



# Validation of safety control measures and pathogen reduction steps for the safe production of traditional artisanal dairy products from the Mesoamerican region

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# AGENDA

1. Generalities: project overview
2. Justification & objective
3. Project stages and methodology
4. What have we done so far?
5. What's next?
6. Impact and lessons learned
7. Final remarks

The opinions expressed here are those of the presenter and do not reflect those of the International Life Sciences Institute



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# The project



3-year project (2017-2019)

Research, teaching & extension



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# Objective

**Evaluate the adequacy of the currently applied control measures for three highly consumed traditional dairy products in the Mesoamerican Region, and to develop science-based and technical guidelines and educational materials for the safe processing of these products**



# Justification







High consumption

Lack of regulations



Potentially hazardous products (pH,  $a_w$ )

Raw milk



High nutritional value

Lack of technical guidelines (Spanish & lay terms)

Numerous artisanal producers

Lack of validations







# Food Safety for Moms-To-Be: While You're Pregnant



## Listeriosis & Pregnant Hispanic Women

Studies show that pregnant Hispanic women may have a higher incidence of listeriosis than pregnant non-Hispanic women. This is most likely because they might make and eat homemade soft cheese and other traditional foods made from unpasteurized milk. "Queso fresco"- a traditional homemade cheese, prepared from unpasteurized milk and widely consumed by Hispanics - has led to miscarriages, death of newborns, and premature delivery caused by *L. monocytogenes*.

To prevent the risk of listeriosis, Hispanic pregnant women should not eat homemade soft cheeses and other traditional foods made from unpasteurized milk. Like all other pregnant women, they should follow the food safety precautions outlined below.

# Let's pasteurize the milk!

The product changes

I've never done it  
and we're fine

I don't know how



I'm applying  
alternative treatments

Dry salting

Acidification  
+ Heating

Fermentation





Culinary heritage



Productive practices



# Project stages





1

Product selection

2

GMPs and microbiological diagnostic  
(*E. coli* & *L. monocytogenes*)

3

Formulation and processing standardization  
(pilot plant scale)

4

Validation of safety control measures

5

Processing guidelines / educational material  
development and training



# What have we done so far?



1

## Product selection



1

Fermented milk



2

Dry-salted cheese



3

Pulled-curd cheese



# 2

## GMPs and microbiological diagnostic (*E. coli* & *L. monocytogenes*)

- 15 processors (volunteers)
- 3 visits per processor
- GMPs (local regulation)
- 3 batches per product
- Formulation and processing
- Common GMPs deficiencies
- *E. coli* presence
- *L. monocytogenes* absence

3

## Formulation and processing standardization (pilot plant scale)



# 1

## Pulled-curd cheese

- Heat penetration (heating and cooling stages) for calculation of F-value during the curd-stretching step
- Potential of pathogen growth (*L. monocytogenes*, *Salmonella*, *E. coli* O157:H7 and *S. aureus*) in the cheese (after molding)

“Cheese Shelf Stability Predictor” from the University of Wisconsin-Madison







**Table 1.** Predicted log reductions for different pathogens caused by the curd stretching step in pulled-curd cheese manufactured by different processors (mean value  $\pm$  standard deviation,  $n=3$ ).

Pathogen	Processor			
	1	2	3	Pilot plant
<i>C. burnetii</i>	2 $\pm$ 1	0.06 $\pm$ 0.08	0.2 $\pm$ 0.3	0.04 $\pm$ 0.05
<i>E. coli</i> O157:H7	38 $\pm$ 25	2 $\pm$ 2	3 $\pm$ 6	1 $\pm$ 1
<i>L. monocytogenes</i>	6 $\pm$ 2	1.0 $\pm$ 0.4	1.0 $\pm$ 0.8	0.7 $\pm$ 0.6
<i>Salmonella</i>	41 $\pm$ 25	2 $\pm$ 2	4 $\pm$ 6	2 $\pm$ 2
<i>S. aureus</i>	17 $\pm$ 2	5 $\pm$ 2	5 $\pm$ 2	3 $\pm$ 2

- Lethalities obtained do not consistently ensure a greater than 5-log reduction of *Coxiella burnetii* (z value = 4.34°C) and other pathogens of concern. Thus, **the curd-stretching step cannot substitute milk pasteurization.**
- Cheese pH and  $a_w$  support the growth of pathogens of concern. Therefore, **GMPs and refrigeration are strictly required.**



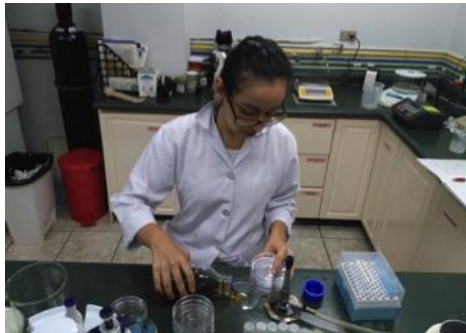


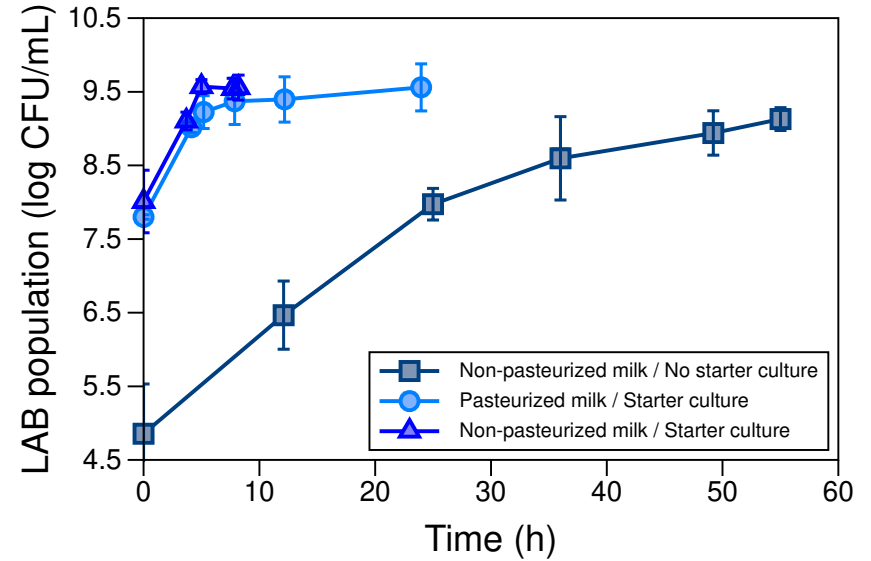
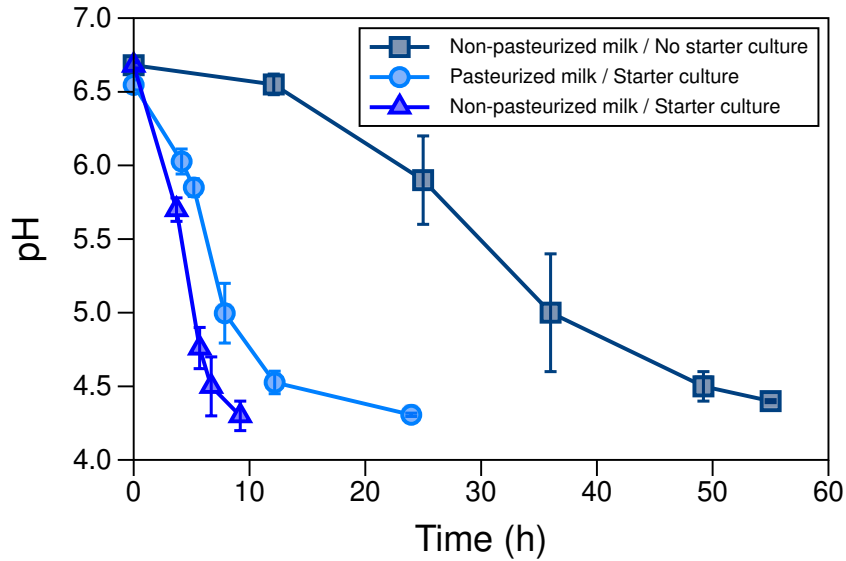
## 2

## Fermented milk



The effects of fermentation **temperature** (refrigeration, room temperature, and 37°C), **use of starter cultures**, and **milk pasteurization prior to fermentation** on the growth of lactic acid bacteria and milk acidification kinetics are under evaluation.





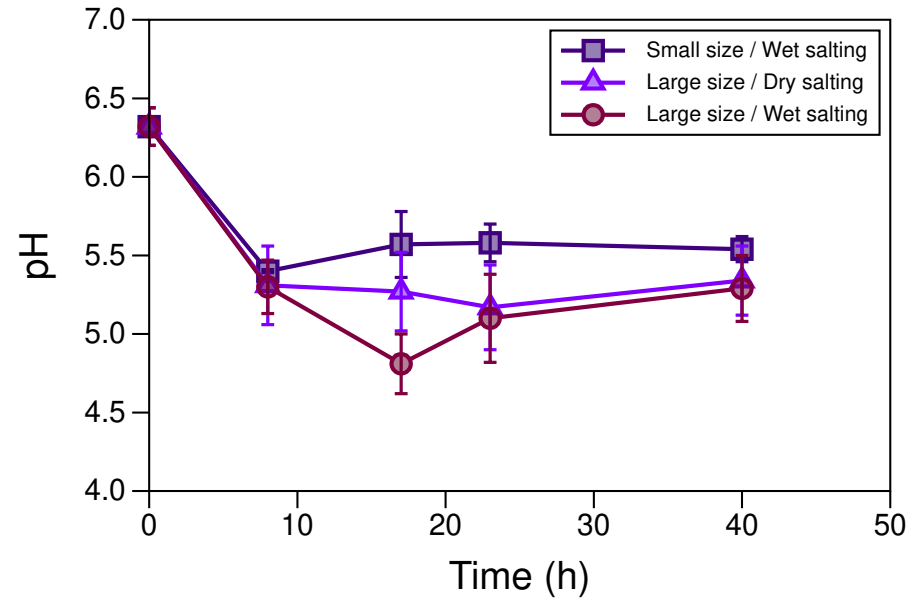
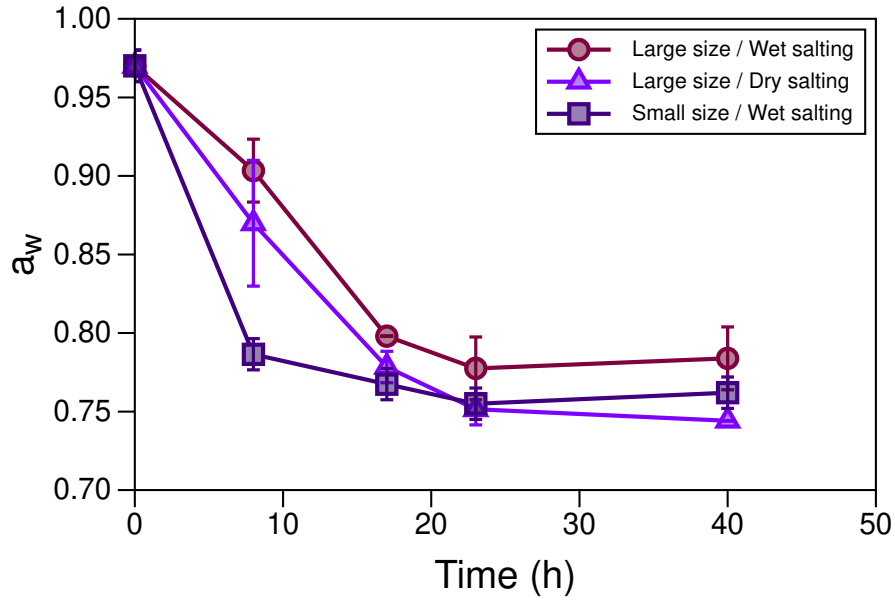
**Figure 1.** Acidification curves and population of lactic acid bacteria, at room temperature, during milk fermentation (mean value  $\pm$  standard deviation,  $n=3$ ).

## 2

### Dry-salted cheese

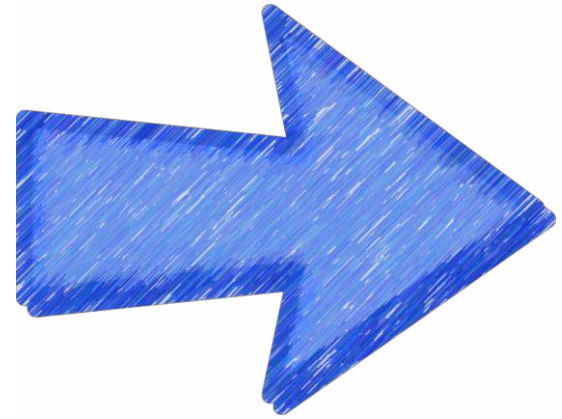
The effects of salting method (dry and moist), and cheese size (two sizes) on the pH, water activity, sodium content, and probability of pathogen growth (*E. coli* O157:H7, *Salmonella*, *S. aureus* and *L. monocytogenes*) are under investigation.





**Figure 2.** Representative curves for the  $a_w$  and pH kinetics during cheese salting over time.

# What's next?



- 1 Development and transfer of science-based technical guidelines
- 2 Development of educational material
- 3 Training (processors and regulatory representatives)
- 4 Education of consumers (videos / social media)
- 5 Scientific publication



# Impact and lessons learned







Science and society





**THANK YOU!**

