Total Solids & SNF estimation

- Gravimetric Method
- Lactometer Method
- Infrared Spectroscopy
- Formulas- Richmond, Babcock, Fleischmann's

CONDENSED OR CONCENTRATED MILK

Concentrated milk – product obtained by evaporating part of the water of whole or skim milk with or without addition of sugar

- Condensed milk: full cream sweetened milk
- Evaporated milk: full cream unsweetened milk
- Skimmed milk products: sweetened and unsweetened
- Unsweetened condensed milk – Evaporated milk
- ratio of concentration of milk solids: 1: 2.5 for full cream products and 1: 3 for sweetened condensed skim milk

	Fat %	Milk Solids % (minimum)
Evaporated milk	8% (minimum)	26
Condensed milk	9% (minimum)	31
Evaporated Skim milk	0.5% (maximum)	20
Condensed skim milk	0.5% (maximum)	26

Cane Sugar in sweetened milks: 40% (minimum)

Seeding

- Crystallization of lactose by the addition of fine powder of lactose or small quantity of condensed milk from previous batch.
- Purpose: **forms very small crystals** in the supersaturated solution

- Pilot Sterilization test: to determine the amount of chemical stabilizer to be added in evaporated milk
- Baume Hydrometer test- most commonly used for density test of condensed milks
- Storage temp.- 5-16 **°C**

Dried milks

- Dried milk or milk powder: moisture content 5% or less

	Whole Milk powder (WMP)	Skim Milk powder (SMP)
Moisture % (max)	5	5
Fat %	26 (minimum)	1.5 (max)
Solubility index	15 if roller dried and 2 if spray dried	

Milk Drying Systems

- **Cold**
  - **Freezing out water And centrifuge**
  - **Freezing milk. And sublimation.**
- **Heat**
  - **Film, Roller or Drum Drying**
    - **Atmospheric Or Vacuum**
  - **Spray Drying – commercial method**
    - **Compressed Air, Pressure Spray or Centrifugal Disc**

Spray drying method:

Receiving milk

Cooling

5 ºC

Pre-heating at 71 ºC.

Filtration/clarification

Heat

Combination of 82 ºC for 15 minutes

Condensing

concentration of 35-40 % total solids is produced

Pumping

preheated concentrate at 71º C is forced through the atomizer pressure of 2500 psi.

Spray drying

dried with inlet air at 143-232 º C and the exit air at 74 to 93 ºC

Cooling, Sifting

A12 mesh screen

Packaging ,Storage:

temperatures lower than, 24º C, in a cool, dry place

- Instantization: process by which dried milk are made instant soluble
- Wettability: measure for the ability of a powder to be wetted with water at a given temperature
- Agglomeration: particles collide with each other and adhere
- Skim milk powders more wettable than WMP because of less fat content
- solubility (reconstitutability):
- Spray dried milk (once it has been wetted) - soluble up to 98 to 99%
- roller- drying reduces the solubility of the powder to 80 to 85% by damage to the fat globule – lowest in all methods

Fermented milk

- Acidophilus milk: fermented milk developed with L. acidophilus culture
- Bulgarian milk : L. bulgaricus

Kumiss: originated in Russia - Lactic acid + Alchol fermented milk
- Formerly mare's milk now cow's
- Alcohol content 2.5%

Kefir: 1% lactic acid + 1% alcohol

Filmjolk: Scandinavian sour milk

Functional milk products

- specialized dairy items designed to provide additional health benefits beyond basic nutrition
- lactose-free milk - made by filtering regular milk to remove half the lactose and adding enzyme Lactase
- Filled milk: homogenized product prepared from refined vegetable oil & water.
- UHT processed milk: packed & aseptically sealed in pre-sterilized containers. can be stored Unrefrigerated for at least 3 months
- Designer milk: as per consumer requirement using biotechnology
- Irradiated milk: increased Vitamin D content by UV rays exposure
- Evaporated milk must be fortified with Vit. D

- Recombined Milk: product obtained when butter oil (also called anhydrous milk fat), skim milk powder and water are combined in the correct proportions to yield fluid milk.
- Reconstituted milk: dispersing milk powder in water
- Humanized milk: chemical composition modified to match human milk
- Imitation milk: milk of non dairy origin
- Vegetable toned milk: milk protein of SMP substituted by groundnut protein (MILTONE BY CFTRI , Mysore)

Cream

According to PFA 1976, minimum fat % - 25%
(FSSR, 2011):
1. Low fat cream: milk fat not less than 25.0 %
2. Medium fat cream: not less than 40.0 %
3. High fat cream: milk fat not less than 60.0 %

Classification: based on end use

- Table cream, Light cream, Coffee cream : 20-25% milk fat
- Heavy cream Whipping cream: 30-40% milk fat
- Plastic cream: 65-85% milk fat

PRINCIPLE: Based on the fact that milk fat is lighter than skim milk portion

PARTICULARS	GRAVITY METHOD	CENTRIFUGAL METHOD
NATURE OF FORCE CAUSING SEPARATION	GRAVITATIONAL	CENTRIFUGAL
SPEED OF SEPARATION	EXTREMELY SLOW	PRACTICALLY INSTANTANEOUS
DIRECTION OF MOVEMENT PARTICLES	VERTICAL	HORIZONTAL
FAT % OF CREAM	10-25	18-25
% fat recovered in cream	Not more than 90	99-99.5

- velocity or rate at which the fat globules rise is given by a equation, which is known as Stoke's Law
- In centrifugal method – skim milk on periphery and cream inside
- Cream screw in and skim milk screw out: higher fat% and vice versa

- skimming efficiency: % age of fat recovered in form of cream from milk
- High acidity of milk precipitate casein resulting in clogging of bowl deceasing efficiency of skimming

- can not be separated from Homogenized milk
- Pasteurization : LTLT-> 71 °C for 20 min
- HTST: 95-100 °C for 5-16 seconds

- Vaceration: dilutes the cream and it will lower the fat percentage of cream up to 6 - 8 %

Defects

- Oxidized/oily/Metallic/Tallowy: Fat oxidation due to direct contact of milk with copper or iron, exposure of milk or cream to sunlight, etc.
- Rancid: Fat hydrolysis due to lipase action in milk or cream
- Highly acid/sour

i. Using sour milk for separation

ii. Acid development in cream

Butter

- Balancing wheel of dairy industry
- water-in-oil type emulsion
- Butter fat- 80% (76% in desi butter) Moisture-16 % Salt-3 % and Curd-1.5 % (FSSR)
- No preservative except common salt
- No coloring material except annato or carotene
- Flavoring agent – Diacetyl (not more than 4ppm)

Indian butter: Butter fat-80.2% Moisture-16.3 % Salt-2.5 % and Curd-1.0 %

- fat in water emulsion is changed to water in milk fat emulsion
- Milk→ separated to get cream→ treatment of cream→ conversion to butter → storage
- Coloring agent: natural Annatto, carotene
  - Neutralizers: lime, soda
  - Flavoring agent: Diacetyl

Fisher and Hooker's phase reversal theory

- Churning is process of phase reversal Changing oil in water to water in oil

-agitation of cream causes: coalescence and clumping of fat globules

-ratio of surface area to volume of fat becomes very small

-no longer contains all the buttermilk in stable form

-fat in water emulsion breaks

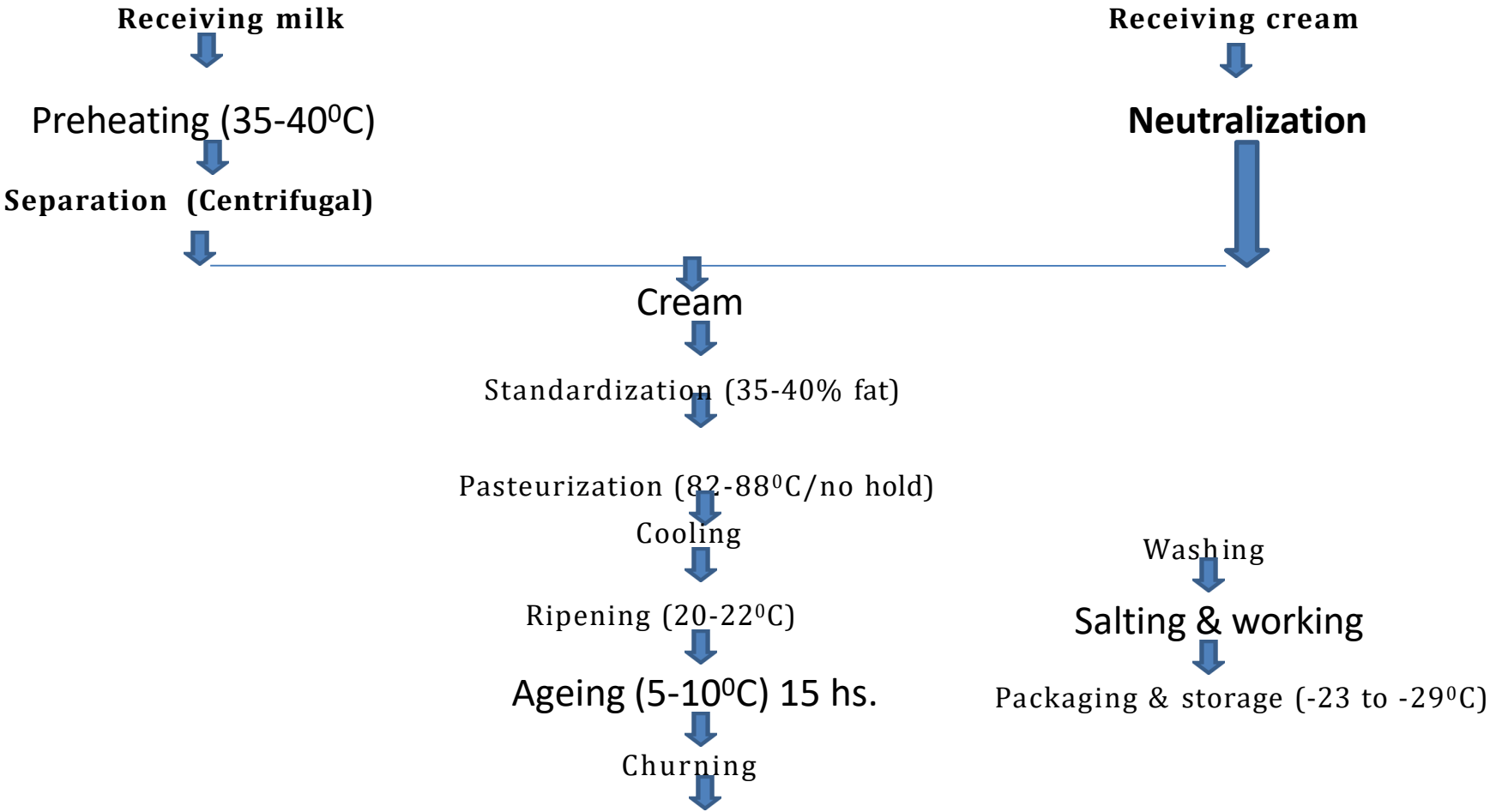
Rahn's foam theory

- foam produced→ fat globule concentrate in foam → bubble due to surface tension--→ foam producing assumes solid character→ foam collapses and fat globules coalesce and butter formed
- based on principle Air/ foam was necessary for churning

king's modern theory

- churning breaks the clusters and causes foam formation
- fat globules concentrated to air bubble in the foam thus brought close to each other to form large particles

Method of manufacture, packaging and storage



Steps in butter making:

- Neutralization of cream: reduce the acidity of cream to 0.14-0.16%
- Standardization of cream: 33-40%
- Pasteurization of cream: 90- 95 ^{o} C for 15 or 105-110^{o}C with no holding
- Cooling and ageing at 5-10 ^{o}C
- Ripening of cream: by mixture of both acid producing (*Streptococcus lactis*, *S.cremories*) and flavour producing (*S.diacetylactis*, *Leuconostoc citrovorum* and/or *Leuc. Dextranicum*, Clostridium butyricum)
- the cream is incubated at about 21^{o}C till desired an acidity is reached.

- Churning of Cream: Winters- 10-13°C
  Summers: 7-9°C (Avg. 9-11)

- Salting & Working: Working of butter is a kneading process in which butter granules are formed into a compact mass
- Storage -23 to -29°C

- Gritty - Undissolved coarse salt, incorrect salting
- Grainy - Incorrect neutralization of high acid cream with lime
- *Yeasty flavour and odour*: fermentation of the cream by Torula Cremoris and Torula sphaerica

Over run

- increase in the amount of butter made from the given amount of fat caused by the presence of **moisture , curd, salt etc in butter**
- $\% \text{ OR} = \frac{B-F}{F} \times 100$

- OR= Overrun in butter(%)
- B= Butter made (kg)
- F= Fat in churn (kg)

ICE CREAM

frozen milk product made by freezing a pasteurized mix with agitation to incorporate air.

should contain not less **than 10%milk fat, 3.5% protein, and 36% total solids**

Composition of Ice cream mix-

Milk/milk powder +sugar + dextrose+ corn syrup+ water + flavour + stabilizer (0.3-0.5%) + emulsifier (0.3-0.5%)

Composition of Ice-cream-

Fat (12-20%) ,SNF (8-15%), Sugar (13-20%).

Role of the constituents in ice cream

1. **Milk fat:** full, rich, creamy flavour

2. **Milk solids not fat:** milk sugar adds to the sweet taste. The milk proteins help to make ice cream more compact and smooth
3. **Sugar:** increase the acceptability of ice cream. The desired sweetening effect is only produced by sucrose.

4. **Stabilizers:** prevent the formation of objectionable large ice crystals in ice cream, especially during storage.

5. **Emulsifiers:** improve upon and provide a uniform whipping quality of the mixture.

- Ice cream without Hardening process: Soft serve or Softy
- overrun due to air - Maximum allowable over run up to 100%
- Sandy Texture: caused by Lactose crystals which do not dissolve readily and produce a rough or gritty sensation in the mouth
- Whipping quality: reduced air cell sizes and a homogeneous distribution of air in the ice cream

Stabilizer- prevent the formation of objectionable large ice crystals in ice cream, especially during storage

-Sodium alginate, methyl cellulose, gelatin

Emulisifier- mainly to improve upon and provide a uniform whipping quality of the mixture, and to produce a drier ice cream with smoother body and texture.

- Egg yolk, sorbitol, propylene glycol esters

Cheese

1) Very hard- less than 25% moisture e.g. Parmesan, Romano

2) Hard – 25 to 36% moisture
a)Ripened by bacteria, without eyes: **Cheddar**
b)Ripened by bacteria, with eyes: Swiss (*Propionibacterium shermanii*)

3.)Soft cheese - 40 % moisture
a)Unripened – Cottage
b)Ripened – Neufchatel

4.) Semi-hard- 36 to 40 % moisture

a)Ripened principally by bacteria: Brick

b)Ripened by bacteria and surface microorganisms: Limburger

c) Ripened principally by blue mould:

i)External – Camembert (*Penicillium camemberti*)

ii)Internal – Gorgonzola, Blue, Roquefort (*Penicillium Roqueforti* and *Penicillium Glaucum*)

- Cottage cheese from Skim milk
- Ricotta cheese from Whey
- Mozarella cheese from buffalo milk
- Cheddar cheese from Cow milk
- Feta cheese from goat milk
- Portuguese cheese from ewe milk
- Withania coagulans/Indian rennet- rennet substitute in the production of cheese

AVERAGE COMPOSITION OF CHEESE

Name	Moisture	Fat	Protein	Ash and salt
Brick	42.5	30.7	21.1	3.0
Camembert	47.9	26.3	22.2	4.1
CHEDDAR	36.8	33.8	23.7	5.6
Cottage	69.8	1.0	23.3	1.9
Cream	42.7	39.9	14.5	1.9
Edam	38.1	22.7	30.9	6.2
Limburger	54.8	19.6	21.3	5.2
Parmesan	17.0	22.7	49.4	7.6
Roquefort	38.7	32.2.	21.4	6.1.

Scientific basis of cheese making

1. First stage is Souring /ripening
2. Second stage is Clotting /coagulation by rennet
3. Third stage is Cutting and drainage of whey.
4. Fourth stage is Matting of the curd.
5. Fifth stage is Maturing /curing

CHEDDAR CHEESE

- type of hard cheese
- Starter culture usually contains Str. Lactis and/or Str. Cremoris
- Hot iron test: to check end of cheddaring
- Starter culture added @ 0.5-1% of milk at 30-31°C
- **Rennet: Rennin (clotting) + Pepsin (proteolysis)** @ 15-25ml/100L of milk
- Color @ 30-200ml/ 1000Kg of milk
- Salting @1-2%

Flow diagram of manufacture

Heart of cheese

Receiving of milk
↓
Preheating (35-40C)
↓
Filtration/clarification.
↓
Standardization
↓
Pasteurization (63ºC/30min.)
↓
Adding starter cultures (ripening)
↓
Adding colour
↓
Adding rennet (clotting) 31ºC
↓
Coagulation ad setting
↓
Cutting
↓
Cooking (up to 37ºC)
↓
Drainage of whey
↓

Cheddaring
↓
Milling
↓
Salting
↓
Hooping
↓
Dressing
↓
Pressing
↓
Drying
↓
Paraffining
↓
Curing/ maturing.

Filtration and clarification

Preheating: 35 to 40 °C

Standardization: In cheese making standardization refers to adjustment of the casein/fat ratio in cheese to 0.68 to 0.70.

Objectives:

1. To regulate the fat in the dry matter of cheese.
2. To produce the maximum amount of cheese per kg of fat in cheese milk.

Pasteurization: The usual temperature time employed for pasteurization of cheese milk is Holder – 63°C for 30min. HTST – 72°C for 15sec.

Addition of calcium chloride

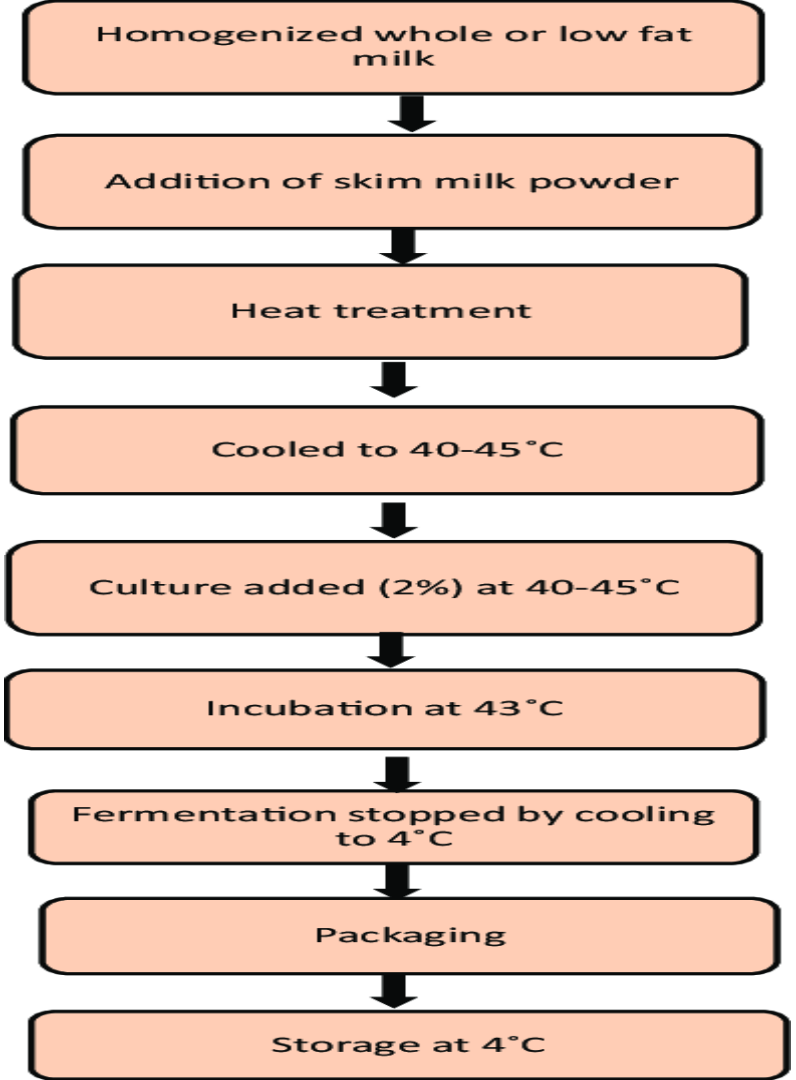
* Excessive heat treatment of milk causes the precipitation of a part of calcium salts in milk.

* It results in slower renneting action and a weaker curd.

* Which can be corrected by the addition of **0.001 to 0.03 %** calcium chloride to milk.

Yoghurt

- Fat % - 0 to 5 and total solids 9-20%
- Lactobacillus bulgaricus and Str. Thermophilus – grow symbiotically and responsible for fermentation
- Temp. of incubation: 41-43°C


Homogenized whole or low fat milk
Addition of skim milk powder
Heat treatment
Cooled to 40-45°C
Culture added (2%) at 40-45°C
Incubation at 43°C
Fermentation stopped by cooling to 4°C
Packaging
Storage at 4°C

Dahi/ Curd

- Sweet Dahi with acidity < 0.7%
- Sour Dahi with acidity around 1%
- Sweetened Dahi: by adding 6.25% cane sugar

- Starter culture for sweet dahi: *Streptococcus lactis, Str. cremoris, Str. diacetalactis*
- Starter culture for sour dahi: same as above along with *Lactobacillus bulgaricus and Str. Thermophilus*

Characteristics	Requirement for sweet dahi	Requirement for sour dahi
Acidity, lactic (percentage weight)	0.70	1.0
Yeast and mould count/gm	100	100
Coliform count/gm	10	10
Phosphatase test	Negative	Negative

Dahi v/s Yoghurt

Dahi

- Acidity: 0.6-0.7%
- Flavor due diacetyl (obtained from mother compound acetyl methyl carbinol)

Yoghurt

- Acidity: 0.9%
- addition of artificial sweeteners and flavors
- Acetaldehyde and diacetyl responsible for flavor

Misti Dahi

- Sweetened Dahi: Misti dahi or lal dahi – popular in eastern region of country
- Brown color , cooked and caramelized flavor
- Addition of 6.25% cane sugar

Shrikhand

- sweetened-dewatered dahi. This product is extremely popular Western and some parts of Southern India.
- Minimum fat % 8.5 and total solids 58%
- Titrable acidity not more than 1.4%

- inoculated with culture containing Str. lactis subsp. lactis and Lactococcus Lactis var. diacetilactis

Preparation

- dahi is suspended in a muslin cloth until all the free water has drained off
- The semisolid mass obtained is called Chakka
- In industrial method, skim milk is used initially and sugar is added @ 80% of amount of chakka, required amount of plastic cream having 80% fat added to give at least 8.5% fat to shrikhand

Dairy Products

1. Cultured/ fermented milk products: curd, lassi, Dahi, Chakka, Shrikhand

2. Acid coagulated milk products- Channa, panner

3. Acid and Rennet coagulated milk products- Cheese

4. Heat dessicated/ dehydrated(concentration and coagulation) - Rabri, Basundi, Khoa, Khurchan (23.6%fat)

Chhana-based sweets i. Rasogolla ii. Pantooa iii. Sandesh iv Rasmalai v. Cham Cham vi. Chhana-murki vii. Chhana podo viii. Milk cake

Indian Dairy product	Western counterpart
Kheer/ Basundi	Condensed milk
Khoa	Evaporated milk
Rabri	Clotted cream
Kulfi	Ice cream
Ghee	Butter oil
Lassi	Butter milk
Channa	Lactic coagulated green cheese
Paneer	Soft cheese

Partially desiccated sweetened milk product: Basundi

Partially concentrated and sweetened milk product that contains several layers of clotted cream: Rabri (20% fat)

- Conc. Milk, rice, sugar: Payasam
- Rennet coagulated, small sized soft cheese: Panir

Channa

- milk solids obtained by the acid coagulation of boiled hot milk and subsequent drainage of whey.
- Moisture-53.5% Fat- 25%
- Protein-17.5%
- Lactose-2% Ash-.2%

- should not contain more than 70 per cent moisture and milk fat should not be less than 50 per cent of the dry matter

Preparation

- Boiling of milk in karahi.
- Reducing the temperature of milk to 80°C and required quantity of coagulants is added slowly till the coagulation.
- The strength of the coagulating acid solution is 1-2%.
- Coagulants are lactic (for rosogolla) and citric acid (for sandesh).
- Contents of vessel emptied over a piece of muslin cloth.
- No pressure is applied

- **Yield of channa:**
  - Cow milk is 16-18%.
  - Buffalo milk is 22-24%

- Cow milk preferred for channa making, because it has open texture - yields smooth textured and smooth body product
- Used for making sweets like rosogulla, Sandesh

Sandesh

- sweet of eastern India and Bangladesh
- Made up of Milk, sugar, channa or paneer

It is broadly classified in 3 main varieties:

1. Low moisture / Hard grade – Kara Pak
2. **Medium moisture / Soft grade – Naram Pak**
3. High moisture – Kaccha gola

- Soft grade is the most selling variety in India

PANEER

- Heat acid coagulated milk solid
- moisture 60-70%
- Total solids 30-40% (milk fat not less than 50% of DM basis)
- pressure is applied for removal of whey while in Channa hanged over a hook wrapped in cloth
- Buffalo milk preferred –whitish, sweetish

Flow chart

Standardization of milk to 6% fat

↓

Heating upto 82 ^{o}C for 5 minutes

↓

cooling to 70 ^{o}C

↓

coagulation with 1% citric acid (1.5-2/litre)

↓

Drain the whey

↓

pressed & made it into cubes

↓

hardened in chilled water for 1-2 hours (4-6 ^{o}C temperature)

↓

Cut into pieces and packed

Khoa/ Mawa

- Partially dehydrated (heat coagulated) whole milk product prepared by continuous heating of milk in a karahi over a direct fire, while also constantly stirring-cum-scraping by till it reached a semi solid consistency.
- milk fat content should not be less than 20 percent

- Buffalo milk is preferred over cow milk because it gives higher yield with good quality khoa with soft and smooth body, granular texture.
- Overrun is because of moisture.
- Yield – cow milk: 17-19% while buffalo milk 21-23%

Type of milk	Composition of khoa					
	Moisture	Fat	Protein	Lactose	Ash	Iron(ppm)
Cow	25.6	25.7	19.2	25.5	3.8	103
Buffalo	19.2	37.1	17.8	22.1	3.6	101

three main varieties are "**pindi**" for burfi, "**dhap**" for gulabjamun, pantooa etc., and "**danedar**" used for kalakand

Increase in Iron content :From 2 to 4 ppm in milk, the iron content in khoa exceeds 100 ppm due to scrapping of the pan surfaces during the manufacture

Constituents	Khoa type		
	Dhap	Pindi	Danedar
TS (%) min	55	65	60
Fat (% dmb) min	37	37	37
Protein (% dmb) min	37	37	37
Ash (%dmb) max	6	6	6
Titrable acidity (% LA) max	0.6	0.8	0.9
End uses	Gulabjamun, milk cake	Burfi, peda Pantua	Kalakand,

Khoa

- At room temperature (24-30°C) a rancid flavour is developed on *khoa*
- low temperature (5-10°C) a stale and sour flavour is observed and there is mould growth on the surface
- keeping quality of *khoa* at room temperature-5 days and 10 weeks at 4°C
- **Generally 4 kg of buffalo milk or 5 kg of cow milk yield one kg of *khoa***
- ***Pantua, Kala jamun manufactured from both Khoa and channa***

Ghee

- Clarified butter fat prepared chiefly from cow or buffalo milk.

- Milk fat - 99 to 99.5%
- Moisture Not more than 0.5 %
- Shelf life of ghee- 6-12 months at 21°C
- Buffalo milk preferred being richer in fat content and gives larger yield of ghee
- Flavor of Ghee is because of Lactones

Properties

- Specific gravity: 0.93-0.94
- Refractive index 40-45
- RM number: min. 28 (cotton seed feeding areas 20)
- Polenske number: min. 2 (------do→1.5)
- Solidifying point 28 to 15° C
- Iodine value : 26 to 38
- Saponification number: 220
- Melting point: 28-44° C

- Granularity in Ghee: presence of high melting saturated FA e.g Stearic, Palmitic acid
- buffalo: white color with greenish tinge due to Biliverdin
- cow- golden yellow due to carotene
- Natural antioxidants: Tocopherol, carotene
- Synthetic: BHA, BHT, hydroquinone, gallic acid esters
- BHA level should not exceed 0.02% in Ghee (PFA, 1976)

Ghee may contain BHA not more than 0.02% as antioxidant

Table 4: Agmark standards of *Ghee*

Sr. No.	Tests	All India	Winter regional	Summer
1.	B audouin	Negative	Negative	Negative
2.	Phytosterol acetate	Negative	Negative	Negative
3.	B.R. reading (40°C)	40.0-43.0	41.5-44.0	42.5-45.0
4.	R.M.value (Minimum)	28	23.0	21.0
5.	Polenske value	1.0-2.0	0.5-1.2	0.5-1.0
6.	Moisture (%)	Maximum	0.3	
7.	Free fatty acids (as % Olic acid)			
	Special grade (Red label)	Not more than	1.4	----------
	General grade (Green label)	Not more than	2.5	
	Standard grade (Chocolate label)	Not more than	3.0	----------

PREPARATION

- Ghee is prepared by five methods, namely,
- Desi
- Creamery butter
- Direct cream
- Pre-stratification methods
- Continuous method – industrial method

Desi Method: Fresh makkhan (butter) heated and stirred on a low fire moisture has been removed, further heating is stopped and cooled.

Merits:

1. Desirable flavour, body and texture

Demerits:

1. Extremely small scale in operation
2. Low keeping quality and vitamin content.

Creamery butter method:

- Unsalted creamery butter heated in an ghee boiler at a temperature of 90°C.
- The contents are agitated to prevent scorching.
- The scum, periodically removed,
- When all the moisture have been driven out---end point is indicated by the appearance of effervescence.
- Characteristic ghee flavour emanates at temperature 110-120 °C
- heating stopped, the ghee is filtered

Pre-stratification method:

1. Butter is left undisturbed 80-85 °C for 15 to 30 minutes.
2. Stratifies, into 3 distinct layers
   I. a top layer of floating denatured particles of curd,
   II. a middle layer of fat,
   III. and a bottom layer of buttermilk.
3. Bottom layer of buttermilk contains 60-70 % of solids-not-fat and over 80 % moisture.
4. Buttermilk is removed mechanically without disturbing the top and middle layers.
5. Temperature of the remaining two upper layers is raised to the usual clarifying temperature of 110-120°c.

Direct-cream method: Cream heated in ghee boiler similar to Creamery butter method

Continuous method:

Objective:

To manufacture ghee on an industrial scale

Advantages:

1. Large scale handling
2. Utilization of machines for a large number of operations
3. High fat recovery
4. No stirring, no scrapping and no laborious effort on the part of the ghee operators required.

Test for adulteration

- Valenta test: animal fat adulteration
- Halphens test: for cotton seed oil
- Nitric acid test, Baudin test, Phytosterol test: vegetable oil adulteration

Indian Dairy Products

- Panir: indian variety of rennet coagulated small sized soft cheese e.g. surati panir, bandal cheese
- Kheer/ basundi: partial dehydation of whole milk in karahi
- Khurchan: concentrated, sweetened whole milk product prepared by simmering without stirring in karahi and have fat % of 23.6
- Rabri: concentrated and sweetened milk product containing several layers of clotted cream and have 20% fat

BUTTEROIL

- Butteroil - almost total removal of water and milk solids not fat
- moisture around 0.4%
- Fat: 99.8%

*Anhydrous milk fat(AMF) moisture around 0.1%

By- products of commercial value are obtained during the manufacture of main product from milk.

Main product	By product
Cream	**skim milk**
Butter	butter milk
Ghee	**ghee residue**
Channa/paneer/cheese	**whey**
Curd	lassi

Composition of whey

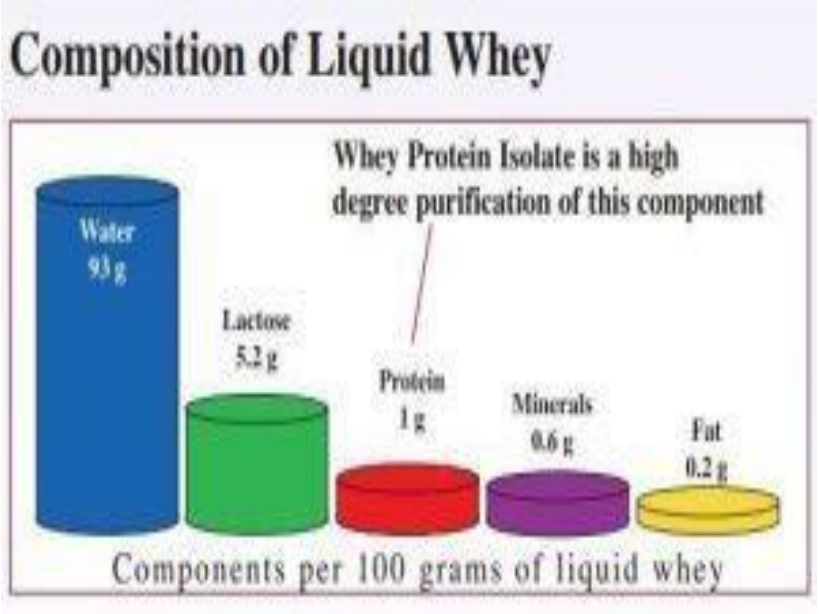


Table 1

Protein	Content in Milk g/L
Major Whey Proteins	
β-lactoglobulin	3.3
α-lactalbumin	0.7
Serum Albumin	0.3
Proteose peptones	1
Minor Whey Proteins	
Immunoglobulin	700mg/L
Lactoferrin	100mg/L
Lactoperoxidase	30mg/L
Lysozyme	0.13mg/L

Adapted from (Modler, 2000).

Product	Packaging Material
Liquid milk	Glass bottles (obsolete) LDPE film Paper laminates for tetra packs
Milk Powder	Tin plate containers, nitrogen packed, and lacquered from outside. Flexible laminates such as metallized PET / BOPP / Aluminium foil / Poly laminates. Refill packs; lined cartons laminated with BOPP / PET, varnished on the outside. Bag-in-box; Powder filled in laminate and packed in cartons.
Butter	Duplex board with vegetable parchment paper Tin plate containers Aluminium foil
Cheese / Cheese spread	Tin plate containers lacquered from inside First packed in aluminium foil and then in duplex board carton Injection moulded PP / HDPE container
Ghee	Tin plate containers lacquered from inside Glass bottles HDPE film pouches
Ice cream	Thermoformed / Injection moulded plastic containers Duplex board carton (poly laminated) Laminates of BOPP (Biaxially Oriented Polypropylene) / PET
Indian Dairy Products	Injection moulded / thermoformed containers (shrikhand, gulab jamun) Stand up laminated pouches

APPENDIX

Bacteriological standards as prescribed by Bureau of Indian Standards (BIS)

Bacteriological standards of raw milk (IS-1479 PART III-1997)

Grades	Direct microscopic count per ml (lakhs)	Standard plate count per ml (lakhs)	Methylene blue reduction time (hr)	One hour resuzurin disc. (No.)	Presumptive coliform test (in 0.01 ml) i.e. 1 in 100
Very good	NS	< 2	> 5	NS	absent
Good	< 5	2-10	3-4	4 or higher	absent
Fair	5-40	10-50	1-2	3.5 to 1.0	absent
Poor	40-200	> 50	< 1/2	0.5 to 0	present
Very poor	> 200	NS	NS	NS	NS

NS : Not specified

Bacteriological standards of pasteurised milk (IS-6397-1971)

Test	Requirement
Standard plate count	Maximum 30000 cfu/ml
Coliform count	absent in 1:10 dilution
MBRT	more than 4 hr
Alkaline phosphatase	test negative

Bacteriological standards of cream (IS-3509-1966)

Type of Cream	Type of count	Level in Cfu/ml or g (lakhs)	Grade
Raw Cream	Standard plate count	< 4	Very good
		4-20	Good
		20-100	Fair
	Coliform count	100	Poor
		< 100	Satisfactory
Pasteurised	Standard plate count	< 60000	Satisfactory
	Coliform count	< 10	Satisfactory

Bacteriological standards of butter (IS-3507-1966)

Yeast & Mold count/ml	Quality
< 20	Good
21-50	Fair
51-100	Poor
> 100	Very poor

Bacteriological standards of ice cream (IS-2802-1964)

Test	Limit
Standard plate count (per g)	not more than 2,50,000
Coliform count (per g)	not more than 90
Phosphatase test	negative

Bacteriological standards of condensed milk (IS-1166-1973)

Characteristics	Full cream	Skim milk
Bacterial count (cfu/g. maximum)	500	500
Test for Coliforms	Negative	Negative
Yeast and Mold count (cfu/g. maximum)	10	10

Bacteriological standards of milk powder (IS-1165-1975)

Types	WMP and extra grade SMP	Standard grade SMP
Total bacterial count, max, cfu/g	40,000	50,000
Coliform count	absent in 0.1 g	absent in 0.1 g
Salmonella	absent in 25 g	not specified
Staph aureus (coagulase positive)	absent in 0.1 g	not specified
Shigella	absent in 25 g	not specified

Bacteriological standards of indigenous dairy products.

Product	Standard plate count max (cfu/g)	Coliform count, max (cfu/g)	Yeast and mold count, max (cfu/g)	ISI Manual Reference No.
Khoa	NS	90	50	IS-4883-1980
Burfi	30,000	NS	10	IS-555-1970
Paneer	5,00,000	100	250	IS-10984-1983
Kulfi	2,50,000	100	NS	IS-10501-1983
Chakka	NS	10	20	IS-9532-1980
Shrikhand	NS	10	50	IS-9532-1980
Canned Rasogolla	500	Nil	NS	IS-4079-1967

Microbiological standards for assessing the sterility of utensils/equipments as prescribed by BIS (cited from *Fundamantals of Dairly microbiology* by Prajapati p:44.)

	Rinse method Colony count per liter capacity of can	Swab method Colony count per 900 sq.cm. area of equipment surface
Satisfactory	< 1000	< 5000
Fairly satisfactory	1000 to 5000	5000 to 25,000
Unsatisfactory	> 5000	> 25,000

- Buffalo milk is preferred over cow milk for manufacture of Paneer because (RPSC 2019)

a) Paneer prepared from Buffalo milk is white in colour, sweetish, spongy, nutty flavoured.

b) Paneer prepared from Buffalo milk is very compact and fragile and its pieces lose their identity during cooking.

c) Paneer prepared from Buffalo milk is often substituted for meat in many vegetarian dishes of Indian cuisine.

d) Paneer prepared with buffalo milk is more quantitatively as compared to cow milk.

- Which of the following milk product has the highest fat percentage?

(A) Rasgulla (B) Kulfi (C) Khoa (D) Basundi

- Normal Butyro-Refractometer (BR) reading of ghee at 40 °C varies from

[A] 40-45 [B] 20-25 [C] 30-35 [D] 50-55

- Standardization of cheese milk during cheese making is adjustment of casein/fat ratio of

[A] 0.48 to 0.50

[B] 0.86 to 0.90

[C] 0.68 to 0.70

[D] 0.78 to 0.80

A good quality paneer is obtained by

- a. heating milk to 90° C, cooling to 70° C.
- b. heating milk to 100° C, cooling to 30° C.
- c. and acidifying hot milk by adding 10% citric acid solution.
- d. and acidifying hot milk by adding 1% citric acid solution.

i. a and c

ii. a and d

iii. b and c

iv. b and d

- The moisture content of hard cheese in generally:

(A) 35-40% (B) 40-45% (C) 70-80% (D) None of the above

- The milk having an acidity of 0.72% will:

(A) Curdle on boiling

(B) Coagulate spontaneously

(C) Coagulate followed by liquefaction

(D) Remain normal

- Difficulties are experienced in curdling and ripening of cheese if milk contains:

(A) Antibiotic residue

(B) Pesticide residue

(C) Insecticide residue

(D) All of the above

- According to BIS, the SPC in 'burfi' should not exceed:

(A) 250/g

(B) 3×10^4

(C) 2×10^8

(D) 4×10^7

- The permitted antioxidant in ghee is:

(A) BHA (B) BHT (C) NDGA (D) Ethyl gallate

- The adulteration of animal fat in ghee is tested through:

a) Bomer's Phyto-Sterol Test

b) Valenta Test

c) Baudouin Test

d) Halphens Test

The iron content of Khoa should be more than

(A) 175 ppm (B) 100 ppm (C) 200 ppm (D) 250 ppm