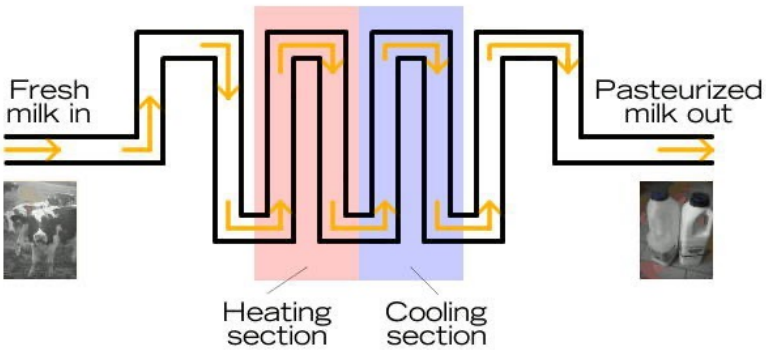
Bridging the gap between oil and water

MILK AND CHEESE

Pasteurization



Pasteurization is the process of quickly heating and then cooling the milk. Milk is heated to temperatures high enough to kill any contaminating bacteria or other microbes present in the raw milk but not enough heat to curdle the milk. The heat stable proteins like casein and tough membranes of fat globules make milk very heat stable, and pasteurization is effective in sterilizing milk for long-term storage. The process of pasteurization was first used to process sake by Buddhist monks and formally used or invented for beer and wine by the French chemist Louis Pasteur in the 1860s

Traditional Pasteurization:
- High Temperature Short Time Pasteurization (HTST)
- Heated to 165°F for 15 seconds
- Perishable with a 2 to 3 week shelf life

UHT Pasteurization:
- Ultra High Temperature Pasteurization (UHT or UP)
- Heated to 280°F for 2 seconds
- Perishable with a 1 to 2 month shelf life (until opened)

UHT Pasteurization + Aseptic Packaging:
- Ultra High Temperature Pasteurization (UHT or UP)
- Heated to 280°F for 2 seconds
- Put in a sterile "box" like package (called aseptic)
- Shelf stable for 6 months (until opened)

Why Pasteurize?

Table 1
List of human pathogenic micro-organisms potentially present in raw cow milk and sources of contamination.

	Direct passage from the blood into the milk (systemic infection)	Mastitis (udder infection)	Faecal contamination (external contamination of the milk during or after milking)/contamination from skin	Environmental sources
Pathogenic bacteria				
Salmonella spp.	(x) (S. Dublin)	(x)	x	x
Brucella abortus	x	(x)		x
Mycobacterium bovis	x		x	x
Coxiella burnetii	x		x	x
Mycobacterium avium subsp. *paratuberculosis*[a]	x		x	x
Listeria monocytogenes	x	x	x	x
Human pathogenic verocytotoxigenic *E. coli*[b]			x	x
Campylobacter coli and *jejuni*			x	x
Corynebacterium pseudotuberculosis	(x)	(x)		
Human pathogenic *Yersinia*[c]		x[d]	x	x
Bacillus cereus[e]				x
Enterotoxin producing *Staphylococcus aureus*		x		x
Arcanobacter pyogenes		x		
Streptococcus zooepidemicus		x		
Leptospira	x			x (Urine)
Pathogenic viruses				
Rift valley fever virus	x			
Viruses of the tick-borne encephalitis (TBE) complex (of which the Central European encephalitis virus)				
Pathogenic parasites				
Cryptosporidium parvum				
Microbial toxins				
Type B toxins of *Clostridium botulinum*	x (Toxins)			

(x) Rarely.
[a] Potentially zoonotic.
[b] Only certain strains of *E. coli* that are transferred by cattle, which co
the serotype O157:H7 are the most frequently reported, but strains of
[c] *Y. enterocolitica* and *Y. pseudotuberculosis* (Shwimmer et al., 2007).
[d] Only *Y. pseudotuberculosis*.
[e] Diarrheal toxins from *B. cereus* could be produced in raw milk. *B. cereus* can also produce emetic toxins (cereulide), but they were never found in milk.

Before 1938, an estimated 25% of all foodborne and waterborne disease outbreaks in the US were associated with milk, whereas nowadays, the percentage of such outbreaks associated with milk is estimated to be below 1% (FDA, 2011).

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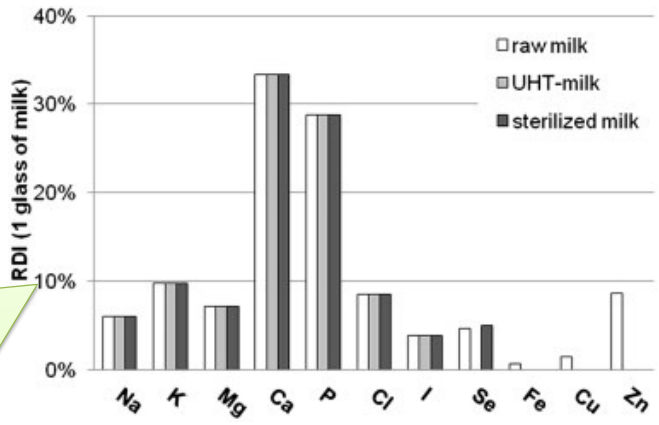
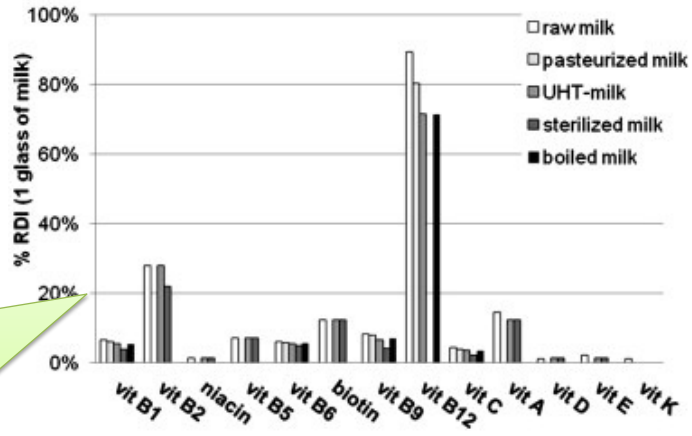


"..there is no difference in the levels of minerals and trace elements between raw and (commercially) heated milk... Milk is in particular a good source of calcium and phosphorus (with the other minerals and trace elements being less relevant). Heat treatment (and homogenization) appears to have no significant effect on the bioavailability of calcium, the major milk mineral"



The effect of a heat treatment (mainly pasteurization and UHT) on the availability of the nutritionally relevant vitamins in milk, particularly vitamin B_2 (riboflavin) and vitamin B_{12} (cyanocobalamin), is very low. Only small or no losses have been reported for B_6 (pyridoxine), niacin (vitamin B_3, nicotinic acid, nicotinamide), panthothenic acid (vitamin B_5), biotin (vitamin B_7) and the fat-soluble vitamins A, D and E...

So what's the difference?

- Taste
- Cheesemaking
  - Pasteurized milk doesn't form curds as easily

Categories of Cheese

⌘Fresh Cheese	Cottage
⌘Soft/Rind-ripened Cheese	Brie
⌘Semi-soft Cheese	Fontina
⌘Hard Cheeses (Firm)	Cheddar
⌘Hard-Grating Cheese	Parmigiano
⌘Blue-veined Cheese	Roquefort

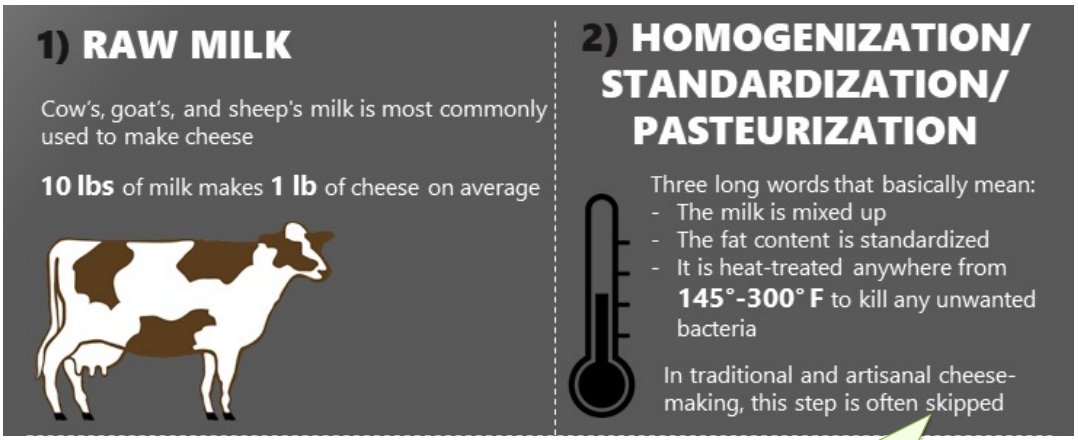
Ingredients

Milk:

- Source influences the milk fat content, type of fats (saturated), protein content and small organic molecules
- Goat, Yak, Cow, Buffalo
  - Animals with higher fat and protein create rich cheese
  - Goat have low casein – less curds and more crumbly finished cheese
  - Feed, Time of year and lactation
    - Alter protein / fat ratio and small flavored molecules
    - Lowest fat in August, highest in October

- Homogenization disrupts the size and membrane coverage of fat globules – casein binds to fat and doesn't curd as well

Initial Steps



Reminder: Does not form curds well.