Difference vs. raw milk for freezing time of				
		7 days	15 days	30 days	60 days	90 days
Fat (g/dL)	5.13 (4.68, 5.59)	-0.19 (-0.28, -0.09)	-0.24 (-0.34, -0.15)	-0.31 (-0.41, -0.22)	-0.42 (-0.51, -0.32)	-0.58 (-0.67, -0.48)
<i>P</i>	—	<i>p</i> =0.0001	<i>p</i> <0.0001	<i>p</i> <0.0001	<i>p</i> <0.0001	<i>p</i> <0.0001
Total nitrogen (g/dL)	1.22 (1.14, 1.30)	0.01 (-0.01, 0.04)	-0.02 (-0.04, 0.01)	-0.03 (-0.05, -0.01)	-0.02 (-0.04, 0.01)	-0.02 (-0.05, 0.01)
<i>P</i>	—	<i>p</i> =0.2035	<i>p</i> =0.1202	<i>p</i> =0.0099	<i>p</i> =0.1158	<i>p</i> =0.0391
Lactose (g/dL)	5.89 (5.8, 5.98)	0.03 (-0.001, 0.07)	0.05 (0.02, 0.09)	0.01 (-0.03, 0.04)	-0.004 (-0.04, 0.03)	-0.09 (-0.12, -0.06)
<i>P</i>	—	<i>p</i> =0.0677	<i>p</i> =0.0017	<i>p</i> =0.9355	<i>p</i> =0.8616	<i>p</i> <0.0001
Caloric (kcal/dL)	76.91 (72.66, 81.15)	-1.51 (-2.39, -0.63)	-2.01 (-2.89, -1.12)	-3.12 (-4.01, -2.23)	-3.99 (-4.89, -3.11)	-6.04 (-6.93, -5.15)
<i>P</i>	—	<i>p</i> =0.0009	<i>p</i> <0.0001	<i>p</i> <0.0001	<i>p</i> <0.0001	<i>p</i> <0.0001

Data are mean (95% confidence interval of the mean) (*n*=61 samples).

Statistical analysis for *p* values was by regression mixed-model analysis.

^aValues of the reference group are estimated for samples of raw milk, manually homogenized and with stage of lactation > 15 days.

García Lara N. Breastfeeding Med. 2011

1. ¿Que ocurre con la leche durante la congelación?



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Impact of Freezing Time on Dornic Acidity in Three Types of Milk: Raw Donor Milk, Mother's Own Milk, and Pasteurized Donor Milk

Sara Vázquez-Román, Diana Escuder-Vieco, Nadia Raquel García-Lara, Clara Alonso-Díaz, David Lora,
María Dolores Martín-Pelegrina, and Carmen Rosa Pallás-Alonso



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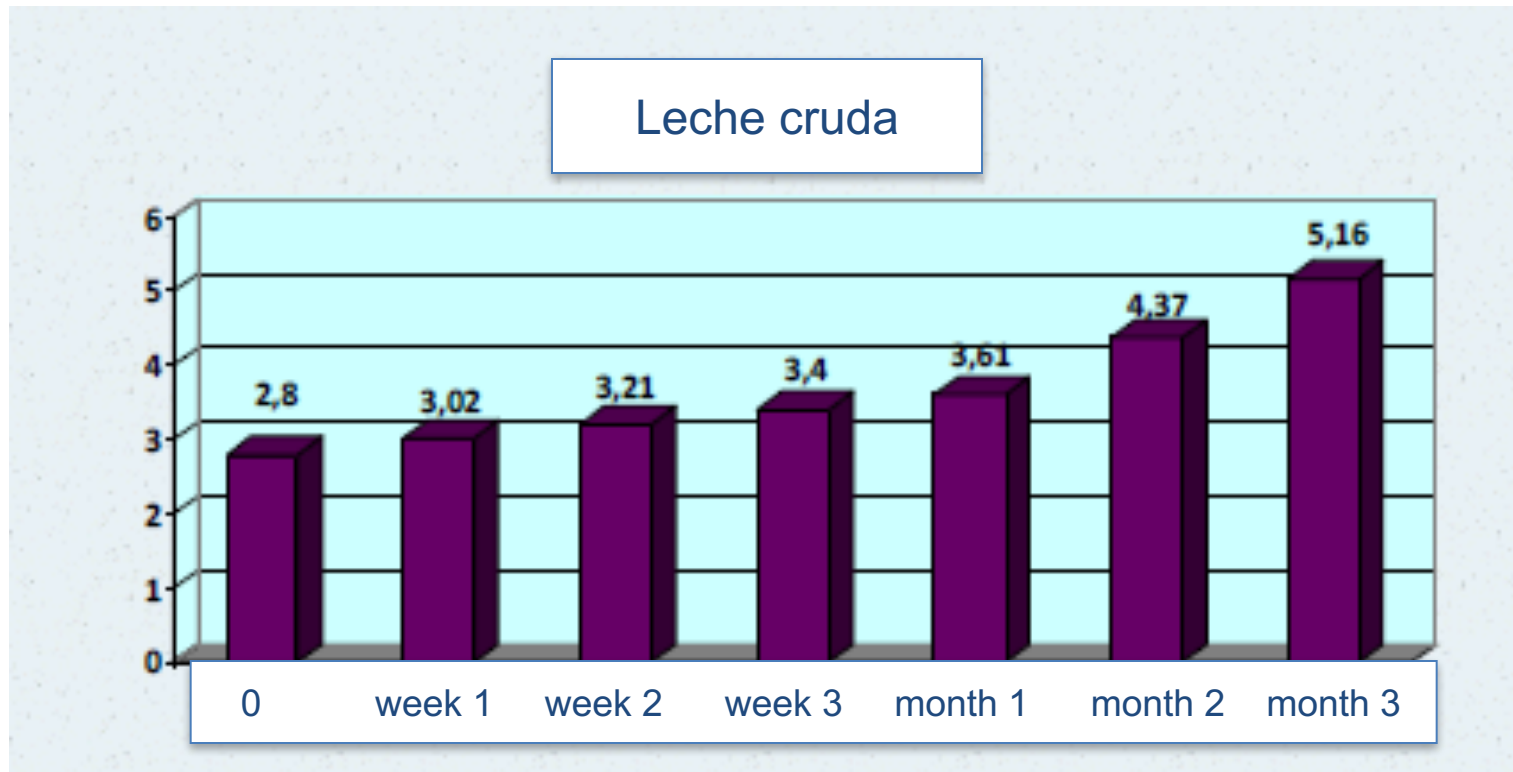
Vázquez Román S. JHL

Servicio de neonatología hospital 12 de Octubre

1. ¿Que ocurre con la leche durante la congelación?



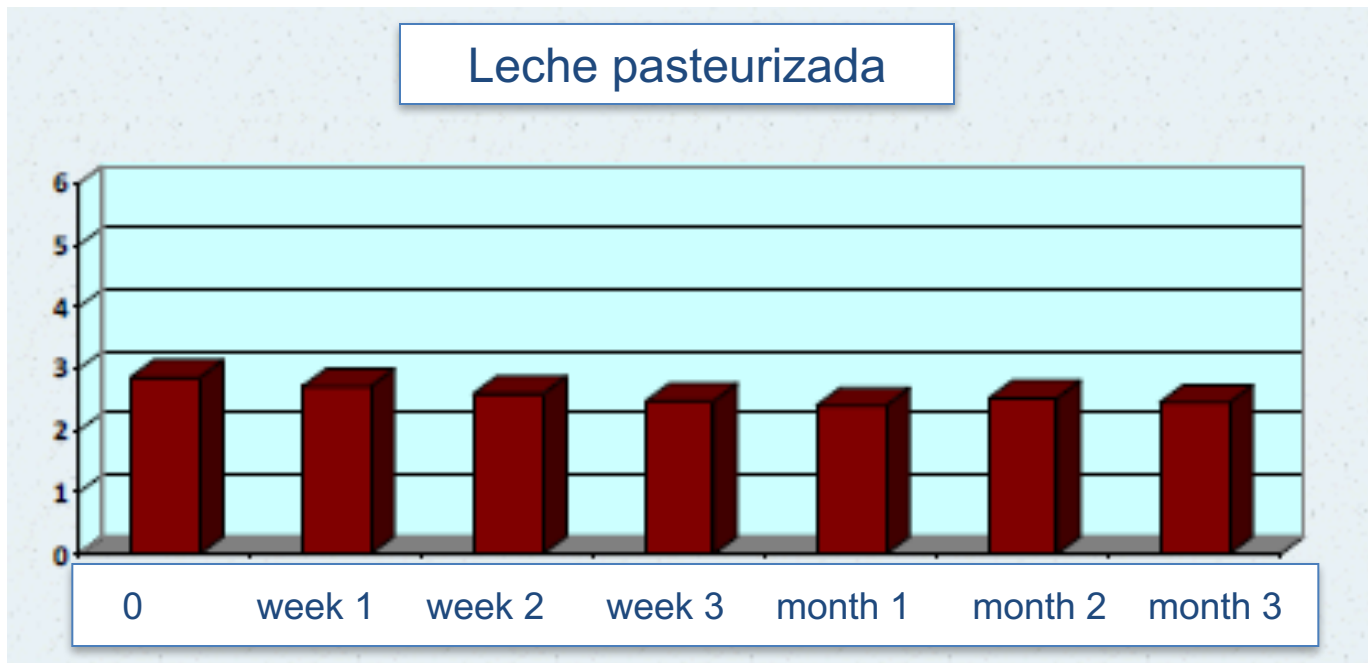
Influencia de la congelación en la acidez Dornic en leche cruda.



1. ¿Que ocurre con la leche durante la congelación?



Influencia de la congelación en la acidez Dornic en lechepasteurizada.



1. ¿Que ocurre con la leche durante la congelación?



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Effects of Extended Freezer Storage on the Integrity of Human Milk

Ali Faraghi Ahrabi, MD¹, Deepali Handa, MD¹, Champa N. Codipilly, PhD^{1,2,3}, Syed Shah, MD², Janet E. Williams, MS⁴,
Mark A. McGuire, PhD⁴, Debra Potak, RN¹, Grace Golda Aharon², and Richard J. Schanler, MD^{1,2,3}

(J Pediatr 2016;177:140-3).



Hospital Universitario
12 de Octubre

Comunidad de Madrid

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Effects of Extended Freezer Storage on the Integrity of Human Milk

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Conclusions Freezer storage of human milk for 9 months at -20°C is associated with decreasing pH and bacterial counts, but preservation of key macronutrients and immunoactive components, with or without prior refrigeration for 72 hours. These data support current guidelines for freezer storage of human milk for up to 9 months for both freshly expressed and refrigerated milk. (J Pediatr 2016;177:140-3).



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1. ¿Que ocurre con la leche durante la congelación?

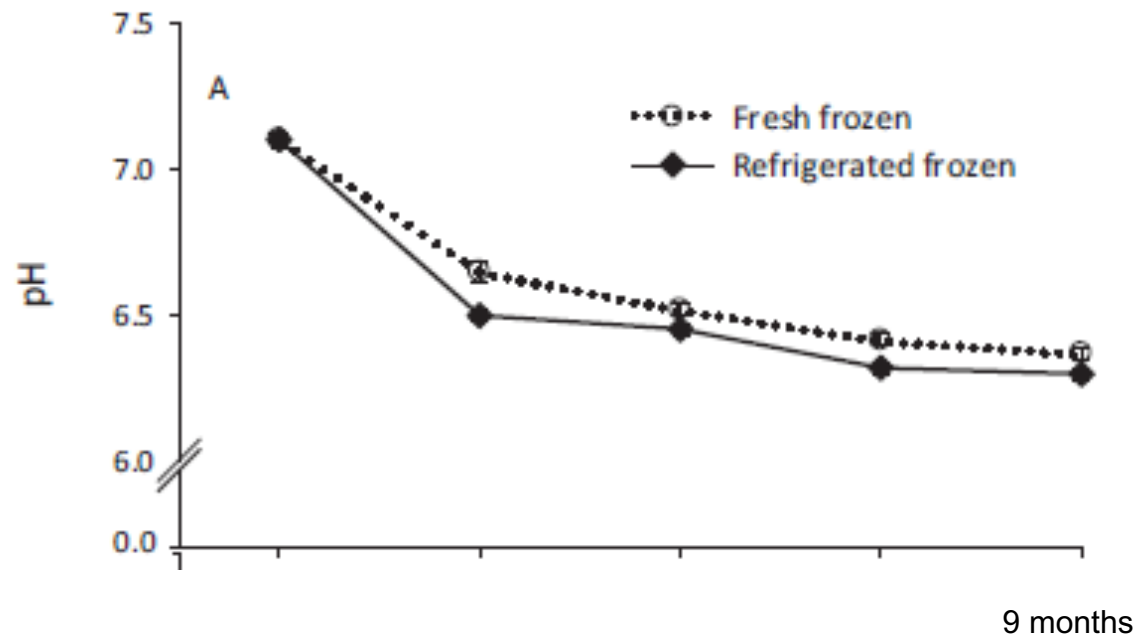
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1. ¿Que ocurre con la leche durante la congelación?



- . Las modificaciones no son muy relevantes pero la congelación es solo uno de los múltiples pasos de la manipulación.
- . Estas modificaciones indican que incluso durante la congelación la leche tiene actividad.

1. ¿Que ocurre con la leche durante la congelación?



Journal of
proteome
research

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Article

Proteome mapping of human skim milk proteins in term and preterm milk

Claire Elisabeth Molinari, Ylenia S Casadio, Ben T Hartmann,
Andreja Livk, Scott Bringans, Peter G Arthur, and Peter E Hartmann

J. Proteome Res., Just Accepted Manuscript • DOI: 10.1021/pr2008797 • Publication Date (Web): 07 Feb 2012

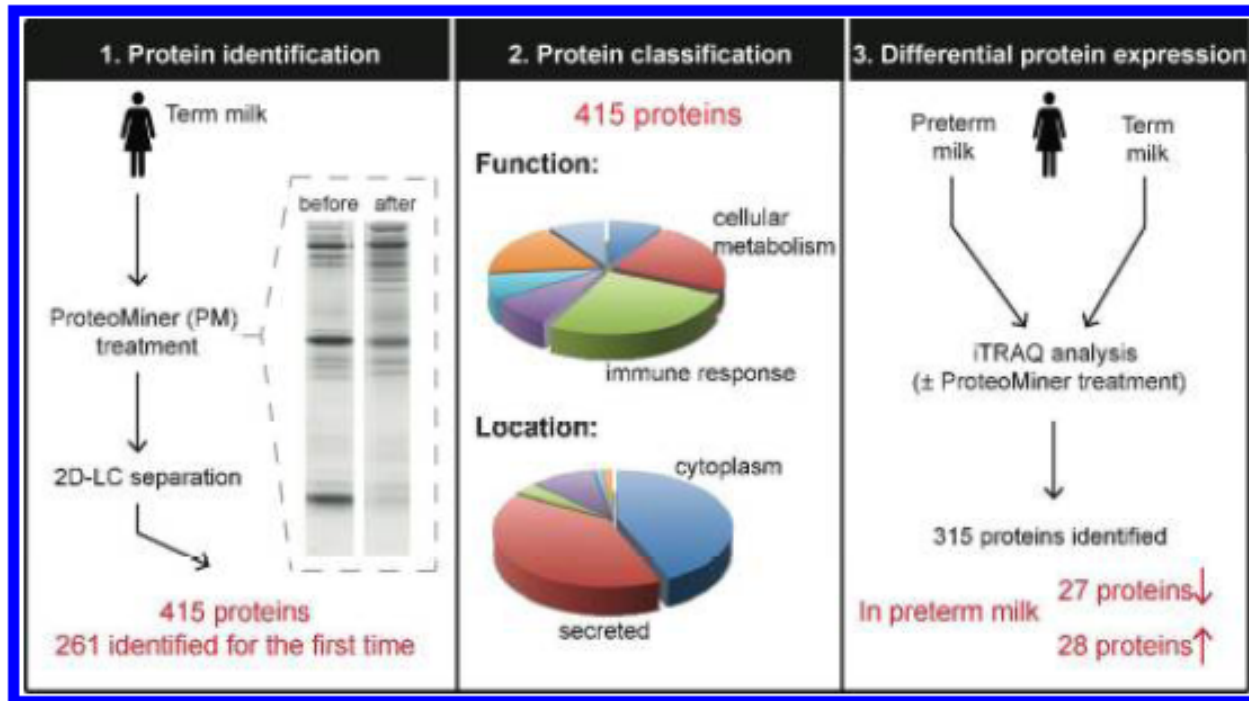
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1. ¿Que ocurre con la leche durante la congelación?



2. ¿Que ocurre con la leche con la descongelación?



2. ¿Que ocurre con la leche con la descongelación?



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ARTICLES

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Refrigerator Storage of Expressed Human Milk in the Neonatal Intensive Care Unit

Meredith Slutzah, DO, Champa N. Codipilly, PhD, Debra Potak, RN, Richard M. Clark, PhD, and Richard J. Schanler, MD

Conclusions Changes were minimal and the overall integrity of milk during refrigerator storage was preserved. Fresh mother's milk may be stored at refrigerator temperature for as long as 96 hours. (*J Pediatr* 2010;156:26-8).



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2. ¿Que ocurre con la leche con la descongelación?

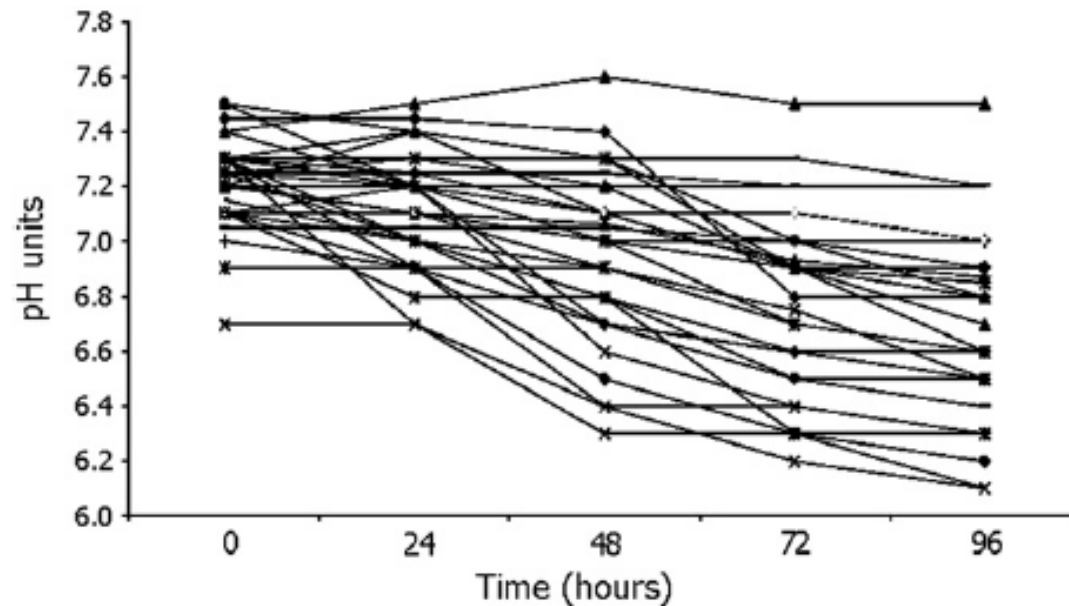


Figure 1. Milk pH declined over 96-hour refrigerator storage ($P < .001$). Each time point differs from the preceding value ($P < .05$).

2. ¿Que ocurre con la leche con la descongelación?

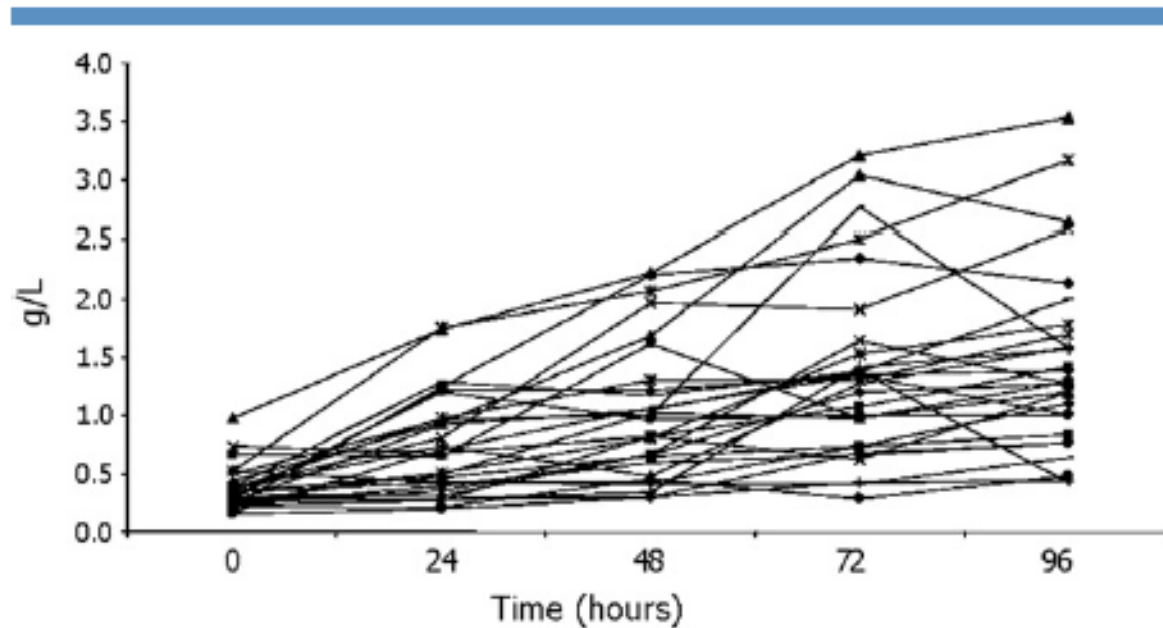


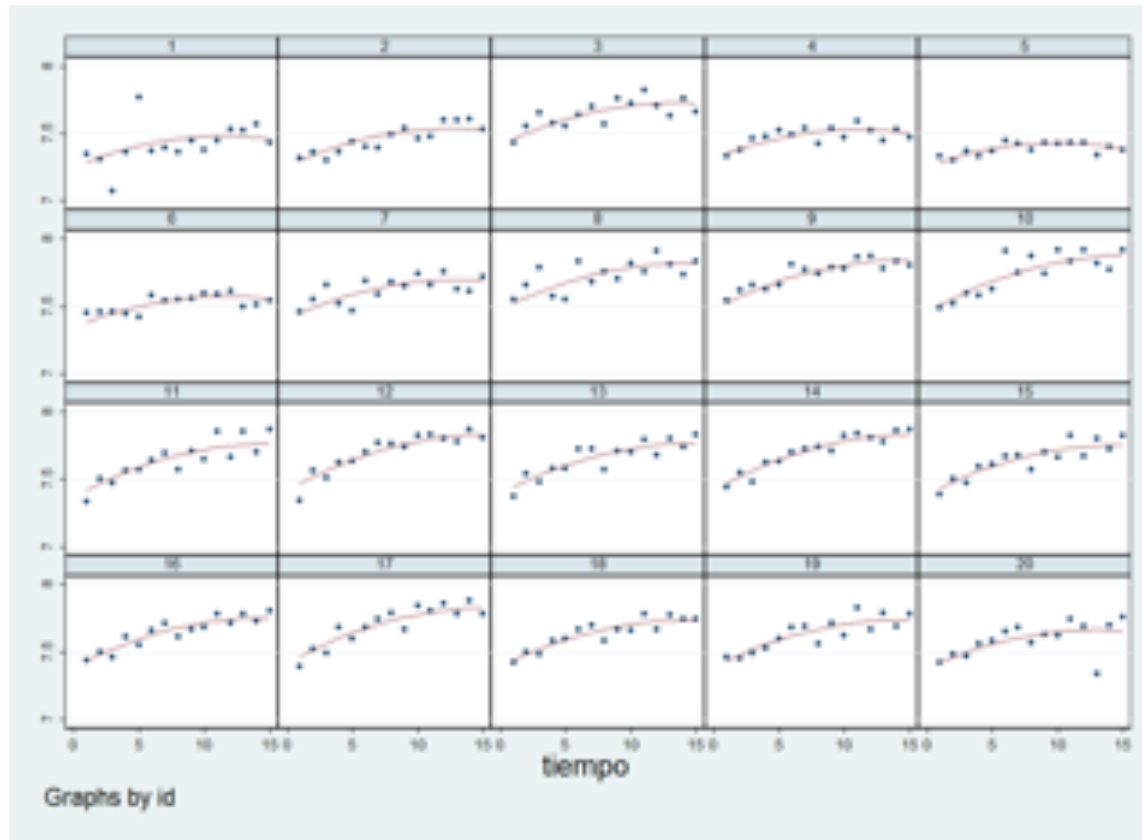
Figure 3. Free fatty acid concentrations increased 3-fold over 96-hour storage ($P < .001$).

2. ¿Que ocurre con la leche con la descongelación?



Todo depende del equilibrio entre
seguridad y seguridad.

2. ¿Que ocurre con la leche **pasteurizada** con la descongelación?



Sara Vázquez Román. 2016

2. ¿Que ocurre con la leche **pasteurizada** con la descongelación?



Variable	Obs	Mean	Std. Dev.	Min	Max
-----+					
pHdía1	20	7.4125	.0688152	7.32	7.55
pHdía2	20	7.4905	.0935541	7.3	7.66
pH3	20	7.491	.1481429	7.07	7.79
pH4	20	7.539	.0970567	7.33	7.68
pH5	20	7.5665	.090686	7.37	7.77
-----+					
pH6	20	7.647	.1359605	7.37	7.91
pH7	20	7.6435	.1227438	7.39	7.77
pH8	20	7.607	.1384919	7.36	7.87
pH9	20	7.654	.0998103	7.43	7.79
pH10	20	7.669	.148781	7.38	7.92
-----+					
pH11	20	7.7265	.1412081	7.43	7.86
pH12	20	7.704	.1317254	7.43	7.92
pH13	20	7.6775	.1650797	7.34	7.85
pH14	20	7.6975	.1268598	7.4	7.88
pHFin	20	7.717	.1595091	7.38	7.92

2. ¿Que ocurre con la leche con la descongelación?



Journal of Perinatology (2014), 1–4

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ORIGINAL ARTICLE

Do thawing and warming affect the integrity of human milk?

D Handa¹, AF Ahrabi¹, CN Codipilly^{1,2}, S Shah², S Ruff³, D Potak¹, JE Williams⁴, MA McGuire⁴ and RJ Schanler^{1,2,3}

2. ¿Que ocurre con la leche con la descongelación?

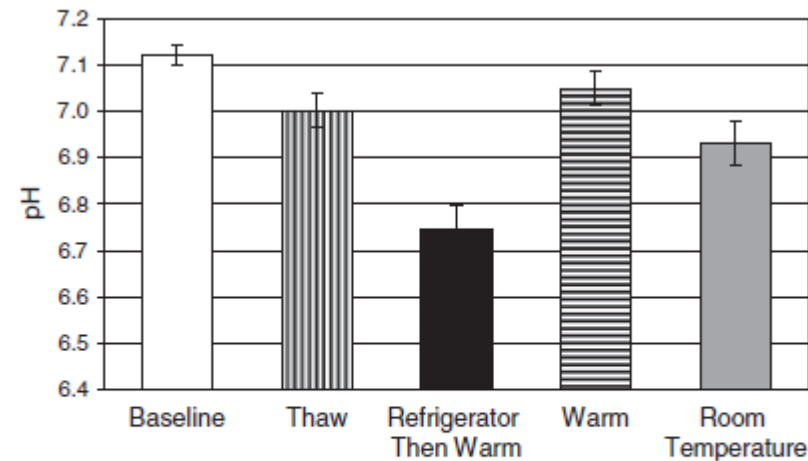
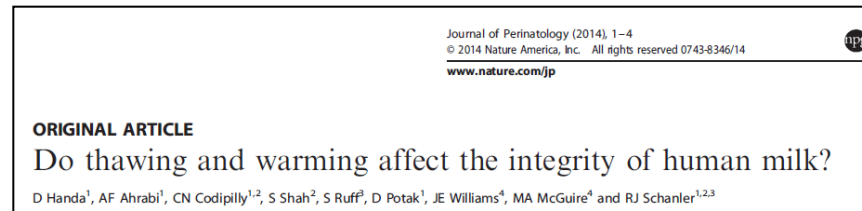


Figure 2. Milk pH. There is a significant change in pH between baseline and after thawing, warming and maintenance at room temperature, $P < 0.001$. Even more so, there is a significant difference between baseline and thawed milk that had been warmed after refrigeration, $P < 0.001$. Mean \pm s.e.m.

2. ¿Que ocurre con la leche con la descongelación?

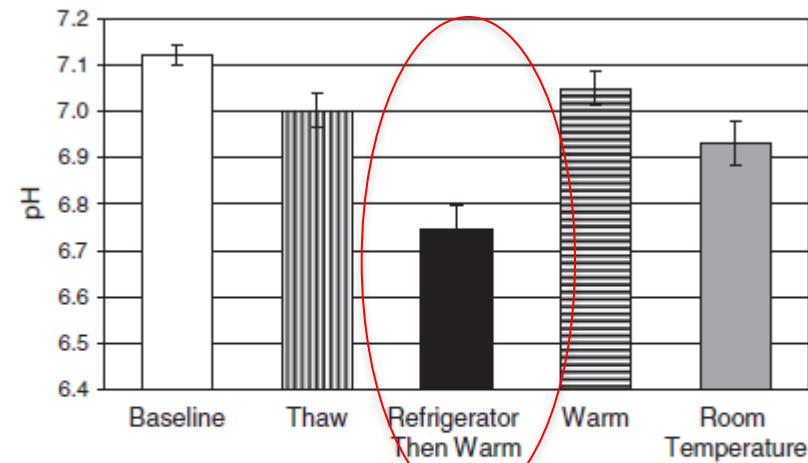
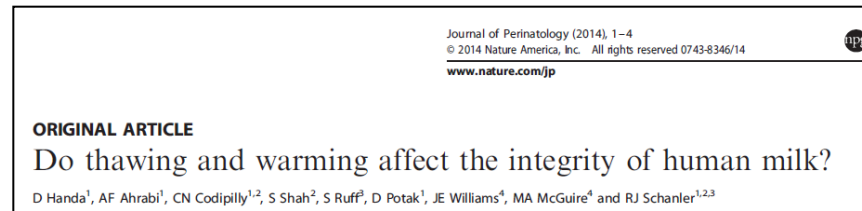


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2. ¿Que ocurre con la leche con la descongelación?

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ORIGINAL ARTICLE

Do thawing and warming affect the integrity of human milk?

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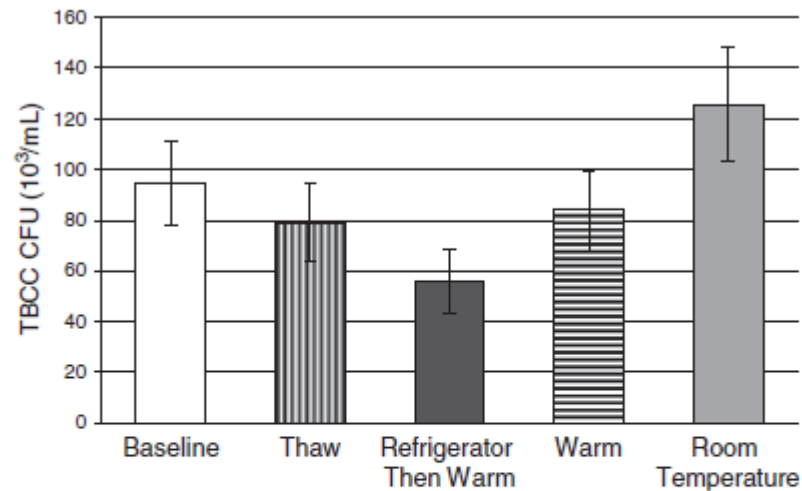


Figure 3. Total bacterial colony counts (TBCC). There is a significant change in TBCC between baseline and after thawing, warming and maintenance at room temperature, $P = 0.002$. The increase in TBCC on maintaining warmed milk at room temperature for 4 h was significant, $P = 0.008$, but did not differ significantly from baseline, $P = 0.37$. Even more so, there is a significant difference between baseline and thawed milk that had been warmed after refrigeration, $P < 0.001$. Mean \pm s.e.m.

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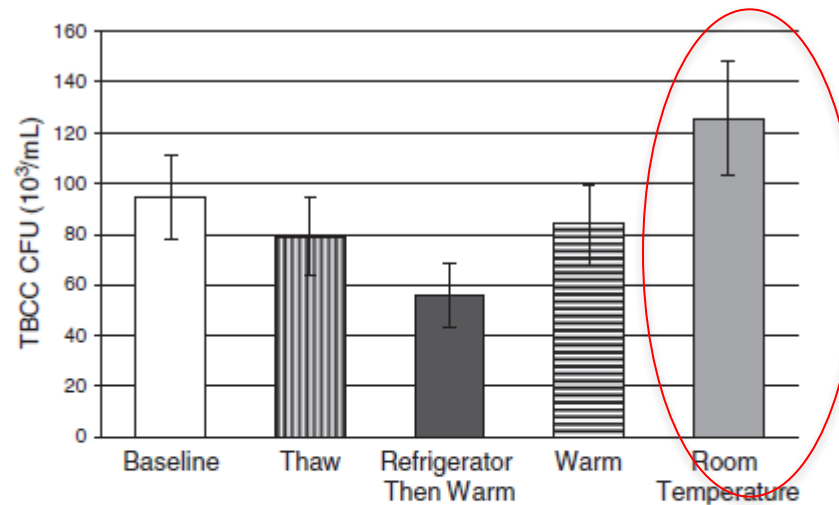


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2. ¿Que ocurre con la leche con la descongelación?



- .Las modificaciones no son muy relevantes pero la descongelación y refrigeración son solo dos de los múltiples pasos de la manipulación.

3. ¿Qué ocurre durante la administración?



3. ¿Qué ocurre durante la administración?



3. ¿Qué ocurre durante la administración?



Journal of Human Lactation

<http://jhl.sagepub.com/>

Type of Homogenization and Fat Loss during Continuous Infusion of Human Milk

Nadia Raquel García-Lara, Diana Escuder-Vieco, Clara Alonso Díaz, Sara Vázquez Román, Javier De la Cruz-Bértolo and Carmen Rosa Pallás-Alonso

J Hum Lact published online 13 August 2014

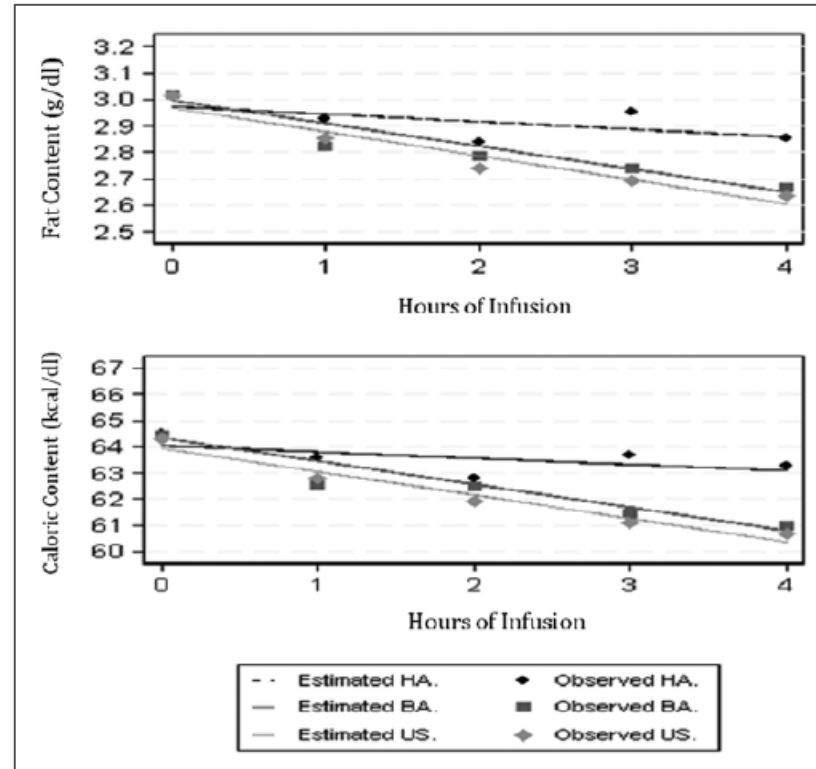
DOI: 10.1177/0890334414546044

The online version of this article can be found at:

<http://jhl.sagepub.com/content/early/2014/08/11/0890334414546044>

3. ¿Qué ocurre durante la administración?

Figure 2. Nutritional Content over Time.



Mean observed values are shown for each study group (BA corresponds to baseline agitation, HA to hourly agitation, and US to ultrasound). Lines represent estimated means across time and homogenization groups with a mixed-effect linear regression model.

3. ¿Qué ocurre durante la administración?



- Durante la administración, parte del contenido calórico y otros elementos esenciales para el crecimiento pueden perderse.
- Todo el proceso de administración debería optimizarse.

¿Qué podemos hacer?



Pasos para el control de los puntos críticos para el manejo de la leche extraída.

Expressed breast milk on a neonatal unit: A hazard analysis and critical control points approach

Veerle Cossey, MD,^{a,b} Axel Jeurissen, MD, PhD,^{b,c} Marie-José Thelissen,^b Chris Vanhole, MD, PhD,^a and Annette Schuermans, MD, PhD^b
Leuven and Wilrijk, Belgium

With the increasing use of human milk and growing evidence of the benefits of mother's milk for preterm and ill newborns, guidelines to ensure its quality and safety are an important part of daily practice in neonatal intensive care units. Operating procedures based on hazard analysis and critical control points can standardize the handling of mother's expressed milk, thereby improving nutrition and minimizing the risk of breast milk-induced infection in susceptible newborns. Because breast milk is not sterile, microorganisms can multiply when the milk is not handled properly. Additional exogenous contamination should be prevented. Strict hygiene and careful temperature and time control are important during the expression, collection, transport, storage, and feeding of maternal milk. In contrast to formula milk, no legal standards exist for the use of expressed maternal milk. The need for additional measures, such as bacteriological screening or heat treatment, remains unresolved.

Key Words: NICU; infection control; mother's milk; quality control.

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Pasos para el control de los puntos críticos para el manejo de la leche extraída.

Table I. HACCP plan for expressed breast milk

Steps in the process	Potential hazards	Control measures	Control point	CCP
Milk expression and collection	<ul style="list-style-type: none"> • Hands may touch breast and milk during pumping. Breasts or nipples may be colonized or infected. • Pump may be contaminated with pathogens (exterior and interior; backflow of aerosol of milk). • Accessory kits may be contaminated. • Milk not placed in cool storage after expression. 	<ul style="list-style-type: none"> • Teach mothers to perform careful hygiene of hands before expressing or handling milk, as well as daily hygiene of breasts. • Use a correctly designed type of pump with separated internal circuits and a safety valve. Perform regular pump cleaning and maintenance. • Thermal disinfection of shields and other parts in contact with milk after each use. Use clean disposable or sterile bottles or containers. • Educate parents to refrigerate or freeze the milk within 1 hour. 	<ul style="list-style-type: none"> • No compliance with hygienic advice. • Visibly not clean. • Visibly not clean. 	

Cossey V. Am J Infect Control 2011;

Pasos para el control de los puntos críticos para el manejo de la leche extraída.

Steps in the process	Potential hazards	Control measures	Control point	CCP
Milk transfer to the unit	<ul style="list-style-type: none"> • Growth of microorganisms if a break in cold chain occurs. • Contamination of bottles. • No or poor identification on 	<ul style="list-style-type: none"> • Provide information regarding appropriate storage conditions for transporting milk in an icebox or isothermal bag. • Educate parents about general hygiene and the use of a clean transfer box. • Check name, date and time of 	<ul style="list-style-type: none"> • Visibly not clean. 	<ul style="list-style-type: none"> • (Partially) thawed milk at arrival (visual inspection) • Missing labels.

Cossey V. Am J Infect Control 2011;

Pasos para el control de los puntos críticos para el manejo de la leche extraída.



Steps in the process	Potential hazards	Control measures	Control point	CCP
Storage in the unit	<ul style="list-style-type: none"> Exceeding storage time and risk for contamination. First-in, first-out principle may not be followed. Temperature of refrigerator is too high. Temperature of freezer is too high. Other products or dirt in freezer or refrigerator may contaminate the milk. 	<ul style="list-style-type: none"> Use fresh milk within 48 hours. Freeze milk that will not be used within 48 hours. Use thawed milk within 24 hours. Use frozen milk within 3 months. Place newly delivered milk at the back of the drawer in the freezer. Label containers clearly with waterproof ink. Keep doors closed. Monitor core temperature continuously with central alarm connected to the hospital building management system. Calibrate the logger system regularly. Control environmental Keep doors closed. Monitor temperature continuously with central alarm connected to the hospital building management system. Clean and defrost periodically and whenever visually contaminated. Keep a freezer and refrigerator in a secure room exclusively dedicated to milk. Clean daily. 	<ul style="list-style-type: none"> Each deviation from chronologic rank. Core temperature $> 5^{\circ}\text{C}$. > 1 cm of ice or visibly not clean. Temperature $> -15^{\circ}\text{C}$. Visibly not clean. 	<ul style="list-style-type: none"> Storage >48 hours if fresh milk; >24 hours if thawed milk; >3 months if frozen milk. Core temperature $>7^{\circ}\text{C}$ (Partially) thawed milk.

Pasos para el control de los puntos críticos para el manejo de la leche extraída.

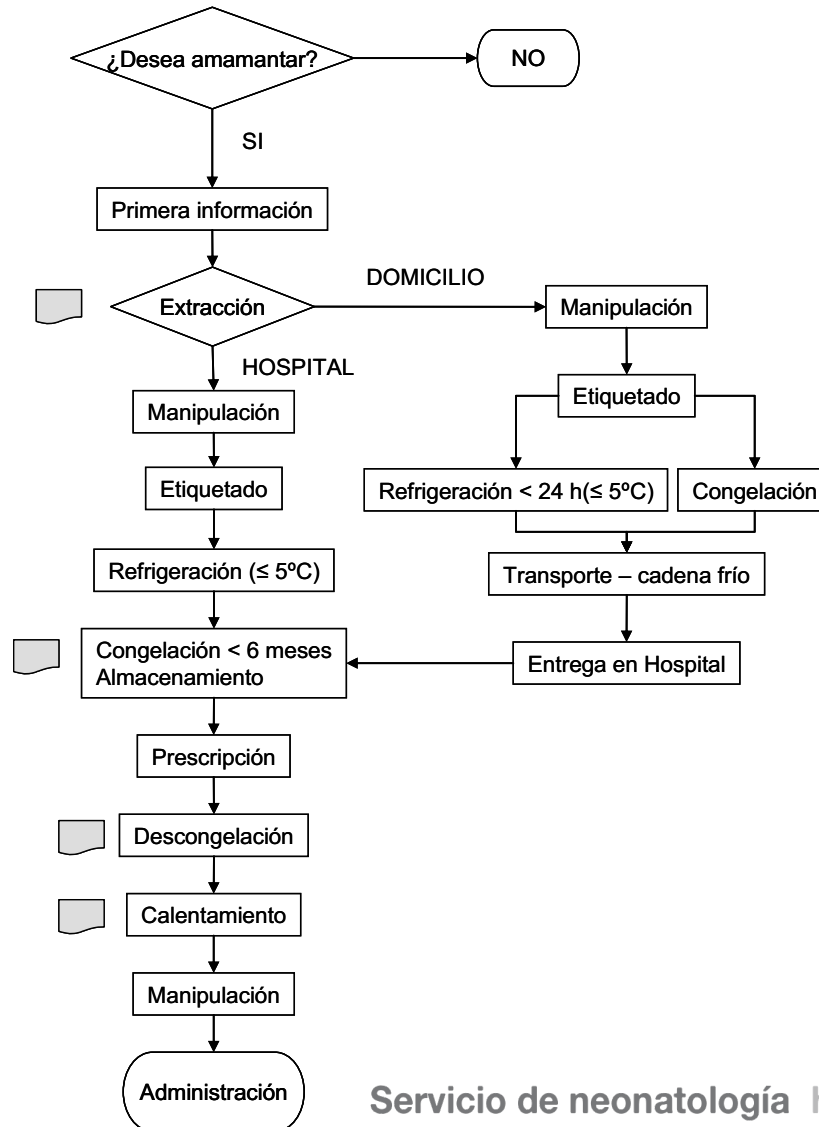
Guía clínica

Extracción, almacenamiento y administración de la leche materna a los niños hospitalizados en la unidad neonatal.

Año 2009

Pasos para el control de los puntos críticos para el manejo de la leche extraída.

4.- Diagrama de flujo del proceso antes de la vía clínica



Pasos para el control de los puntos críticos para el manejo de la leche extraída.



Guidelines for the Preparation and Handling of Expressed and Donor Breast Milk and Special Feeds for Infants and Children in Neonatal and Paediatric Health Care Settings

Contributors

Julie Royle, Dietitian, Royal Manchester Children's Hospital

Gillian Weaver, Human Milk Banking Specialist (Section 6)
President European Milk Bank Association (2012 - 2015)
Former Milk Bank Manager; Queen Charlotte's and Chelsea Hospital Milk Bank (Imperial College Healthcare NHS Trust, London)



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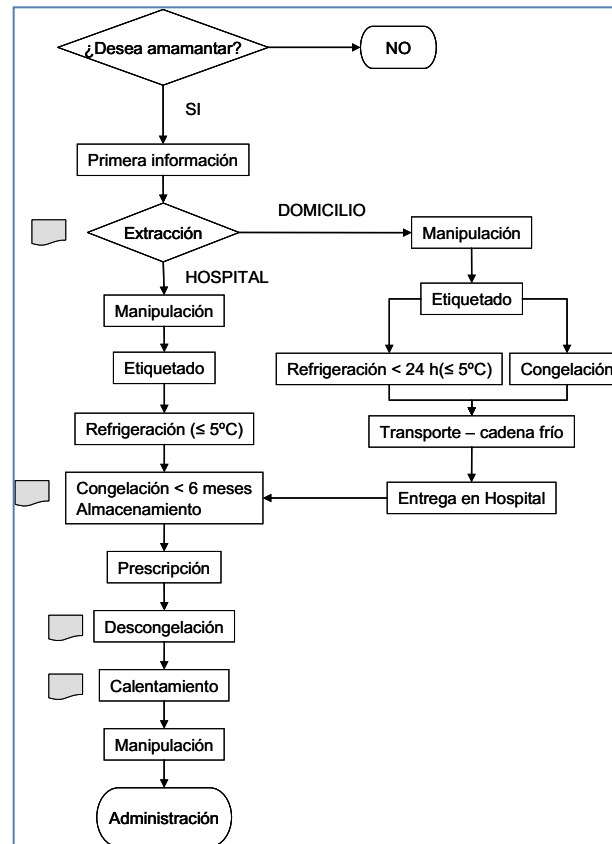
Conclusiones



- La manipulación de la leche en la unidad neonatal requiere múltiples pasos con poco control y estandarización.
- Se conoce poco sobre las condiciones óptimas de la extracción de leche. Quizás las mejores circunstancias para la extracción de leche es inmediatamente después del canguro.
- Durante la congelación y refrigeración, cierta actividad biológica ocurre en la leche materna, esta actividad modifica la calidad de la leche.
- Las consecuencias de la descongelación han sido poco estudiadas.
- A pesar de la gran preocupación en todas las unidades a cerca del crecimiento de los niños prematuros, una parte significativa del valor nutricional de la elche se pierde durante la administración.

Conclusiones

Suma de procedimientos = Suma de modificaciones en la leche



Comentarios



- **Hay muchas oportunidades para mejorar la práctica clínica.**
- **Hay muchas oportunidades para investigar**

