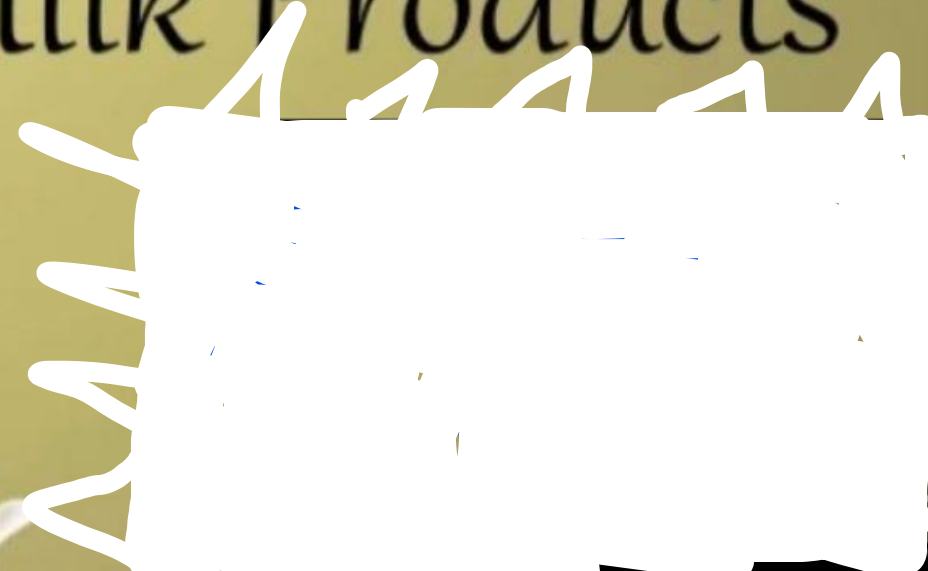



# Milk & Milk Products



# Contents

1. Introduction
  2. Composition of milk
  3. Milk flavour
  4. Contamination of milk products
  5. Physical properties
  6. Nutritive value
  7. Various Milk products
  8. Processing of milk
  9. Storage of milk
  10. Recent researches
- 

# Introduction

Milk is the food which exclusively sustains us during the first few months of life.



## Raw milk

**The lacteal secretion , practically free from colostrum, obtained by the complete milking of one or more healthy cows(PMO).**

- The term *milk* is also used for white colour, non-animal beverages resembling milk in colour & texture such as soy milk, rice milk, almond milk, & coconut milk.

# Composition of Milk

**Water: 87-88%**

**Carbohydrate: (approx. 5% )**

- mainly Lactose → Lactic acid by bacterial fermentation
- In heated milk products, e.g., in condensed milk, there is also *lactulose* which is a little sweeter'

**Fat: 3-4% in whole milk;**

- contains fat soluble vitamins, pigment carotene & Xanthophylls; contains cholesterol & phospholipids but is primarily TGs(95%)
- The fat in milk occurs in the form of droplets or globules, surrounded by a membrane and emulsified in the milk serum part (the whey part or the watery part).
- Milk is an o/w emulsion which is not naturally physically stable that is why creaming occurs if it is left to stand.



# Protein: (3-4%)

## Casein (80% of milk protein)

- The casein is arranged in super-structures called micelles, which consist of protein together with phosphate, citrate and calcium.
- The caseins are actually a group of similar proteins, which can be separated from the other milk proteins by acidification to a pH of 4.6 (Ip)
- The casein micelles also may be coagulated by addition of the enzyme rennin.

## Whey proteins (20% of milk protein)

- lactalbumin, lactoglobulin & immunoglobulin
- Whey proteins are more hydrated than casein and are denatured and precipitated by heat rather than by acid.

## Other protein components

- include enzymes such as lipase, protease, & alkaline phosphatase, which hydrolyses TGs, proteins, & phosphate esters, respectively.

The milk proteins are of high BV & are readily used by the body

## Vitamins & Minerals:

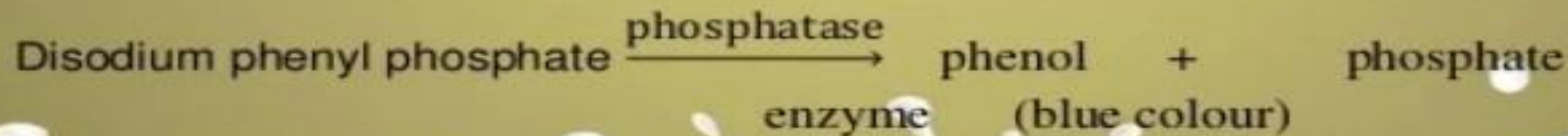
- Vitamins A, B6, B12, C, D, K, E, thiamine, niacin, biotin, riboflavin, folates, and pantothenic acid.
- Vitamin A is *naturally* in the fat component of *whole* milk and more may be added prior to sale.
- whole milk is generally (98%) *fortified* with *vitamin D* because it is naturally present only in *small* amounts.
- *Low-fat* and *non-fat* milk are fortified with *both* of these fat-soluble vitamins because milk fat is reduced or absent.

## Minerals

- Ca & P approx. 1% of milk
- Ca is present as calcium caseinate, calcium phosphate & calcium citrate.
- Other minerals present are chloride, magnesium, potassium, sodium, and sulfur.

## Alkaline phosphatase test:

- Enzyme Alkaline Phosphatase present in raw milk serves as a built-in-indicator to gauge the adequacy of pasteurisation.
- Inadequate pasteurization of raw milk reveals the presence of a high alkaline phosphatase activity.
- It is so sensitive that it gives positive in presence of 0.1% raw milk added or if the pasteurisation temp. is less by 1 degree F.





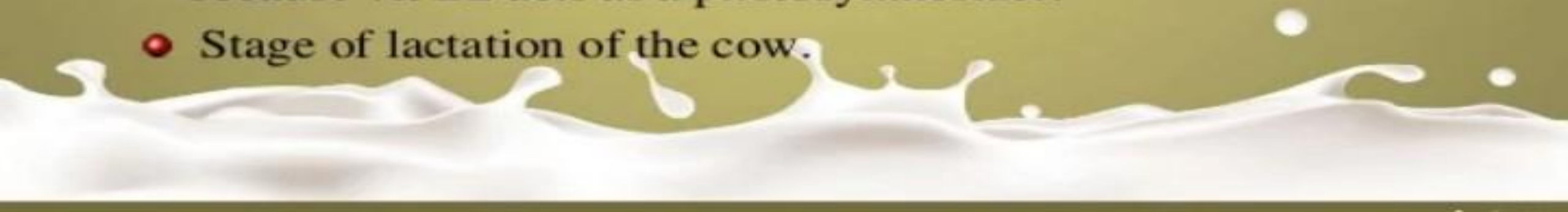
# Flavour of Milk

- The flavour of milk is mild & slightly sweet. The characteristic mouth-feel is due to the presence of emulsified fat, colloiddally dispersed proteins, the carbohydrate lactose, & milk salts.
- Fresh milk contains acetone, acetaldehyde, methyl ketones, & SFAs that provide aroma.
- **“Flavour treatment”** to standardize the odour and flavour typically follows pasteurization. In this treatment process, milk is instantly heated to 195 F (91 C) with live steam (injected directly into the product), and subsequently subject to a vacuum that removes volatile off-flavours and evaporates excess water produced from the steam



Less desirable, “barny” or rancid flavours, or other “off-flavours,” may be due to the following:

- Slightly “cooked” flavour from excessive pasteurization temperatures.
- Animal feed, including ragweed and other weeds, or wild onion from the field.
- **Lipase activity** causes rancidity of the fat, unless destroyed by the heat of pasteurization. (Or, the short-chain butyric acid may produce an off-odour or off-flavour due to bacteria rather than lipase in the emulsified water of milk.).
- **Light-induced flavour changes** in the proteins and riboflavin because vit B2 acts as a photosynthesizer.
- Stage of lactation of the cow.



# Contamination of milk and milk products

- Milk is sterile at secretion in the udder but is contaminated by bacteria even before it leaves the udder.
- Further infection of the milk by microorganisms can take place during milking, handling, storage, and other pre-processing activities.

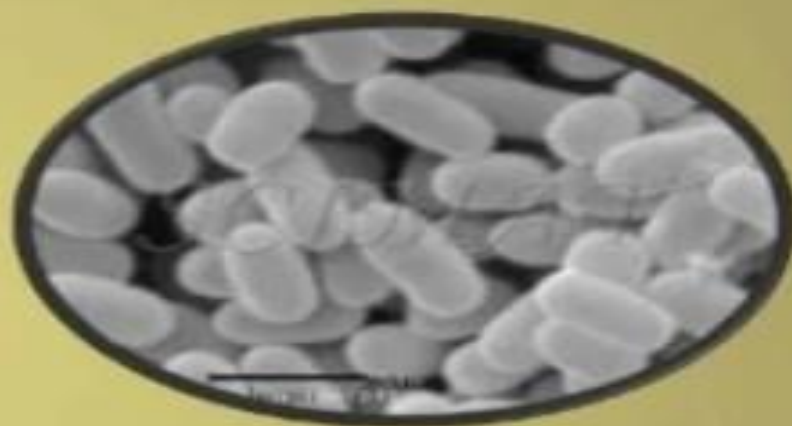




# Few types of micro organisms found in milk.



*Streptococcus lactis*



*Achromobacter*



*Bacillus subtilis*



Coliform bacteria



# Physical Properties



- ☞ **Acidity:** fresh milk pH is 6.5-6.7 at 25°C
- ☞ **Viscosity:** depends on the amount of fat, size of fat globules & extent of clustering of globules.  
Homogenisation & ageing ↑ the viscosity
- ☞ **Freezing point:** -0.55°C addition of 1% of water to milk  
↓ FP by -0.0055°C.
- ☞ **Boiling point:** 100.2°C

# Nutritive value

- ☞ **Good quality protein** & BV is over 90%. Lysine is abundance.
- ☞ **Easily digestible fat** containing 2.1% linoleic acid, 0.5% linolenic acid & 0.14% Arachidonic acid.
- ☞ Only substance that contain lactose which is essential for:
  - Synthesis of myelin sheath(galactose)
  - Favors the growth of lacto bacillus in intestine & decrease the pH thus favoring Ca absorption.
  - Also increases the permeability of Small Intestine for  $Ca^{+2}$ .
- ☞ Poor source of iron & vit C.
- ☞ Not a good source of niacin but **excellent source of tryptophan**
- ☞ Major source of **Calcium & riboflavin**.



# Composition of milk from different species

Nutrient (in 100g)	Cow	Human	Buffalo	Goat	sheep
Water(%)	<b>87.99</b>	87.50	83.39	87.03	80.70
Calories	61	70	97	69	<b>108</b>
Protein(g)	3.29	1.03	3.75	3.56	<b>5.98</b>
Fat(g)	3.34	4.38	6.89	4.14	<b>7</b>
CHO(g)	4.66	<b>6.89</b>	5.18	4.45	5.36
Cholesterol(mg)	14	14	<b>19</b>	11	—
Ca (mg)	119	32	169	134	<b>193</b>
Phosphorus(mg)	93	114	117	111	<b>158</b>
Sodium(mg)	49	17	<b>52</b>	50	44
Potassium(mg)	152	51	178	<b>204</b>	136
Vit C(mg)	0.94	5.00	2.25	1.29	4.16
Vit A (IU)	126	<b>241</b>	178	185	147
Riboflavin(mg)	0.162	0.036	0.135	0.138	<b>0.355</b>



# Classification of Milk Products

Milk products are sold in a number of varieties based on types/degrees of

- additives (e.g. vitamins),
- age (e.g. cheddar),
- coagulation (e.g. cottage cheese),
- farming method (e.g. organic, grass-fed),
- fat content (e.g. half and half),
- fermentation (e.g. buttermilk),
- flavouring (e.g. chocolate),
- homogenization (e.g. cream top),
- reduction or elimination of lactose,
- mammal (e.g. cow, goat, sheep),
- packaging (e.g. bottle),
- pasteurization (e.g. raw milk),
- water content (e.g. dry milk)



# Non-Fermented products

- **Whey protein concentrate:** ultrafiltration technology is used to concentrate protein in whey to various levels between 20-80%. High BV & PER.
- **Skim milk:** fat content reduced to 0.5-2 % by centrifugation. Extensive use in bakery & confectionery. Also used for low calorie diets & children who need high protein.
- **Evaporated milk:** 50-60% water evaporated, clarified raw milk is concentrated in vacuum pan at 74-77°C. fortified with Vit D, sterilised in cans at 118°C for 15 minutes & cooled. As per PFA condensed milk should contain 26% milk solids of which 8% is fat.
- **Sweetened condensed milk:** not sterile, made from pasteurized milk concentrated & sweetened with 65% sucrose. Contains 9% fat out of 31% milk solids.



- **Toned milk:** 7% fat; mix of reconstituted from skim milk powder with buffalo milk.
  - Fat content >5% & SNF 8.5%
- **Double toned milk:** admixture of cow's or buffalo's milk or both with fresh skimmed milk or by admixture with skim milk reconstituted from skim milk powder.
  - Should be pasteurised & show negative phosphatase test.
  - Fat content <1.5% & SNF >9%.
- **Recombined milk:** homogenised product prepared from milk fat, MSNF & water. pasteurised; fat content <3% & SNF 8.5%.
- **Filled milk:** homogenised product prepared from refined vegetable oil & MSNF & water.
  - Fat content > 3% & SNF 8.5%



- **Malted Milk** is a powdered gruel made from a mixture of malted barley, wheat flour, and whole milk, which is evaporated until it forms a **powder**.
- Malt powder comes in two forms:
  - **Diastatic malt** contains enzymes that break down starch into sugar; this is the form bakers add to bread dough to help the dough rise and create a good crust.
  - **Nondiastatic malt** has no active enzymes and is used primarily for flavor, mostly in beverages. It sometimes contains sugar, coloring agents, and other additives.
- A **lactose-free milk** is available for people who are lactose-intolerant. This modified milk is made by filtering regular milk to remove half the lactose. The enzyme *lactase* is then added to the milk to break down the remaining lactose into simpler forms which the body can absorb.



- **flavoured milk**



- **UHT processed milk:** packed & aseptically sealed in pre-sterilized containers under aseptic conditions.
  - can be stored Unrefrigerated for atleast 3 months.
  - Cooked flavour due to denaturation of  $\beta$ -lactoglobulin.
- **Standardised milk:** fat is maintained 4.5% and SNF 8.5%. Mix of buffalo & skim milk
- **Dry milk:** made with whole milk or skimmed milk dehydrated to about 97% by spray drying & vaccum drying. Good shelf life. Highly hygroscopic & can be reconstituted to fluid milk.
- **Khoa:** semi-solid obtained from milk by evaporating in open pans with continuous stirring in circular motion. Yield is about 20% of weight of milk used





- **Rabri:** concentrated sweetened product comprising several layers of clotted cream. Sugar is added to milk reduced to 1/3 of its original volume.
- **Chhaina:** major heat & acid coagulated product. Used in sweets like rasmalai, rasogolla, etc.
- **Ice-cream:** frozen dairy product consisting of whole milk, skim milk, cream, butter, condensed milk products or dried milk products. MF & MSNF constitute 60% of TS giving it a rich flavour, improved body & texture.
  - Also contains sugar, stabiliser, emulsifier, flavoring material, water & air.
  - Sugar provides sweetness, smoothness & lowers the freezing point.
  - Stabiliser prevent formation of ice crystals. Forms gel with water & thereby improve body & texture. e.g., gelatin, sea weed, china grass & CMC.
  - Emulsifier help disperse fat globules throughout the mix & prevent clump formation, further help make ice-cream dry & stiff.





# Cream

- *Cream* is the high-fat component separated from whole milk as a result of the creaming process. It has a higher proportion of fat droplets to milk than regular fluid milk; and according to federal standards of identity, cream must contain *18% milk fat* or more. Due to this high fat content of cream compared to milk, some yellow, fat-soluble pigments may be apparent.
- Various liquid creams available for use in foods include the following:
  - Light (coffee) cream: 18–30% butterfat.
  - Light whipping cream: 30–36% butterfat.
  - Heavy cream: 36% butterfat, minimum.
  - “Half-and-half” cream diluted with non-fat milk: 10.5% butterfat.
  - Whipping cream packaged under pressure in aerosol cans; may be non-fat or contain various levels of fat, sugar, flavouring, emulsifiers, and a stabilizer.



# Fermented milk products



## Butter

- fat content is generally about 80%.
- Made from sweet or sour cream.
- *Butter* is a concentrated form of fluid milk produced through churning of pasteurized cream. **Churning** involves agitation that breaks fat globule membranes so the emulsion breaks, fat coalesces, and water (buttermilk) escapes.
- The original 20/80 *oil-in-water* type of emulsion of milk becomes a 20/80 *water-in-oil* emulsion.
- Milk is churned to form butter and the watery buttermilk. Butter may have a yellow color due to the fat-soluble animal pigment, carotene, or an additive.
- Butter spoils as a result of hydrolysis of TG molecules releasing free butyric & caproic acids.



- **Ghee**, a type of clarified butter, is prepared by simmering butter and removing the residue. The texture, colour, and taste of ghee depend on the quality of the butter and the duration of the boiling.



- **Buttermilk** was the liquid left behind after churning butter out of cream. It is beneficial to health as it contains probiotic microbes also fat content of buttermilk is far lower than milk or curd.





**Curd** prepared by cooling boiled milk to body temperature & adding 5-10% starter. After 6-8 hours an acidity of 0.9-1% is formed which coagulate the casein & curd is set.

- Easily digested than normal milk. Contains more vit B than milk.
- Used as marinating & souring agent in cookery.



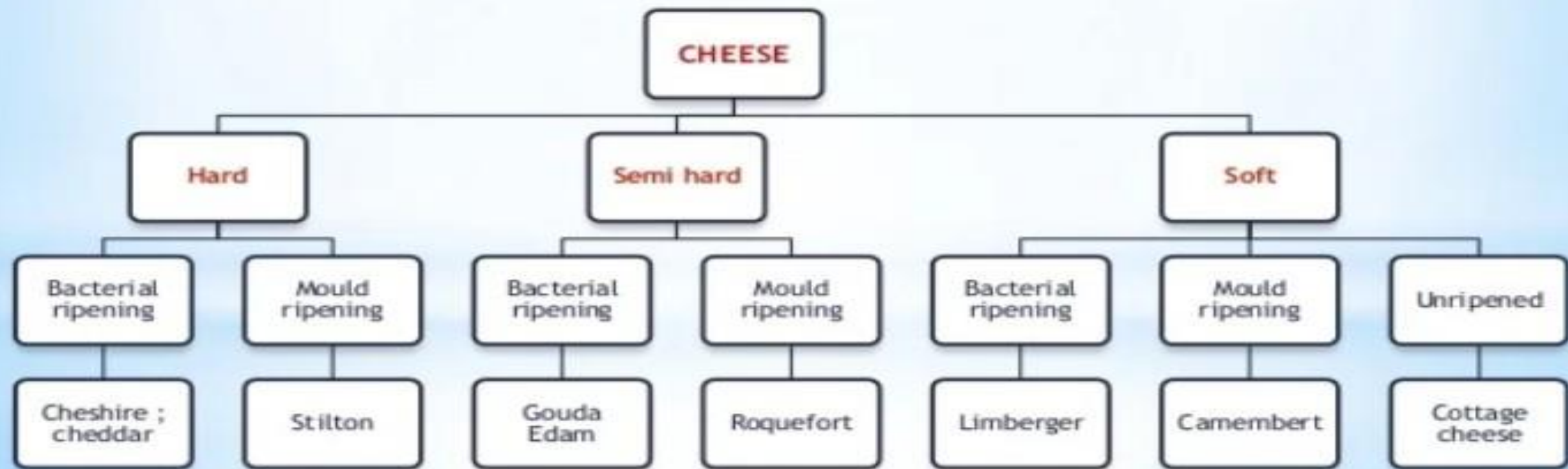
**Yogurt** is a variety of curd. Whole, low fat, skim milks & even cream can be used to make yogurt.

- In production of yogurt, a mixed culture of streptococcus thermophilus, lactobacillus acidophilus is usually added to the pasteurised milk & incubated at 42-46°C.
- Increase in folic acid concentration during fermentation.
- Fermented milk is useful for a wide variety of disorders like colitis, constipation, diarrhoea, gastroenteritis, diabetes & hyper cholesteremia.

**Shrikhand:** fermented product made by concentrating dahi by removing whey & to which sugar, flavor & condiments are added.

**Cheese** is made up of casein. Varieties of cheese are differentiated according to their

- \* Flavour
- \* Texture
- \* Type of milk
- \* Salts & seasoning added
- \* Type of bacteria & mould species used in ripening
- \* Manufacturing & processing method



# Production of cheese

- ❧ **Curd formation:** pasteurised whole milk is brought to a temperature of  $31^{\circ}\text{C}$ , starter & required colouring matter is added. After 30 min rennin is added, stirred & allowed to set curd.
- ❧ **Curd cutting:** into small cubes
- ❧ **Curd cooking:** heated to  $38^{\circ}\text{C}$  & held for 45 min. curd is stirred to prevent matting.
- ❧ **Curd drainage:** whey is drained off & curd is allowed to mat.
- ❧ **Cheddaring:** cutting matted curd into blocks turning them at 15 min interval & then piling. It is then passed to curd mill which cuts the slab into strips.
- ❧ **Salting the curd:** to draw out the whey from curd & as preservative.
- ❧ **Pressing:** overnight





❧ **Ripening:** 60 days to 12 months depending on the flavour required under controlled conditions of temperature & humidity.

---

❧ Changes from a bland tough rubbery mass to a full flavoured soft product.

❧ Rennin splits protein into peptones & peptides.

❧ Increases the B-vitamins & improves cooking quality.

Cheese has limited keeping quality & requires refrigeration, should be kept cold & dry i.e., wrapped in wax paper or metal foil.

# Milk Processing

- Clarification
- Homogenization
- Pasteurization
- Fortification
- Bleaching
- Dehydration

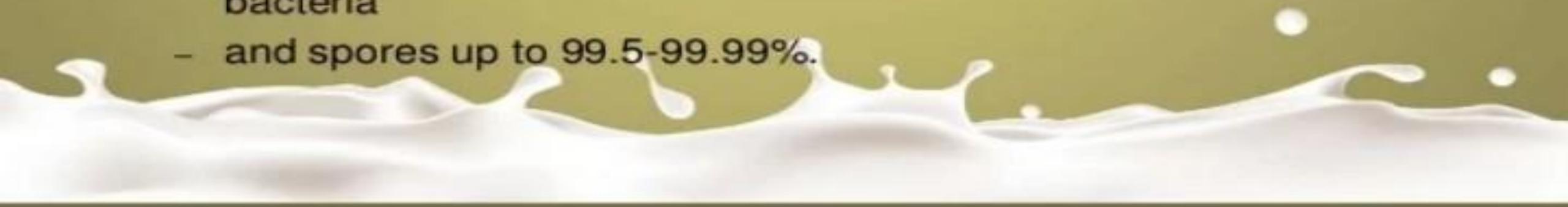


Processing is done to produce milk of low bacterial count, good flavor & sufficient keeping Quality.



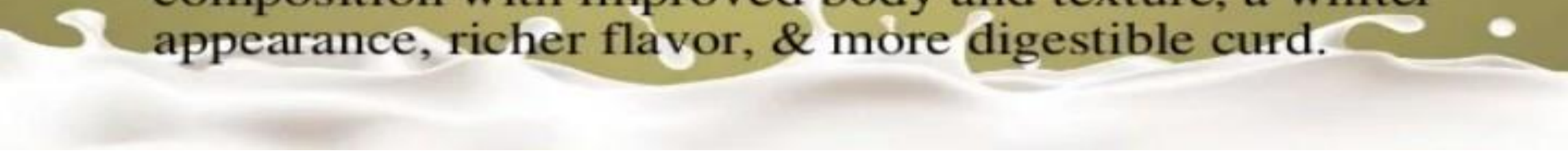
# 1. Clarification and Clearing

- ❖ **Clarification:** removal of small particles
  - straw, hair etc. from milk; 2 lb/2,642 gal
  - based on density
- ❖ **“Bactofugation”:** Centrifugal separation of microorganisms from milk:
  - Bacteria and particularly spores have higher density than milk
  - Two-stage centrifugation can reduce spore loads up to >99%
  - Optimal temperature for clarification is 55-60°C
- ❖ **Microfiltration**
  - Micro-filter membranes of 1.4  $\mu\text{m}$  or less can lead to reduction of bacteria
  - and spores up to 99.5-99.99%.





## 2. Homogenization

- *Function* : to *prevent creaming*, or the rising of fat to the top of the container of milk.
  - The process of homogenization permanently *emulsifies* the fine fat globules by a method that pumps milk under high pressure [2000–2500 lb/in<sup>2</sup> (psi)] through small mesh orifices of a homogenizer.
  - Homogenization *mechanically increases the number & reduces the size of the fat globules*. The size is reduced to 1/10 of their original size.
  - *Resulting* in the milk that maintains more uniform composition with improved body and texture, a whiter appearance, richer flavor, & more digestible curd.
- 

# 3. Pasteurisation

- Pasteurisation is a relatively mild heat treatment, sufficient to destroy disease-causing microorganisms and inactivate enzymes to extend its shelf life.
- It should be followed by immediate cooling of product to the temp. sufficiently low to check the growth of microorganisms which are resistant to temp. used.
- pasteurisation causes minimal sensory and nutritive changes in the food. Some vitamin levels are reduced, mainly vit B<sub>1</sub> & vit C.





# Different pasteurisation methods

1

- **Low-temperature-longer time (LTLT)**
- 65°C for 30 minutes, called the Holding or Batch method

2

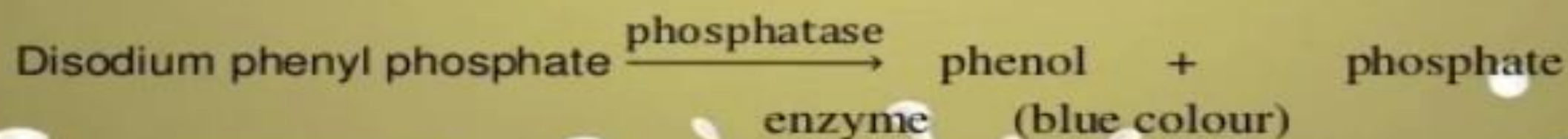
- **High-Temperature-Short-Time (HTST)**
- heat treatment of 72°C for 15 seconds is applied, followed by rapid cooling to below 10°C. Also called the continuous system or flash pasteurisation.

3

- **Ultra High Temperature (UHT)**
- 149.5°C for 1 second or 93.4°C for 3 sec.

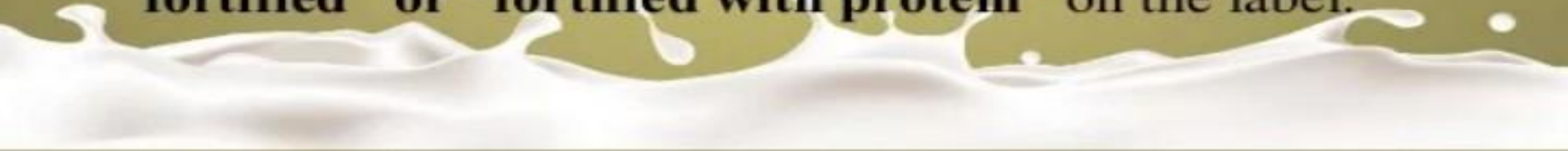
## Alkaline phosphatase test:

- Enzyme Alkaline Phosphatase present in raw milk serves as a built-in-indicator to gauge the adequacy of pasteurisation.
- Inadequate pasteurization of raw milk reveals the presence of a high alkaline phosphatase activity.
- It is so sensitive that it gives positive in presence of 0.1% raw milk added or if the pasteurisation temp. is less by 1 degree F.





## 4. Fortification

- The addition of fat-soluble vitamins A and D to *whole milk* is optional but must for Low-fat milk & non-fat milk (usually before pasteurization) to carry
    - 2000 IU or 140 retinol equivalents (RE) *vitamin A* per quart.
    - *Vitamin D* to reach levels of 400 IU's per quart is *optional* but routinely practiced. Evaporated milks must be fortified.
  - To increase the viscosity and appearance, as well as the nutritive value of low-fat milk, (*MSNF*) may be *added* to milk. This addition allows milk to reach a 10% MSNF (versus 8.25% usually present), and it will state “**protein fortified**” or “**fortified with protein**” on the label.
- 



## 5. Bleaching

- *Bleaching* carotenoid or chlorophyll pigments in milk may be desirable.
  - The FDA allows benzoyl peroxide or a blend of it with potassium alum, calcium sulphate, or magnesium carbonate to be used as a bleaching agent in milk.
  - The weight of benzoyl peroxide must not exceed 0.002% of the weight of the milk, and the potassium alum, calcium sulphate, and magnesium carbonate, individually or 246 Proteins combined, must not be more than six times the weight of the benzoyl peroxide.
- Vitamin A or its precursors *may be destroyed* in the bleaching process; therefore, sufficient vit A is added into the milk, or in the case of cheese-making to the curd.



# Effects of Heat

- Coagulation of protein (lactalbumin & lactoglobulin) at 66°C.
- Increasing temperatures and length of heating may break the fat emulsion if the protein film around the fat globules breaks. Thus the fat will coalesce.
- *High* heat also forms greater amounts of coagulum at the bottom of the pan than low heat.
- **Maillard reaction** or **Non-enzymatic browning** or “**carbonyl-amine browning**” reaction between the free carbonyl group of a reducing sugar and the free amino group of protein. Max. effect is with lysine followed by tryptophan & arginine.
- **Scum formation**
- Destruction of microorganisms at higher temperatures.
- **Scorching of milk:** heating over hot water stirring can prevent it.
- Colour, flavour & digestibility.

# Effect of Phenolic compounds & Salt

- **Polyphenolic compound**

*Phenolic* compounds (tannins) are in some plant materials including fruits, vegetables (eg, potatoes, tomatoes), tea, and coffee and they coagulate milk.

- baking soda (alkali) may be added to milk combinations to shift the pH and control curdling, it is not recommended, as it destroys vitamin C in the product.
- Low heat and a gelatinized starch buffer (white sauce) may be used for controlling this undesirable coagulation.

- **Salt:**

Calcium and Phosphorous salts present in milk or salty foods, or addition of salt NaCl can curdle milk.



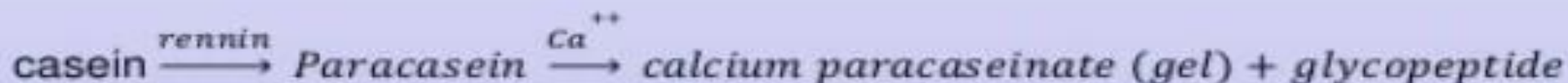


## Effects of acid:

coagulates casein when pH is lowered to 5.2. forms curd at pH 4.6 (Ip)

## Effects of enzyme:

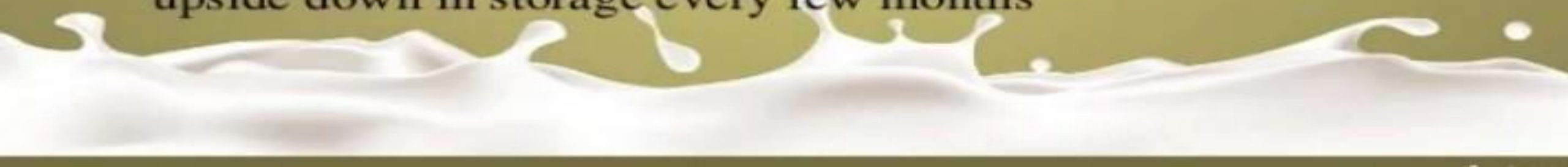
- Rennin(Chymosin) is a proteolytic enzyme.
  - It coagulates casein, Ca is not released in to whey but remains attached to casein.
  - Cheese made up with rennin is better source of Ca.



- Factors affecting rennin coagulation:
  - Temperature: 40-42°C optimum temp.
  - Heating milk before enzyme action over 65°C made casein resistant to coagulation.
  - pH of milk: acts best at 5.8 pH
  - Concentration of constituents
  - Agitation

# Storage tips

- Pick up as one of the last items in store
- **Refrigerate** as soon as possible
- Use milk in order of purchase from individual refrigerators at home. (Put freshest milk in the back and use the oldest first)
- Chill UHT milk before serving. Refrigerate after opened.
- Dry milk should be refrigerated after reconstituted
- Do not pour unused milk back into original container
- Close container so milk will not absorb flavors
- Canned milk - store in cool, dry place; rotate and turn cans upside down in storage every few months





# CONSUMER ISSUES

## Lactose intolerance

- due to a natural intolerance to lactose (sugar in milk)
- Normally lactose is broken down, or digested, by an enzyme called *lactase*. As we get older, the amount of the enzyme in our body decreases. Lactase declines rapidly after weaning.
- Body's inability to digest Lactose results in symptoms such as bloating and diarrhoea.
- People with lactose intolerance can sometimes take small amounts of milk without being too ill and can usually drink fermented milk products, Low lactose milks have also been developed. Milk products, such as cheese and ice-cream, should not in themselves present problems to lactose intolerant consumers but the practice of adding back milk solids reintroduces lactose.
- Some lactose intolerance is not due to low lactase levels but to other things such as Crohn's disease, Coeliac's disease or acute gastroenteritis.

## Milk Allergy

- allergy to the protein in milk, causing an immune-system response in the body.
- Allergy sufferers needs to totally eliminate milk, dairy products & any foods containing milk ingredients.
- dairy alternatives, such as milk from soya and cereals, are available to allergy sufferers.



# Organic dairy products

- Organically produced milk and dairy products represent a growing segment of the food industry in the UK and Europe.
- Organic milk is produced under standards controlling production and handling. Generally, organic production falls under regulations concerned with chemicals and pesticide use, grazing access for cows, GMOs, antibiotics and hormones, where this is of relevance.
- Reasons for opting for organic products vary – the main drivers can be related to human health, animal welfare, environmental or societal issues.
- For example, in the USA a hormone called *bovine somatotrophin* (BST, or bST), which is used to increase milk yields, is not allowed in organic milk. In Europe, this hormone is not allowed in any milk production, organic or conventional. It is also banned in Australia, New Zealand and Canada.



# International research in dairy science

ice cream, called *Milk Time*, contains the probiotic BB 12 : R&D scientists at an international food company have discovered new ways to deliver probiotics in an ice cream product. The ice cream, called *Milk Time*, contains the probiotic BB12 Bifidobacterium lactis which is commonly used in dairy products, particularly in drinking yogurts. However, yogurts as chilled products, are susceptible to temperature fluctuations on transport and storage and, as a result, the probiotic levels in the yogurt can decline by the time it reaches the supermarket shelf. In this new ice-cream product, the bacteria are frozen alive in the ice cream and remain in a state of suspended animation and in constant numbers until they are reanimated at the time when the product is eaten.

- Chemistry & Industry, 07/07/2008



- Numerous studies have found that [conjugated linoleic acid](#), found mainly in milk, meat and dairy products, provides several health benefits including prevention of atherosclerosis, different types of cancer, and hypertension and improved immune function.
- In 2010, scientists at the [Harvard School of Public Health](#) identified a substance in dairy fat, trans-palmitoleic acid, that may substantially reduce the risk of type 2 diabetes. The researchers examined participants who have been followed for 20 years in an observational study to evaluate risk factors for cardiovascular diseases in older adults. During follow up it was found that individuals with higher circulating levels of trans-palmitoleic acid had a much lower risk of developing diabetes, with about a 60% lower risk among participants in the highest quintile (fifth) of trans-palmitoleic acid levels.<sup>1</sup>





- Another type of new pasteurisation process, called *infusion pasteurization*, is currently under development. Very rapid heating to relatively high temperatures (ca. 80-100C) combined with very short times (0.1- 0.9s) have been shown to alter physical properties of the milk at the level of the casein micelle.





**Recent  
Related  
Studies**



# Application of osmometry in quality analysis of milk

Colin Musara· William Pote

- ▶ Osmolality of different sample was determined by *freezing point* osmometry using an osmometer.
- ▶ Min. & max. values for normal osmolality of fresh milk were taken to be 280 & 290 mOsmoles kg<sup>-1</sup>.
- ▶ The relationship between osmolality & pH of fermented milk was investigated during spontaneous fermentation of UHT milk at 37°C for 48 h.

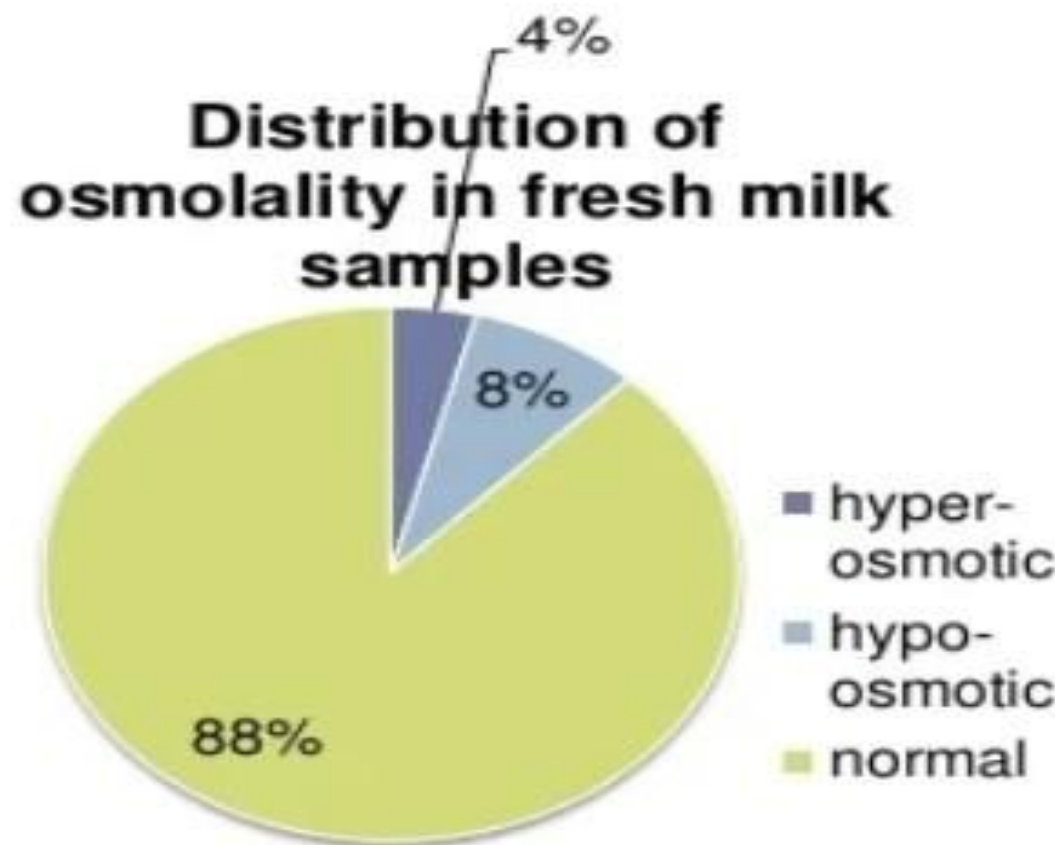
Milk product	Osmolality(mOsmoles kg <sup>-1</sup> )
Raw milk	290.2±7.98
Sterilized milk	290.2±5.84
Skimmed UHT milk	290.8±3.31
Pasteurised milk	283.6±2.28
Standard UHT milk	281.6±4.59
Fermented milk	466.0±17.30

Table: Osmolality of milk products (Mean±SD, n=5 for each product)

## Findings:

---

- ▶ Fermentation studies revealed a high negative correlation between osmolality & pH, with a correlation coefficient of -97.49%.
- ▶ Hypo-osmotic milk shows mixing of milk with water along the production chain.
- ▶ Hyper -osmotic milk indicates fermentation of milk at high ambient temperatures or with prolonged storage. It may also reveal adulteration of fresh milk with a soluble substance.

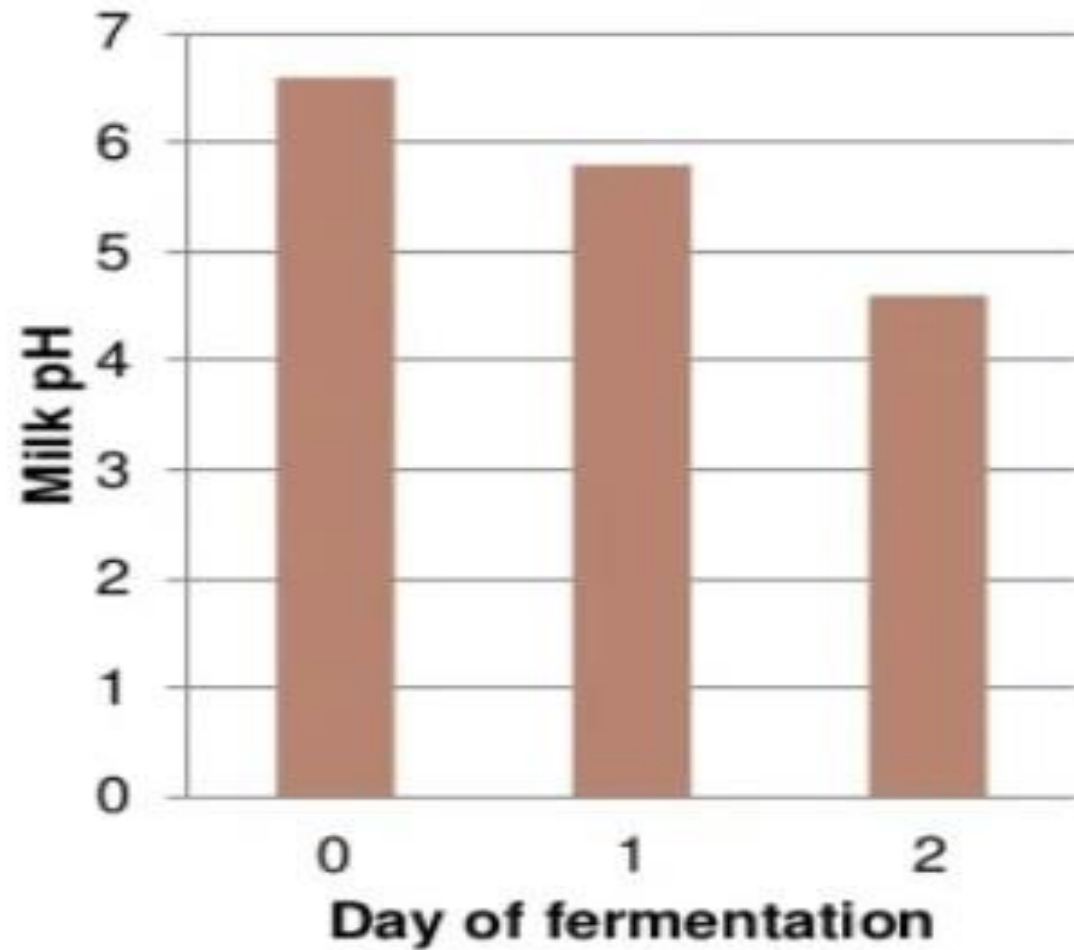




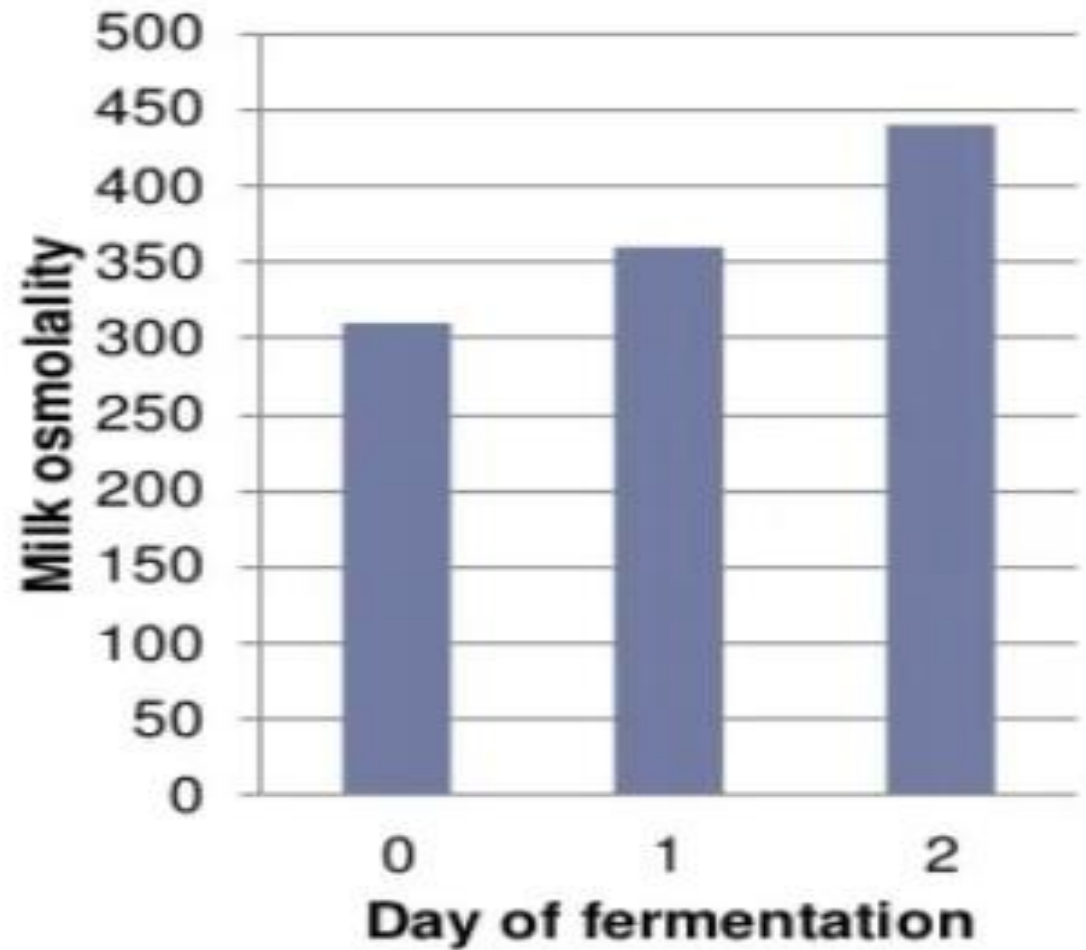
# Changes in UHT milk occurring during spontaneous fermentation at 37°C

---

## Change in pH



## Change in osmolality



## Conclusion of the study:

---

- ▶ This method gives the benefit of monitoring milk for proper composition & assurance of Shelf life.
- ▶ Osmolality can also be used as an index of the extent of milk fermentation & is therefore suitable for quality analysis of fermented milks & milk products.



## 2. Effect of **k-carrageenan** & tetrasodium pyrophosphate on the yield of direct acidified cottage cheese.

---

Subarna Makhal · Apurba Giri · Suresh Kumar Kanawjia

- ▶ Endeavours were made to improve the yield of direct acidified cottage cheese through the addition of **k-carrageenan** in milk before heat treatment and **TSPP** immediately before renneting.
- ▶ **k-carrageenan** was added at the levels of 0.005, 0.015 & 0.025% whereas **TSPP** was added at the levels of 0.02, 0.05 & 0.08%.
- ▶ **k-carrageenan** possesses strong gel forming ability & shows interaction with the whey proteins thereby including them with the casein during coagulation.

## Effect of addition of different levels of $\kappa$ -carrageenan & TSPP in milk on the yield of direct acidified cottage cheese curd

Level of $\kappa$ -carrageenan %				
	control	0.005	0.015	0.025
Protein%	73.4±0.10	88.3±0.04	88.5±0.03	88.5±0.04
Whey proteins%	1.20±0.39	14.5±0.06	14.8±0.07	14.8±0.07
Moisture%	74.4±0.07	74.9±0.08	75.4±0.09	75.5±0.10
Level of TSPP %				
	control	0.02	0.05	0.08
Protein%	73.4±0.10	73.5±0.11	73.4±0.09	73.4±0.09
Whey proteins%	1.20±0.39	1.18±0.38	1.17±0.04	1.20±0.037
Moisture%	74.4±0.07	74.4±0.05	74.3±0.06	74.45±0.07



## Conclusion of the study:

---

- ▶ The addition of 0.015% k- carrageenan followed by heat treatment at 90°C for 5 min enhanced the yield by 13.6% due to increased recovery of whey proteins & moisture retention in cheese.
  - ▶ Addition of TSPP had no beneficial effect on the yield of cottage cheese.
  - ▶ Therefore, k- carrageenan could be utilised in the manufacture of good quality cottage cheese with increased yield.
-

# References

- Srilaksmi.B, Food Science, Third Edition, 2003, New Age International Publisher, New Delhi.
- Vaclavik, V.A., Christian, E.W., Essentials of Food Science, Third Edition, Springer.
- Journal of food science & technology
- [www.wikipedia.com](http://www.wikipedia.com)
- <http://www.ifst.org/learninghome/>





*Thank you*

