

10. VALUE ADDED LIVESTOCK PRODUCTS

Can you recall ?

1. Different milk products
2. Different meat products



There is worldwide rapid increase in the demand of livestock products i.e. milk, meat and eggs. The animal protein food is at the top of food chain. Milk, meat and eggs are the integral components of human diet. About 88-90 % milk produced in India is handled in unorganized sector and only 10-12 % in organized sector. Out of total milk production, 46 % milk is consumed as liquid milk while 50% milk is converted into indigenous milk products and 4 % into western milk products.

10.1 Dairy Products

Classification of Indigenous dairy products

Indian dairy products are classified as given below

A. Concentrated milk products

1. Kheer / Basundi
2. Khoa(Mava)
3. Rabri

B. Coagulated milk products

1. Paneer
2. Chhana

C. Fermented milk products

1. Dahi/ Curd
2. Shrikhand
3. Lassi

D. Fat rich milk products

1. Cream
2. Butter / Makkhan
3. Ghee

E. Frozen milk products

1. Kulfi
2. Ice-cream

Above products are manufactured from whole milk.

A. Concentrated/Desiccated milk products

Milk is highly perishable food product. In order to increase its shelf life, various technologies are employed. The products which are prepared by partial removal of moisture from milk using heat are called as heat desiccated or concentrated milk products. The general principle of manufacture

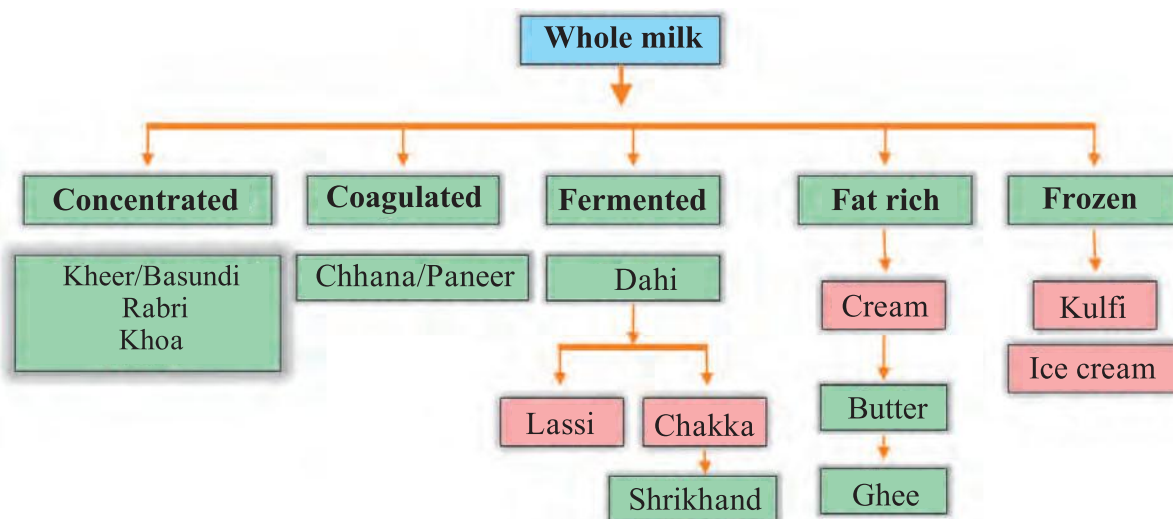
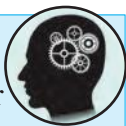


Fig. 10.1 : Indigenous milk products

of these involves removal of moisture and there by concentrating the milk solids by heating (mainly boiling) of milk in a wide mouth open vessel. Milk is continuously boiled till desired concentration of solids is achieved and more importantly till typical characteristic flavour and desired texture are developed in the final product.

Remember...

Buffalo milk is preferred for making concentrated milk products. The important products that come under this category are khoa, khoa based sweets viz. Burfi, Pedha, Kalakand, Milk cake, Rabri, Basundi /Kheer.



1. Kheer/ Basundi

Do you know ?

What is difference between kheer and Rabri ?



Kheer, also known as basundi is an Indian dessert prepared by the partial dehydration of whole milk in a karahi over a direct fire together with sugar and usually rice or occasionally semolina. It is a popular dish throughout the country.

Chemical composition : The average chemical composition of Kheer/ Basundi (Prepared under standardized conditions) is given in the table 10.1

Table 10.1: Chemical composition of Kheer

Constituents	Per cent
Moisture	67.02
Fat	7.83
Protein	6.34
Lactose	8.45
Ash	1.41
Sugar(added)	8.95

Use your brain power

Is kheer good for health?

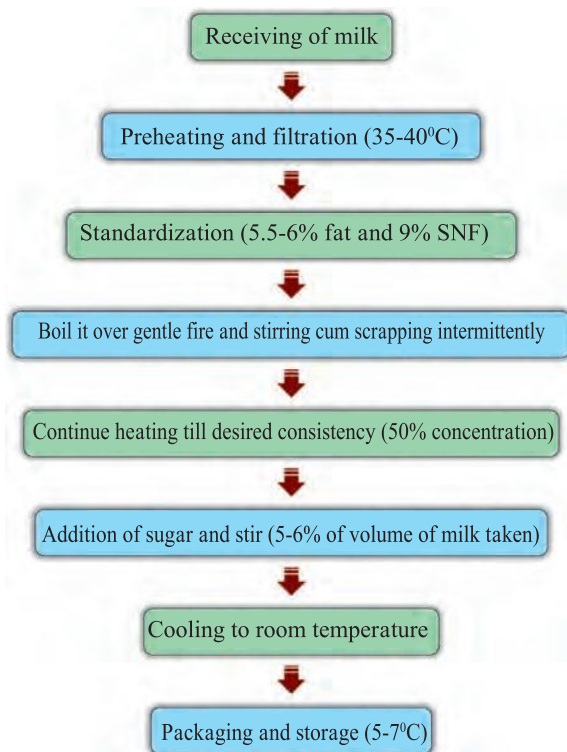


Fig. 10.2 : Method of preparation of Basundi/Kheer

Desirable qualities

- Colour: White to light caramel/brown colour.
- Flavour: Caramel aroma, having pleasant cooked and nutty flavour is most preferable.
- Body and Texture: Smooth and creamy consistency with soft textured flakes that are uniformly suspended throughout the product.



Fig. 10.3 : Basundi

Do you know ?

Do you know the term Caramelization?



Packaging and shelf life : Polystyrene and polypropylene cups, flexible polyethylene films laminated pouches are used for packaging.

At room temperature shelf life of basundi will not be more than 15-16 hrs while at refrigeration temperature it will be 15 days.

Yield : From one litre buffalo milk the yield of basundi will be approximate 500 g i.e. 50% recovery. The yield depends on the level of concentration of the milk

2. Rabri

A specially prepared concentrated and sweetened whole milk product, containing several layers of clotted cream (Malai) .It is quite popular in the northern and eastern regions of India.

Definition : Rabri is product obtained from cow or buffalo milk or combination thereof by heat desiccation in which milk is continuously simmered in wide mouth open pan. During simmering, the surface of milk intermittently cooled by hand fan to permit formation of skin. Piece of skin, which forms on the surface of milk, are continuously broken up and moved to cooler parts of the vessel. When the volume of milk

Table 10.2 : Chemical composition of Rabri

Constituents	Moisture	Fat	Protein	Lactose	Ash	Sugar
Per cent	30	20	10	17	3	20

(Source: Aneja et.al.,2002)

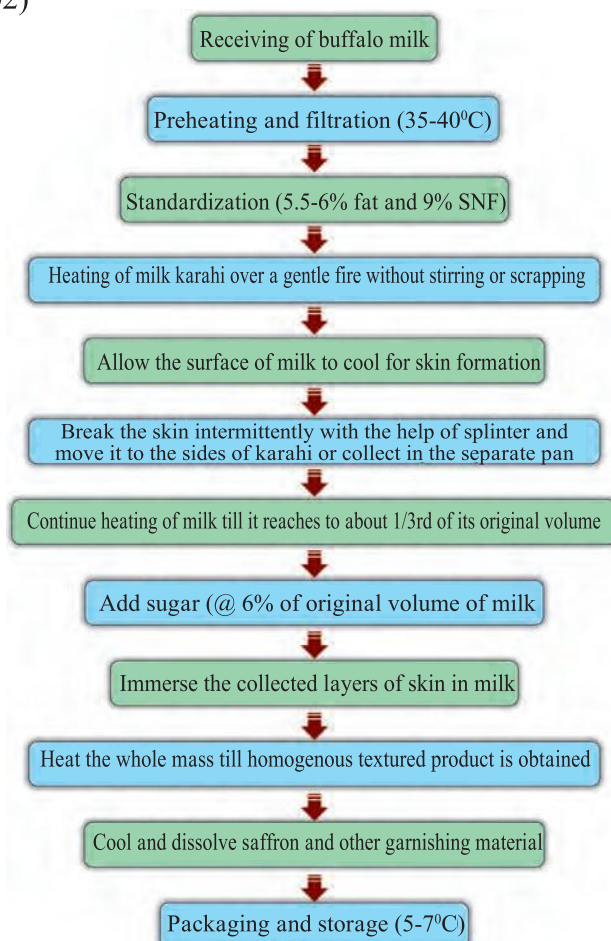
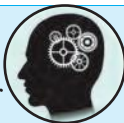


Fig. 10.4 : Method of preparation of Rabri

has been considerably reduced, sugar is added, then layers of clotted cream are immersed in the mixture and the finished product is obtained by heating whole mass for few minutes.

Remember...

Buffalo milk is desirable for Rabri preparation as it produces more creamy and chewy consistency and a higher yield.



Can you tell ?

- Is rabri and basundi same?
- Is rabri available in your area?



Fig. 10.5 : Rabri

Desirable qualities in Rabri

- Colour: Whitish to brownish with caramelized clots.
- Flavour: Sweet caramelized flavour
- Body and Texture : Creamy consistency and a viscous body with several layers of non homogenous flakes partly covered and partly floating in sweet condensed milk.

Packaging and shelf life

Polystyrene and polypropylene cups, flexible films and laminate pouches are suitable for packaging.

When packaged in polystyrene cup its shelf life is 18 hours at room temperature and 15 to 17 days at refrigeration temperature.

Yield : On an average from one litre buffalo milk the yield of rabri will be 400 to 450 grams i.e. 40 to 45 % recovery.

3. Khoa : Khoa is an important Indigenous milk product which is prepared by continuous boiling of milk until desired concentration and texture is achieved.

Do you know ?

Khoa is used as a base material for a variety of popular sweets such as burfi, pedha, gulabjamun, kalakand, kunda and many more...



Definition : Khoa is prepared by heat desiccation in which milk is continuously boiled in wide mouth open pan. During boiling, the liquid milk is stirred at first and later its solidified portion is constantly scrapped with long handed flat edged metal scrapper called “khunti” to prevent caramelization (burning).

Classification

It is classified into three main types: Pindi, Dhap and Danedar

Remember...

The principle behind khoa making is continuous heating (boiling) along with stirring and scraping of milk so that excessive moisture is evaporated, partial de-naturation of protein takes place and typical heated (Slightly cooked) flavour and slightly graining texture is developed in the final product



Buffalo milk khoa is preferred as it yields a product with a soft, loose body and smooth, granular texture while cow milk khoa is inferior in quality due to its moist surface, sticky and sandy texture.

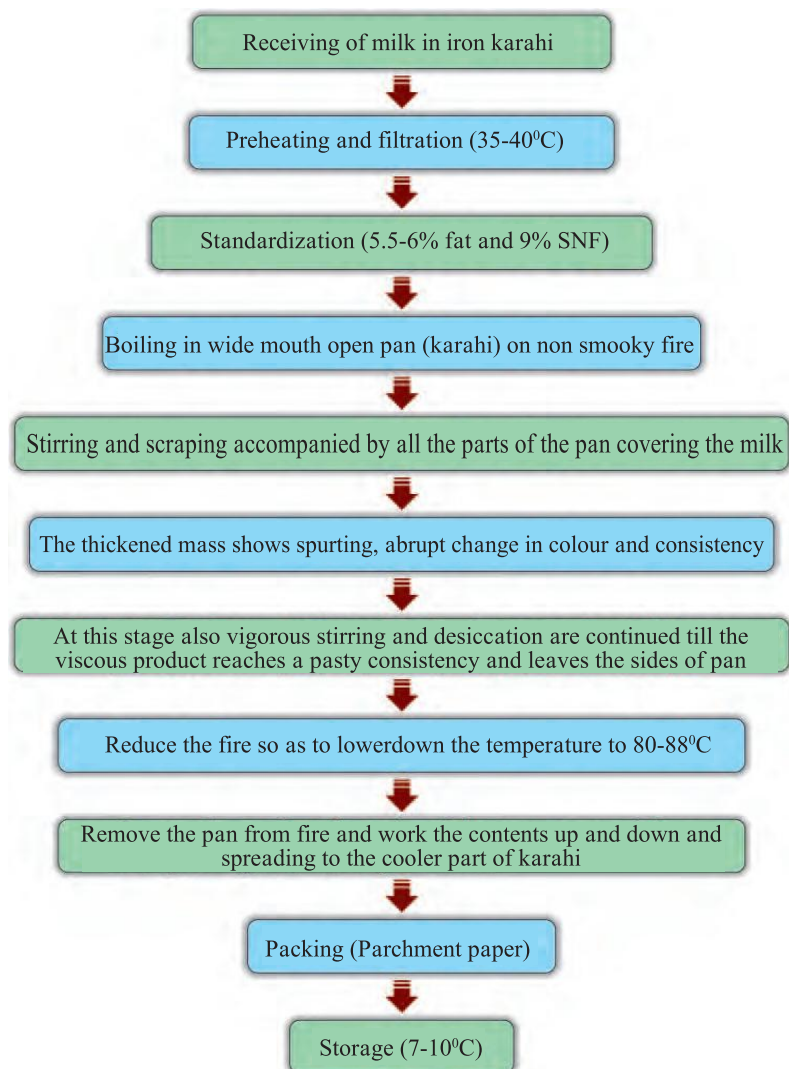
Table 10.3 : Major varieties of Khoa and their composition

Type	Fat%	Total solids %	Sweets prepared
Pindi	21-26	67-69	Burfi, Pedha
Dhap	20-23	56-63	Gulabjamun, Pantooa
Danedar	20-25	60-65	Kalakand

Table 10.4 : Chemical composition of Khoa

Sr. No.	Constituents	Cow milk	Buffalo milk
1	Moisture%	25.6	19.2
2	Fat%	25.7	37.1
3	Protein%	19.2	17.8
4	Lactose%	25.5	22.1
5	Ash%	3.8	3.6
6	Iron(ppm)	103.0	101.0

* Chemical composition of Khoa depends on composition of milk used for its preparation

**Fig. 10.6 : Preparation of Khoa by traditional method**

Do you know ?

- Some khoa makers add 0.1 per cent citric acid, at the closing stage to get a granular texture which is considered desirable for certain sweets. eg. Kalakand



Use your brain power



- Can you identify this machinery?
- Do you know it's working and uses?



Fig. 10.7 : Khoa



Fig. 10.8 : Khoa Pat

Desirable Qualities of khoa

- Colour: White with brown tinge in buffalo milk khoa and pale yellow in cow milk khoa
- Flavour: Rich/ Nutty, slightly sweet
- Body and Texture : Smooth body with small sized uniform granules with no signs of water leakage

Packaging and shelf life : Parchment paper, aluminum foil, polyethene films, dhak leaves and tin cans are used for packaging of khoa. Shelf life of khoa at ambient temperature is 2 days while at refrigeration temperature it is 15 to 20 days. Presently in market the shelf life of khoa is enhanced by using four ply laminated pouch and vacuum packaging (120 days at refrigeration temperature)

Yield : Yield of khoa depends upon the type of milk used. Normally the yield of khoa (With 28% moisture) ranges from 17-19 per cent from cow milk and 21-23 per cent from buffalo milk.

B. Coagulated milk products

The dairy products which are prepared by coagulating the heated milk using diluted acid are termed as heat acid coagulated milk products.

1. Paneer

Definition : Paneer is obtained from the cow or buffalo milk or a combination thereof by precipitation with sour milk, lactic acid or citric acid followed by drainage of whey and pressing the coagulum.

Paneer is used for preparing vegetable dishes or eaten raw.

Chemical composition

Remember...

Paneer is preferably prepared from Buffalo milk because of its high total solids resulting into higher yield and good body texture.



Do you know ?

Paneer prepared from soya-milk is known as "Tofu".



Table 10.5 : Chemical composition of paneer.

Type of milk	Per cent				
	Moisture	Fat	Protein	Lactose	Ash
Cow milk	52-54	24-26	16-19	2.0-2.2	2.0-2.3
Buffalo milk	50-52	28-30	13-15	2.2-2.4	1.9-2.1

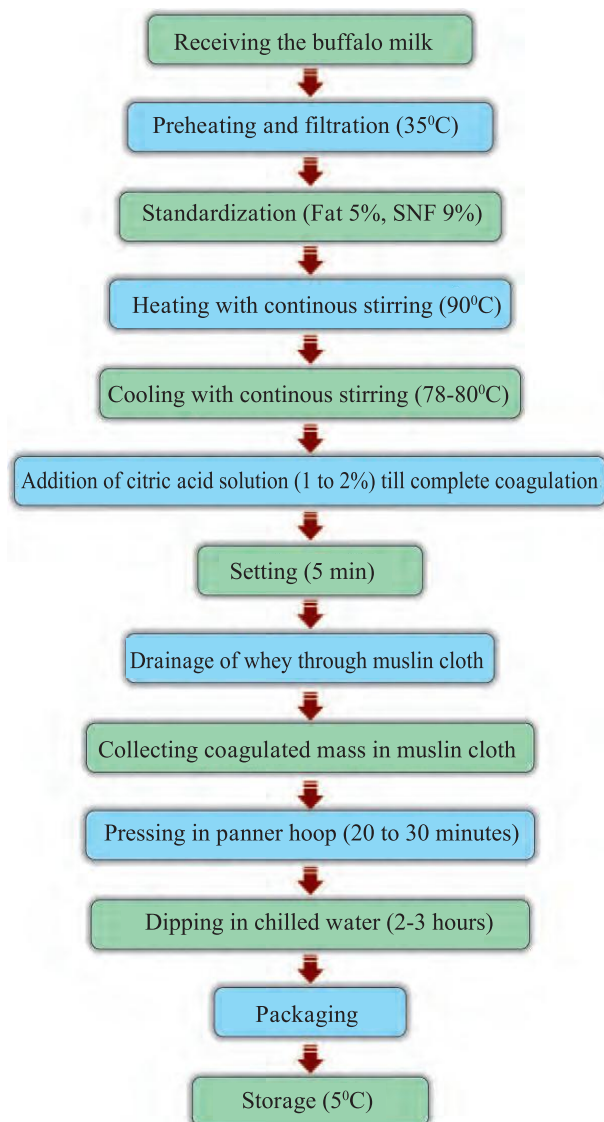


Fig. 10.9 : Method of preparation of Paneer



Fig. 10.10 : Paneer



Fig. 10.11 : Paneer press machine

Desirable qualities in Paneer

- **Colour** : Even white to dull white (Marble) in appearance
- **Flavour** : Sweetish, mildly –acidic and nutty flavour
- **Body and texture** : Firm / compact, cohesive and spongy body and closely knit smooth texture.

Do you know ?

Health benefits of paneer ?



Remember...

Good quality paneer does not melt on heating.



Packaging and shelf life : Flexible Polypropylene film, retort pouches are mostly used for packaging of paneer. Vacuum packaging is most effective and adoptable method for paneer packaging. Shelf life of paneer at room temperature is not more than one day while under refrigeration temperature it is about 7 days. If paneer is packed in vacuum packaging then its shelf life is about 90 days at 7°C.

Internet my friend

Is Tofu better than paneer?



Yield : From 1 litre buffalo milk the yield of paneer ranges from 220-250g (22 to 25 %) while from 1 litre cow milk the yield of paneer ranges from 170-190 g. (17 to 19%).

Remember...

Cow milk is preferred for chhana making because it yields soft, spongy and smooth textured with velvety body which is desirable for making chhana based sweets where as chhana from buffalo milk is hard bodied, coarse and less spongy.



1. Chhana : Chhana is an important heat and acid coagulated milk product serves as base material for many varieties of Indian sweet meats such as rasgolla, sandesh, cham-cham, rasmalai, pantooa, rajbhog, chhana-murki and many more.

Definition : Chhana refers to the milk solid obtained by the acid coagulation of boiled milk and subsequent drainage of whey. Acids commonly used are lactic acid or citric acid.

Do you know ?

Chhana differs from paneer as no pressure is applied to drain the whey and its pH is slightly higher.



Fig. 10.12 : Chhana

Chemical composition

Table 10.6 : Chemical composition of Chhana(Per cent)

Type of milk	Cow	Buffalo
Moisture	53.4	51.6
Fat	24.8	29.6
Protein	17.4	14.4
Lactose	2.1	2.3
Ash	2.1	2.0

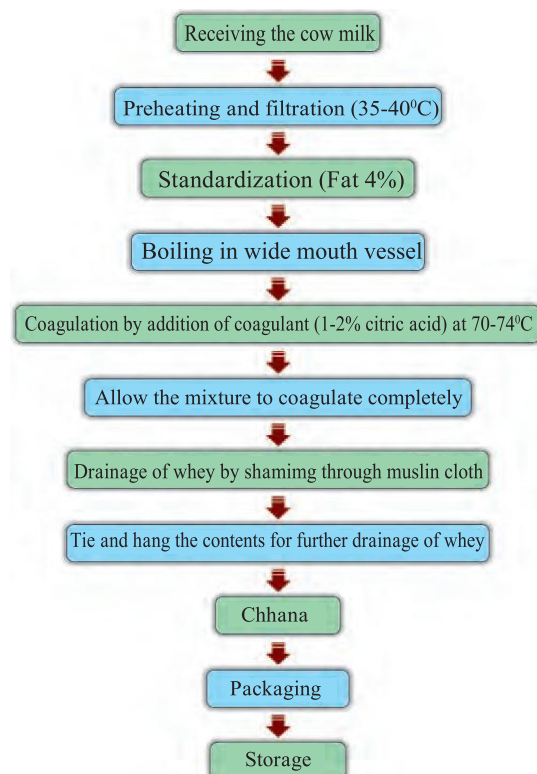
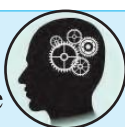


Fig. 10.13 : Method of preparation of Chhana

Remember...

Good quality chhana can be obtained from cow milk when it is coagulated at 82 °C temperature.



Remember...

Major limitation in the commercial production of chhana and chhana based sweet is that their shelf life is very short i.e. not exceeding a few days



Desirable qualities in chhana

- **Colour** : Slightly pale yellow, creamy and marble white in appearance.
- **Flavour** : Sweetish, mildly –acidic and nutty flavour
- **Body and texture** : Smooth and soft, uniform texture. It should yield round ball of even surface and no cracks. It should always be smoother and spongier than paneer
- **Appearance** : Neither too moist nor too dry, there should not be any visible soil or burnt particle.

Packaging and shelf life

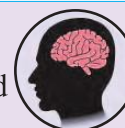
Vegetable parchment paper is the best option for packaging of chhana. It can be packed and stored in tin cans, cellulose film and LDPE. Shelf life of Chhana at room temperature is not more than one day whereas at refrigerated temperature it is 10-12 days.

Yield

From one litre of cow milk, yield of chhana ranges from 170-190 g. i.e. 17 - 19% recovery.

Use your brain power

Differentiate between Paneer and Chhana



C. Fermented milk products

Fermented milk products are those which are prepared by inoculating the milk with starter culture /organism mainly Lactic Acid Bacteria (LAB). These bacteria hydrolyze the lactose of milk into lactic acid and thus raise the acidity and decrease the pH of milk. The fermentation is accompanied by gelling of solids particularly the milk protein.

1. Dahi/ Curd

Indian Curd is known as Dahi which is well known fermented milk product consumed throughout India. It is consumed as a part of the daily diet along with the meal or as a refreshing beverage. It is obtained by Lactic acid fermentation of milk. The conversion of milk into dahi is an intermediate step for shrikhand, makkhan, and ghee.



Fig. 10.14 : Dahi

Do you know ?

Filtration, clarification, standardization, homogenization, inoculation, incubation, body and texture, starter culture and souring of milk



Definition : Dahi / curd is the product obtained from pasteurized or boiled milk by souring natural or otherwise by a harmless lactic acid or other bacterial culture. Dahi may contain additional cane sugar. It should have the same percentage of fat and solids not fat as the milk from which it is prepared

Chemical composition

Table 10.7 : Chemical composition of whole milk dahi (Per cent)

Types of milk	Buffalo	Cow
Moisture	82-85	85-88
Fat	6.0-8.0	3.5-4.5
Protein	3.5 - 4.0	3.0 -3.5
Lactose	4.6-5.2	3.8-4.5
Ash	0.70-0.72	0.64-0.66
Lactic Acid	0.5-1.1	0.5-1.0

Remember...

Dahi is prepared from fresh, sweet, good quality milk by boiling and then cooling the milk (22 – 25°C). Incubation at same temperature for 16-18 hours to develop acidity. The product thus obtained is then transferred in refrigeration storage

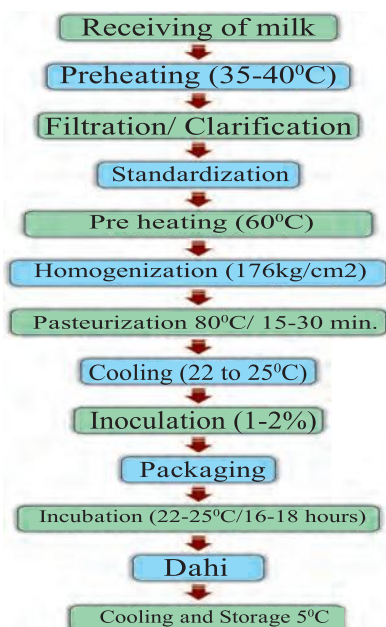
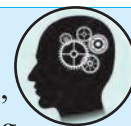


Fig. 10.15 : Method of preparation of Dahi

Do you know ?

Dahi prepared from buffalo milk is superior in body and texture than cow milk.



Remember...

- Culture (single/mixed) used for preparation of dahi are *Lactococcus lactis*, *Lactococcus diactetylactis*, *Lactococcus cremoris*, single or in combination with or without *Leuconostoc* species.
- Rate of inoculation of starter is 0.5 to 1.0% and incubation temperature is 22 to 25°C for about 16-18 hours till it reaches to acidity about 0.7%.



Desirable Qualities in Dahi

- **Colour** : Yellowish creamy white for cow and creamy white for buffalo milk free from browning
- **Flavour** : Good, Clean, Pleasant and diacetyl flavour of culture free from flavours
- **Body and texture** : Soft and Firm ,free from gas holes and pockets
- **Appearance** : Smooth and glossy surface, creamy layer on top, free from visible foreign matter

Packaging and Shelf life : Traditional Dahi is packed in earthenware cup. Nowadays dahi is packed in polystyrene cups. The recommended storage temp is 5-10°C. The storage/shelf life of dahi at room temperature is not more than 24 hours and at refrigeration temperature is about 7 days.

Yield : From 1 kg of cow or buffalo milk yield of dahi is about same in quantity i.e.100 percent recovery.

Internet my friend

What is Yoghurt?



1. Shrikhand

Shrikhand is a fermented and sweetened milk product of Indian origin which is derived from Sanskrit word “Shrikarini” meaning a curd prepared with the addition of sugar, flavouring material, dried fruits, etc. It is regularly consumed in Gujarat, Maharashtra and certain parts of Karnataka , Madhya Pradesh and Rajasthan.



Fig. 10.16 : Shrikhand

Definition : Shrikhand is a semi-soft, sweetish-sour, whole milk product form lactic fermented curd.The curd (dahi) is partially strained through a muslin cloth to remove the whey and this produce a solid mass called chakka which is mixed with required amount of sugar to yield Shrikhand.

Chemical Composition

Table 10.8 : Chemical Composition of Shrikhand (Per cent)

Moisture	40-45%
Fat	5-6%
Protein	7-8%
Lactose	8-9%
Ash	0.45-0.55%
Sucrose	40-45%

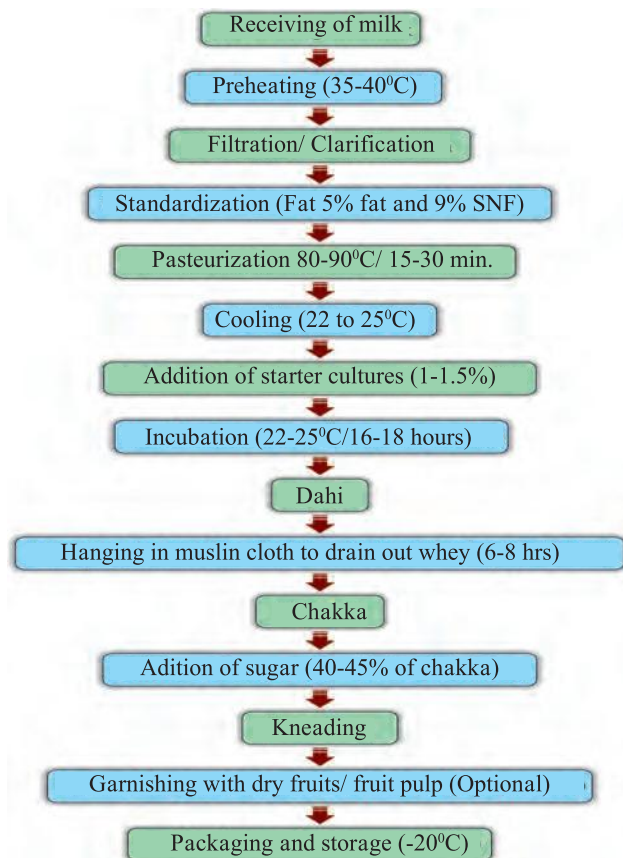


Fig. 10.17 : Method of preparation of Shrikhand

Do you know ?

The term kneading.



Desirable qualities in Shrikhand

- **Colour :** Free from sign of free fat or syrup separation or both, even colour distribution
- **Flavour :** Clean , Pleasant ,Sweetish-sour representing blend of added sugar and fermented milk solids
- **Body and Texture :** Semi-solid consistency with a characteristic smoothness, firmness, pliability without any sign of graininess

Use your brain power

How many calories are there in Shrikhand?



Packaging and shelf life : Shrikhand, being a semi-solid product, is packed in heat stable polystyrene container of various sizes ranging from 100g to 1kg. Owing to both high acid and sugar levels, shrikhand has a fairly long shelf

life of 35-40 days at 8°C and 2-3 days at 30°C and 6 – 12 months at -18 to -20°C.

Yield : From 1 litre of buffalo milk the quantity of Chakka will be 600-650 g. and Shrikhand will be 900-1200 g.

Can you tell ?

What is lassi called in English?



3. Lassi

Lassi, a traditional beverage, has origin in India, popular in south Asia in different varieties. The product in India denotes the butter milk obtained after churning the butter fat from cream or dahi. It is prepared by stirring whole milk curd into a delicate drink to which sugar or salt is added. In northern parts of our country sweet lassi is liked, where as the sour variety is preferred in the south. Various varieties of salted lassi include butter milk, chhach and mattha. It can be flavoured in various ways with salt, mint, cumin,sugar, fruit or fruit juices and even spicy

additions such ground chillies, fresh ginger or garlic.

Do you know ?



- Why Punjabi lassi is more popular?
- The lassi of Punjab sometimes uses a little milk (to reduce the acid tinge) and is topped with a thin layer of malai or clotted cream.

The beverage is enjoyed chilled as refreshing beverage during extreme summer. Lassi was mainly a rural product. Now it is commercially prepared in several parts of India.

Definition : Lassi is fermented milk beverage obtained by churning dahi (4 parts of dahi and 1 to 3 parts of water) and sweetened with sugar.

Chemical Composition

Table 10.9 : Approximate chemical composition of lassi (Per cent)

Total solids	Fat	Protein	Lactose	Sugar	Ash	Acidity (Lactic Acid)
21-23	1.5-3.8	3.0-3.6	2.0-3.0	10-15	0.8-0.9	0.7-0.95



Fig. 10.18 : Lassi

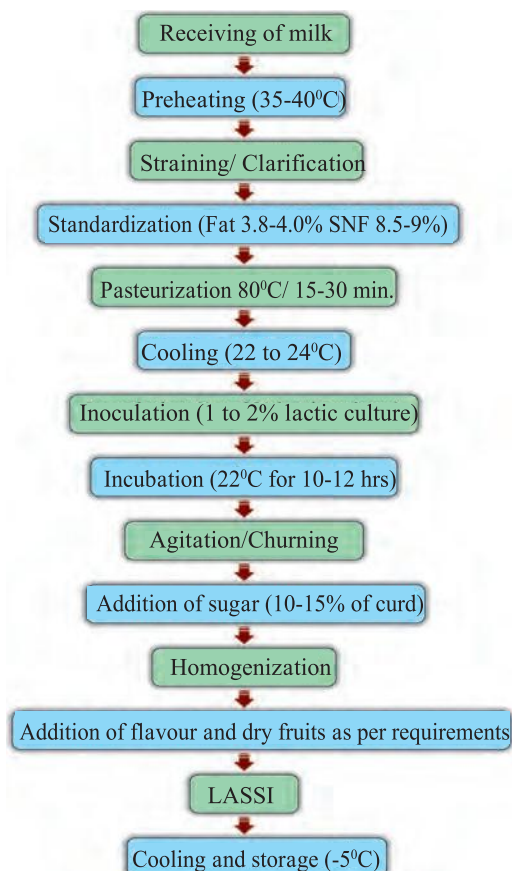


Fig. 10.19 : Method of preparation of Lassi

Internet my friend

- Health benefits of lassi.
- Does lassi increase body weight?



Desirable qualities of Lassi

- **Colour** : Pleasing, attractive and uniform pale to whitish colour
- **Flavour** : Creamy mouth feel clean mildly acidic and rich aroma particularly of diacetyl is desired (except in artificially flavoured lassi)
- **Body and Texture** : Viscous body or thin body as preferred by consumer. Texture should be homogenous with no signs of whey off or grain or curd particles. However medium bodied lassi is preferable.
- **Appearance** : Glossy appearance is desirable.

Packaging and shelf life : Lassi is packaged in plastic sachets however now a days it is available in aseptic (tetra) packaging as a long life lassi. At room temperature shelf life is 10 to 12 hrs while at refrigeration temperature up to 3 to 4 days.

Yield : The yield of lassi depends on the extent to which the dahi is diluted with water. Generally dahi is diluted with 10 to 12 % of water so yield of lassi will be 1.1 to 1.12 litre /litre of milk.

Internet my friend

- Difference between Lassi and Cultured butter milk.



D. Fat Rich milk products

The products where in the fat in the milk is concentrated are termed as fat rich dairy products. In such products the concentration of fat may increase from 25-99.5 % for eg. Cream, butter, makkhan, butteroil, ghee.

1. Cream

Do you know ?

- How is cream made from milk?
- Who invented cream separator machine?



Definition : Cream is the product of cow or buffalo milk or a combination there of which contains not less than 25 per cent milk fat.

- The fat rich portion separated from whole milk is called cream.

Do you know ?

- Cream contains all the milk constituents but in varying proportion. The milk fat in cream may vary from 18 to 85 per cent.



Classification

Cream may be classified broadly as

- | | |
|-------------------|---------------------------------|
| a. Table cream. | } Contains 20 -25 %
milk fat |
| b. Light cream. | |
| c. Coffee cream | |
| d. Whipping cream | } Contains 30-40%
milk fat |
| e. Heavy cream | |
| f. Plastic cream | Contains 65-85 % milk fat |

Chemical Composition

Table 10.10 : Chemical composition of Cream (Per cent)

Constituents	Percentage	
	I	II
Water	68.20	45.45
Fat	25.00	50.00
Protein	2.54	1.69
Lactose	3.71	2.47
Ash	0.56	0.37
Total solids	31.80	54.55
Solid not fat	6.80	4.55

Source: A dictionary of dairying by Davis

Remember...



The basic principle of cream separation whether by gravity or centrifugal method is based on the fact that milk fat is lighter than the skim milk portion. At 16 °C the average density of milk fat is 0.93 and skim milk is 1.036. When milk is subjected to either gravity or a centrifugal force, the two components viz. cream and skim milk due to their differing densities stratify or separate from one another.

Methods of cream separation

Cream is obtained from milk either by gravity or centrifugal method.

a Gravity method : When milk is allowed to stand undisturbed for some time, there is a tendency of the milk fat to rise on top surface of milk. Gravity method includes shallow pan method and deep pan method. Separation of cream is very slow hence this method is no longer used commercially for cream separation.

b. Centrifugal method (Commercial)

When milk enters the rapidly revolving bowl of the cream separator, it is immediately subjected to a tremendous centrifugal force, which is 3000 to 6000 times greater than gravitational force. While both the fat and skim milk are subjected to the centrifugal force the difference in density affects heavier portion (skim milk) more intensely than the lighter portion (Cream). Thereby the skim milk is forced to the periphery while the fat portion moves towards the centre. The skim milk and cream both form vertical walls within the bowl and are separated by being led through separate outlets.



Fig. 10.20 : Centrifugal Cream separator machine

Desirable qualities of Cream

- **Colour :** White to slightly yellow
- **Flavour :** Rich / nutty , slightly sweet
- **Body and Texture :** Smooth body and uniform consistency and free from lumps

Packaging and Shelf life

Depending upon physical characteristics (e.g. light cream is easily pourable where as others are non pourable.) of cream polyethylene tubs, crown capped containers are used for packaging. Pasteurized cream packed in closed container under refrigeration storage has 5-7 days shelf life.

Yield : The yield of cream depends upon the percentage of fat present in milk and the percentage of fat obtained in the cream.

2. Butter : Definition: Butter is obtained by churning cream and working the granules thus obtained into a compact mass. Butter is of types i.e. Table (creamery) butter and white (cooking) butter or desi butter.

Table 10.11 : Chemical composition of Indian butter (Percent)

Constituents	Moisture	Fat	Salt	Curd
Percent	16.3	80.2	2.5	1.0

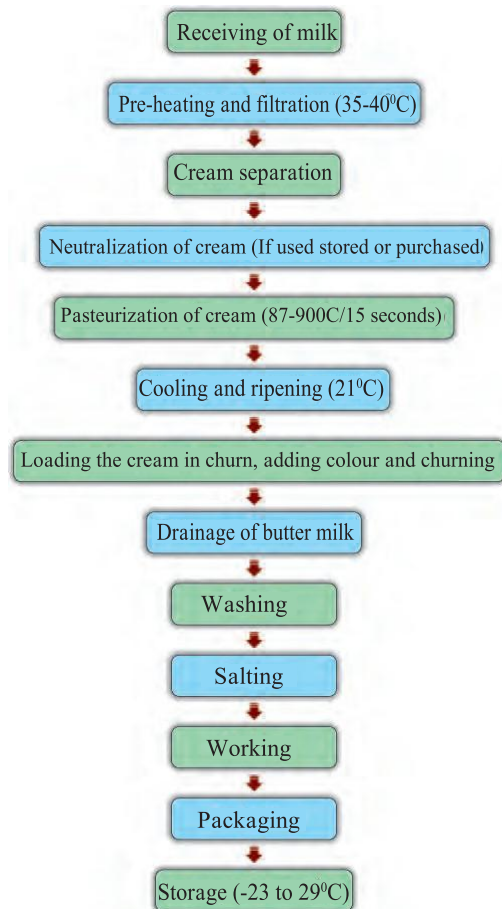


Fig. 10.21: Method of preparation of table butter

Some specific processing steps of butter

a. Preparing cream for churning : Adjust the temperature of cream between 9-11°C by adding chilled or normal water depending upon the season.

b. Neutralization of cream : Neutralization is a process of standardization of acidity of cream. If fresh and normal acidity cream is used there is no need to neutralize it.

c. Standardization of cream : It refers to the adjustment of fat percentage of cream to the desired level. For butter making, cream is usually standardized to 35-40 % fat. To standardize cream to desired fat content, skim milk or cream of higher fat percentage may be used as per the requirement. The quality of added skim milk or cream may be calculated with the help of Pearson's square method.

Internet my friend

- What do you mean by Pearson square method?



d. Pasteurization of cream : It refers to heating every particle of cream to temperature of 87-90 °C for 15 seconds or at any suitable temperature-time combination using properly operated equipments.

e. Ripening of cream : The fermentation of cream with the help of desirable starter cultures is referred to as ripening of cream. The main objective of cream ripening is to produce butter with higher diacetyl flavour to improve the keeping quality of butter.

Remember...

Typical flavour of butter prepared from ripened cream is mainly the effect of diacetyl, and to a smaller extent, of acetic and propionic acids.



f. Cooling and ageing of cream : These are the processes which prepare the cream for subsequent operation of churning. Generally

cooling temperature should be 7-9°C. Ageing i.e. holding the cream at low temperature for overnight is recommended for crystallization of milk fat.

g. Churning of cream : It is a process in which the cream is transferred into a churn for agitation of cream at suitable temperature until the fat globules adhere, forming larger & larger masses. During churning it is essential to add some quantity of chilled water which is called as break water. It brings down the temperature of cream which has increased due to friction and outside temperature. Process of churning ends with the relatively complete separation of fat & buttermilk.

h. Washing, Salting and working of butter :

- **Washing :** After completion of churning followed by draining of buttermilk, it is essential to wash the butter to remove curd content and extra acidity of the mass by adding water. This is done by adding water having temperature less than 2°C of churning temperature.
- **Salting :** It means sprinkling the common salt (@ 2-2.5% of butterfat) over the butter to improve its keeping quality and flavour.
- **Working :** This refers to kneading of butter wherein, salted butter is kept in butter worker and rolled by wooden corrugated roller.

The objectives of working are

- i. To completely dissolve, uniformly distribute & properly incorporate the salt.
- ii. To render the butter compact.
- iii. To remove extra water from butter.

Desirable qualities of butter

- **Colour :** It is light creamy white to dark creamy yellow.
- **Flavour :** Mild, sweet, clean, pleasant flavour and a delicate aroma.
- **Body and texture :** At -7 to -13°C butter should be firm, waxy and consists of such closely knit granules that it appears as a uniform mass. Water and air, in proper amounts should be uniformly distributed.

The ideal butter should be cut easily and evenly when sliced and be readily spreadable.

Packaging of butter and shelf life:

- For bulk packaging (25 to 50 kg) : paper board / corrugated board box, plastic tub or wooden boxes are used.
- For retail packing (25 to 500g) : Parchment paper, grease proof paper, also in tin cans and aluminum foils, card board cartoons are commonly used in order to give added protection to the product.
- Normally shelf life of butter is 2 to 3 months under refrigeration while at -15 to -18°C temperature butter will be stored for 9 months.



Fig. 10.22 : Wooden Butter churn

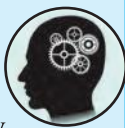


Fig. 10.23 : Wooden Butter worker

Yield : The yield of butter depends upon the percentage of fat present in milk and percentage of fat obtained in the butter.

Remember...

Makkhan/Deshi butter is the fat rich milk product obtained by churning of whole milk curd with crude indigenous devices (Ravi).



Observe and discuss...

Observe and record the method of preparing Deshi butter or Makkhan in your house



3. Ghee

Ghee is clarified butter fat and occupies a very prestigious place in Indian dietary. Though cost wise ghee is quite expensive it is consumed extensively due to its characteristic flavour and aroma, unique taste and high nutritive value.

Do you know ?

At present about 28 % of the total milk produced in India is used in the manufacture of ghee.



Definition Ghee may be defined as the pure clarified fat derived solely from milk or curd or from desi (Cooking) butter or from cream to which no colouring agent or preservative has been added

Remember...

To clarify means “to make clear” a liquid or something liquefied by removing unwanted solid matter or impurities.



Chemical Composition

Table 10.12 : Chemical composition of cow and buffalo Ghee

Sr. No.	Constituents	Requirements	
		Cow	Buffalo
1	Milk fat	99 to 99.5 per cent	
2	Moisture	not more than 0.5 percent	
3	Unsaponifiable matter		
	Carotene ($\mu\text{g/ g}$)	3.2 -7.4	-
	Vit A (I.U. /g)	19-34	17-38
	Tocopherol ($\mu\text{g/ g}$)	26-48	18-37
4	Free fatty acid (%)	Max 2.8 (Agmark)	
5	Charred casein, salts of copper and iron etc.	Traces	

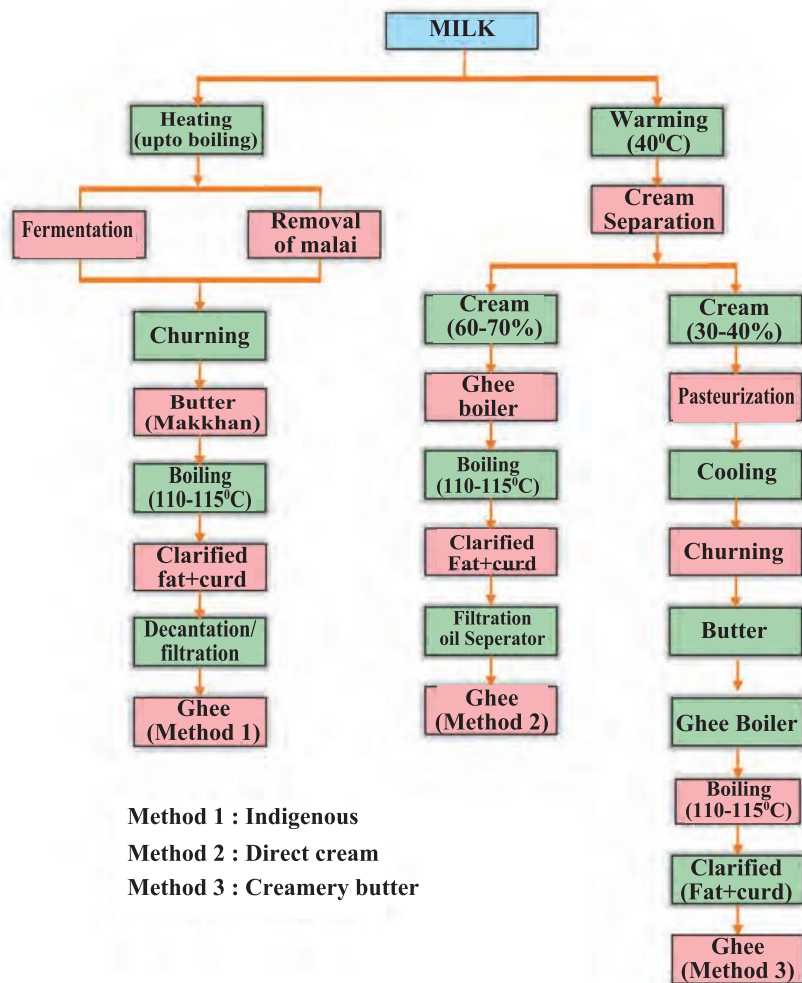


Fig. 10.24 : Different methods of preparation of ghee

Desirable qualities of Ghee

- **Colour** : Buffalo ghee appears white with a characteristic greenish tinge, while cow ghee is golden yellow in colour.
- **Flavour** : Nutty, lightly cooked and rich flavor.
- **Body and texture** : Grains of uniform size, firm and non greasy consistency.



Fig. 10.25 : Ghee boiler

Packaging and shelf life

Now a day's ghee is packed in PE bags, multi – layer films of HDPE and PP laminates, glass bottles, cartons, etc. The storage temperature for ghee is between 20 to 30 °C. The shelf life of ghee is about 9 months at 21°C.

Yield : The yield of ghee depends upon the percentage of fat present in raw material i.e. milk or cream or butter. Considering 3.5 % fat in cow milk the yield of ghee (99.5% fat) from one litre of milk will be approximately 35 g.

E. Frozen milk products

1.Kulfi : Kulfi is the frozen product obtained by thickening milk in shallow pan with constant agitation. Sugar, nuts, essence and colour are added towards the finishing stages. Concentrated

mass is poured into metallic moulds and frozen in a mixture of ice and salt (ice: salt - 4:1) in an earthen pot or other suitable vessel with intermittent stirrings of the freezing mixture.

Do you know ?

1. Kulfi is known as indigenous ice cream
2. Role of coarse salt in preparation of Kulfi



Fig. 10.26 : Kulfi

Chemical composition

Table 10.13 : Chemical Composition of Kulfi

Requirements	Kulfi	Fruits, Nuts, Chocolate Kulfi
Total Solid, % by mass (min)	35	30.0
Milk fat, % by mass (min)	8.0	6.0
Protein % by mass (min)	3.5	3.5
Acidity(as lactic acid % by mass(max)	0.3	0.3
Sucrose % by mass (min)	13.0	13.0

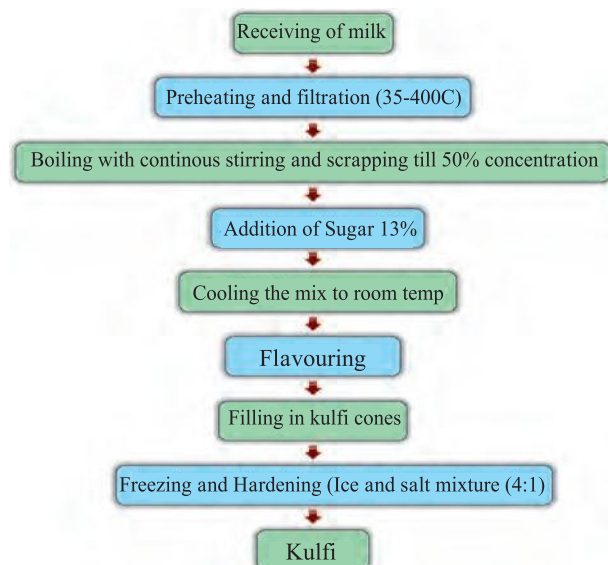
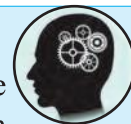


Fig.10.27: Method of preparation of Kulfi

Remember...

Modern moulds/ cones are made of plastic or aluminum, generally conical in shape with screw caps.



Desirable Qualities

- **Colour** : Slightly whitish to brownish and attractive appearance
- **Flavour** : Rich / nutty, creamy, cooked and slightly caramelized flavour
- **Body and Texture** : Uniform consistency with fine grainy texture, compact body free from big sized ice crystals and coagulated milk particles.

Packaging and shelf life : The bars of kulfi are wrapped in papers and put in corrugated boxes. Generally shelf life of kulfi (Wrapped / packed) at -23 to - 29° C is about 6 months.

Yield : From 1 litre cow milk yield of kulfi will be approximate 500 g.i.e.50% recovery.

2. Ice-Cream : Ice-Cream is a delicious, wholesome and nutritious frozen dairy product which is widely consumed in different parts of the world. It is a complex food containing milk fat, milk solids-not fat, sugar etc

Do you know ?

In recent years Ice-cream market (Industry) in India has annual growth rate of about 15 %. It is a good source of energy having 2-3 times higher fat than milk.



Definition : Ice-Cream may be defined as a frozen dairy product made by suitable blending and processing of cream and other milk products together with sugar and flavour with or without stabilizer or colour and with the incorporation of air during the freezing process.

Composition

Table 10.14 : Approximate composition of Ice-cream (Per cent)

Type of Ice cream	Economy Ice cream	Good average Ice cream
Milk fat	10	12
Milk SNF	10-11	11
Sugar	13-15	15
Stabilizer & emulsifier	0.30 – 0.50	0.30



Fig. 10.28 : Cone Ice cream



Fig. 10.29 : Softy Ice cream



Fig. 10.30 : Ice cream

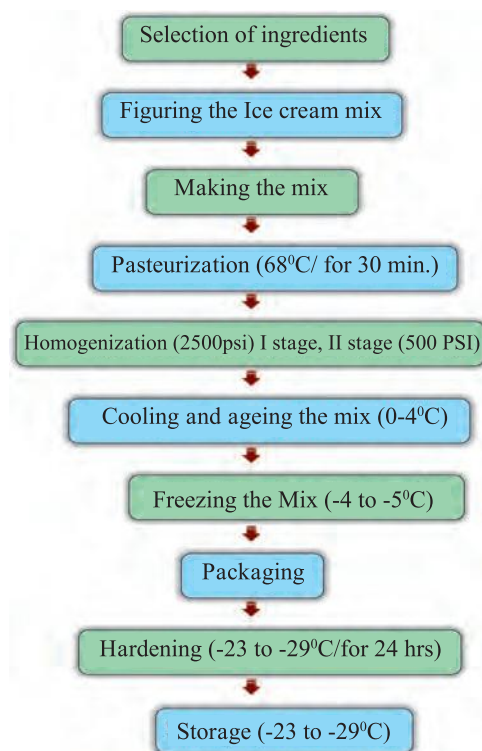


Fig. 10.31 : Method of preparation of Ice-cream

Table 10.15 : Ingredients required for preparation of Ice cream, their source and functions

Ingredients	Examples / source	Function
Fat	Sweet cream, frozen cream, unsalted butter, butter oil, milk	Milk fat provides creaminess and richness to ice cream, smooth body and texture, melting resistance.
Milk solids not fat (MSNF)	Skim milk, skim milk powder	- Improves the body and texture of ice cream. - High in food value
Sweetening agents	Cane and beet sugar, corn syrup	Sweeteners improve the texture and palatability of the ice cream, enhance flavour.
Stabilizers	Gelatin, sodium alginate, guar gum, carboxyl methyl cellulose	- Adds viscosity to the mix. - Prevents formation of large ice crystal during storage.
Emulsifiers	Mono or di glycerides of fat viz. Glycerol mono stearate	- Helps in developing the appropriate fat structure and air distribution. - Essential for good melt down desired in ice cream.
Colouring and flavouring agents	Any food grade colour and flavour	Improves appearance and acceptability of Ice cream.

Internet my friend

- Differentiate stabilizers and emulsifiers with suitable examples available in the market.

**Processing steps in ice cream preparation**

1. Selection of ingredients : Select clean, fresh, easily available less bulky ingredients of dairy and non dairy types.

2. Figuring Ice cream mix : To prepare uniform quality ice cream it is necessary to know how much of each ingredient should be added to produce a balanced mix. This will also be helpful in producing ice cream that conforms to legal standards. Algebraic method is used for calculating the amount of ingredients required for ice cream preparation.

3. Making the mix : For making good mix all liquid ingredients are placed in a vat and start heating and agitation. Add the dry ingredients by avoiding the formation of lumps. Continuous mix making procedure may be adopted for continuous ice cream machine.

4. Pasteurizing the mix : Pasteurization of Ice cream mix is compulsory because this process destroys all the pathogenic bacteria thereby safeguarding the health of the consumer. It dissolves and helps to blend the ingredients of the mix which helps to improve flavour, keeping quality and produces more uniform product.

Remember...

In batch pasteurization system the product is heated in the vat to at least 68 °C and hold for 30 minutes

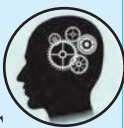


5. Homogenizing the mix : Ice cream mix is homogenized to decrease the milk fat globule size to form a better emulsion and contribute to a smoother creamier ice cream. Homogenization also ensures that the emulsifier and stabilizers are well blended and evenly distributed in the ice cream mix before it is frozen.

6. Cooling and ageing the mix : After homogenization ice cream mix is cooled below 5 °C and then aged at this temp at least for 8 hrs.

Remember...

Ageing means holding the ice cream mix at temperature of 0 °C to 4 °C for a certain period with intermediate stirring to develop desirable viscosity.



Ageing produces the following results

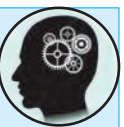
- i. It improves the body and texture of ice cream
- ii. Improves whipping capacity of mix
- iii. Increases overrun
- iv. Increases melting resistance

7. Freezing the mix : It is the process of incorporation of air along with continuous agitation and cooling of ice cream in such a way as to partially freeze the mix to a certain consistency while drawing from freezer. Fast freezing is very essential for getting a smooth product. The batch freezer needs to run at least for 7 minutes to leave the ice cream (Soft) having temperature of -4 to -5 ° C. During freezing the air is incorporated and because of this there is increase in the volume of the ice cream.

8. Packing of ice cream and shelf life : Retail containers are mostly single service i.e. use and throw (e.g. Parchment paper, aluminum foil, plastic coated cups, plastic cups bars, sticks, etc.) whereas, bulk containers are either single or multiservice (e.g. tinned steel can, soft plastic buckets) and may or may not be reusable. Shelf life of ice cream at -23 to -29 °C is near about 6 months.

Remember...

1. Increase in volume of ice cream over its volume of mix is called as overrun, which is expressed in per cent
2. Depending upon the type of ice cream the overrun ranges from 30 to 100 %



9. Hardening of ice cream : It refers to the second phase of freezing where freezing in packages is accomplished without agitation. Here the temperature is lowered to -23 to -29°C as quickly as possible. It is done in either hardening room or hardening tunnel or hardening cabinet.

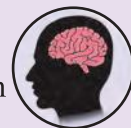
Desirable qualities of ice cream

- **Colour :** Uniform natural but attractive colour
- **Flavour :** Pleasant, balanced flavour and typical of the specific flavour declared on the label
- **Body and texture :** Smooth uniform body, small ice crystals and air cells are required for producing good texture to the product.
- **Melting quality :** Little resistance towards melting when exposed to room temperature for 10 to 15 minutes
- **Package :** An attractive package

Yield : One litre of ice cream mix yields 1.7 to 2.0 litres of ice cream(Considering 70 to 100 % overrun)

Use your brain power

Can you differentiate between Kulfi and Ice cream?



10.2 Meat products

Meat production and consumption has increased remarkably in recent years in India. Demand for quality meat and meat products are increasing due to growing awareness about nutritional and sensory characteristics of such meat products. Changing socio-economic status has also been contributed for enhanced consumption of processed and convenience meat products.

Do you know ?

Chevon (goat meat) is most preferred and widely consumed meat in the country.



10.2.1 Mutton curry

Ingredients - Mutton pieces, edible oil, salt powder, chilly powder, condiments & spices, onion pieces etc.



Fig. 10.32 : Mutton curry

Procedure

1. Add the required quantity of edible oil on fire.
2. Transfer the onion pieces in Oil & fry it
3. Add salt powder & turmeric powder in mutton pieces & mix it thoroughly.
4. Transfer the mutton pieces into a pot on fire. Cook it well.
5. Then add required quantity of boiled water & boil the whole for short time.
6. Add condiments & spices, chilly powder & again boil till the mutton pieces are cooked well.

10.2.2 Meat patties

Meat patti is one of the most popular products among the ground meat items and is generally used as filling for burger roll or sandwich. Some people prefer to consume it separately with tomato sauce or chutney. This product has a very good demand in big towns and cities in India.

Remember...

Patties are partially or completely emulsion based products, contain less than 30 per cent fat and are moulded manually or mechanically in optimum formulation.



Table 10.16 : The formulation of patties

Ingredients	Percentage
Lean meat	70
Fat	10
Table salt	02
Texturised soy protein	10
Dry spices	03
Green curry stuff (Onion 50%, Garlic 25% and Ginger 25%)	05

Method of preparation

1. Lean meat is minced twice through 6 mm plate and fat through 4 mm plate of a meat grinder.
2. These are mixed thoroughly with all other in an electrically operated mixer or prepared into an emulsion.
3. The batter weighing 80-100 g is moulded into 70-80mm diameter and 15-20 mm thick patties.
4. Raw patties may be frozen for future use or broiled in a preheated oven at 150°C for 20 minutes.
5. The internal temperature must reach 72°C. These are deep fat fried preparations.
6. The patties are cooled and consumer packed.



Fig. 10.33 : Meat Patties

10.2.3 Meat loaf/loaves

The important ready-to-eat comminuted meat product is prepared from coarse ground meat or meat emulsion or a combination of both. The formulation of a loaf is given below

Table 10.17: The formulation of a loaf

Ingredients	Percentage
Lean pork	65
Pork back fat	15
Ice flakes	05
Table salt	02
Refined wheat flour	7.5
Skim milk powder	04
Dry spices	1.5
Sodium nitrite	150 ppm



Fig. 10.34 : Meat loaf

Method of preparation

1. The meat mix or batter is tightly filled in aluminium or steel loaf pans which may be rectangular, cubical or cylindrical in shape depending on the requirements of slices for making the sandwiches.
2. The pan-in- mix is cooked in hot water maintained at 80°C or steam without pressure or broiled in hot air oven at 165°C for 2.5 to 3.0 hours.
3. The internal temperature of 70 °C must be achieved.
4. It is then given a cold shower and chilled at 4°C.
5. The chilled loaves are either packed as such or cut into slices of desired thickness and packed.

10.2.4 Meat balls

Indian consumers are familiar with this food item by the name of meat kofta. The product,

stored raw or cooked offers a great convenience to restaurants, hotels and housewives who can just put few balls in the gravy and serve the food



Fig. 10.35 : Meat balls

within 10 minutes.

Method of preparation

1. The product is prepared from ground meat which is mixed with fat, bread powder, salt, condiments and spices in an electrically operated mixer.
2. The dough portion of 15-20 g are rolled into balls manually or mechanically.
3. These are either stored raw or deep fat fried in refined vegetable oil at 135°C for three minutes to get brown colour and fried flavour.
4. Alternately these are cooked in hot water maintained at 80°C for 10 minutes to get an internal temperature of 65-70°C
5. Water cooked balls may be subjected to light frying to get golden brown colour.
6. These are packed in polyethylene pouches and can be kept at 4°C for a week.
7. Whenever required the cooked balls can be simmered in gravy for a few minutes and enjoyed with rice or bread.

10.2.5 Meat nuggets

Meat nuggets is one of the most popular products among the ground meat items and generally used as snack food or mixed with gravy. It has good demand in big towns and cities of India.

Table 10.18 : Formulation of meat nuggets

Sr. No.	Ingredients	Per cent
1	Minced meat	80.00
2	Table salt	01.00
3	Polyphosphate	00.35
4	Sodium nitrite	200 ppm
5	Onion	02.50
6	Ginger paste	01.25
7	Garlic paste	01.20
8	Meat massala	00.50
9	Bengal gram flour	05.00
10	Vegetable oil	08.00
11	Paper	00.20



Fig. 10.36 : Meat Nuggets

Method of preparation

1. Mince meat and fat using meat mincer
2. Make the emulsion in bowl chopper for 8 – 10 min.
3. Temperature should be kept below 15°C by adding ice flakes

Add ingredients to bowl chopper in following sequence.....

Minced meat + Salt + Polyphosphate + Sodium nitrite + Oil + Green curry stuff + Spice mix + Bengal gram flour + Ice

4. Once the emulsion is formed, the mixture is cooked in the pressure cooker
5. Cooked mixture is cut into required size and shape and served with or without frying.

Do you know ?

The common traditional products are tandoori chicken, chicken sheak kabab, chickenshahi kabab, chicken curry, chicken kofta, chicken tikka, chicken samosa, etc. Other poultry products such as barbecue, chicken sausages, chicken patices, etc. also have good market in urban areas.



10.2.6. Tandoori chicken

1. Broilers at 6 weeks of age are preferred for tandoori chicken because of their tender meat and ability to sustain roasting.
2. Dressed chicken with intact skin are rubbed with 4 per cent salt along with spices and seasoning are kept for 75 minutes.
3. After draining, the carcasses are thoroughly marinated with sauce.
4. On the surface and in the interior. A marinating time of 1-2 hours is allowed.
5. The formulation of sauce depends on the consumers preference for taste and other sensory attributes.



Fig. 10.37 : Chicken Tandoori

6. In general dry and ground spices along with condiments are blended with vinegar (10 %) and curd(10%).
7. The marinated chicken are roasted in a tandoori oven under smokeless, moderate and uniform heat for 20-30 minutes depending on the temperature of oven and size of the broilers.

8. Care must be taken to keep the chicken away from the direct fire and avoid burning or blistering of the skin or extremities.
9. During roasting chickens are occasionally removed from the oven and pasted with sauce or fat with the help of a brush.
10. The doneness of tandoori chicken is tested by twisting one of the drum of chicken if dissociate easily from the joint. By the time it also acquires slightly smoked flavour.

10.2.7 Chicken Barbecue

1. Broilers with about 75 g dressed weight are preferred for barbecue.
2. The dressed chickens are longitudinally halved for the purpose after removing the node portion.
3. The chicken halves are marinated with sauces containing spices, salts and seasonings according to the consumer's taste and preference and allowed to stay for an hour.



Fig. 10.38 : Chicken barbecue

4. The sides are then placed on the oven for barbecuing during which these are periodically turned and basted with sauce with the help of a brush to avoid drying.
5. The cooking should proceed slowly at moderate temperature so that tender golden brown and slightly smoked flavoured barbecue is obtained.

10.2.8 Shami kababs

1. Shami kababs meat chunks and water soaked black gram dal are simmered in water for nearby 15 minutes before grinding it.
2. It is seasoned with salt, dry spice and condiment paste.



Fig. 10.39 : Chicken Shami kababs

3. Some people also add liquid egg to the mince.
4. It is made into round cakes which are shallow fried with edible oil on the girdle till both the sides are brown.

10.2.9 Chicken kofta

Meat from spent or culled chicken can be utilized for preparing kofta (meat balls).

1. Lean meat is coarse ground through 8 mm plate of a meat grinder.
2. Ten to fifteen per cent vegetable oil is added to it.
3. Wheat flour (3 per cent) in combination with whole egg liquid (5 per cent) are incorporated to provide sufficient binding strength.



Fig. 10.40 : Chicken Kofta

4. Seasoning, salt and spices can be mixed as per consumer preference.
5. The dough is rolled into 15 g balls with hands.
6. The balls are deep fat fried for 5 minutes.
7. Cooked balls packed in polyethylene pouches have a keeping quality of 8 to 10 days at 4°C.

10.2.10 Chicken samosa

1. Lean chicken is minced through 5 mm plate of a meat grinder.
2. Condiments are fried in vegetable oil to get a golden brown colour and dry spices along with salt are added towards the end.
3. Minced lean and cooked mashed potatoes are mixed with the fried spices and heating is continued for another 4 to 6 minutes.



Fig. 10.41 : Chicken Samosa

4. The fried stuff is ready for filling.
5. Dough portions of about 30 g are rolled out and divided into two halves.
6. Each half is moulded into triangular pouch and the fried stuff (20-25 g) is filled in.
7. The pouch is closed and samosas are deep fried in vegetable oil at medium heat to obtain crispy product.

10.2.11 Chicken Tikka

1. Deboned chicken is minced in a meat grinder.
2. Forty per cent of the mince is pressure cooked for 2 minutes.
3. Besides, peeled and shredded potatoes

are partially cooked in boiling water separately.

4. Now, mince meat (60 raw: 40 cooked), shredded potatoes, rice powder, bread crumbs, salt, spices and condiments are thoroughly mixed in an electrically operated meat mixer.



Fig. 10.42 : Chicken Tikka

5. The blended mass is divided into 70 g portions and moulded into tikkas.
6. These are shallow fat fried in a girdle to achieve an internal temperature of 70°C.
7. The product has a unique texture and is consumed as a hot snack.

Internet my friend

- Search for Chicken-n-ham, chicken salami and chicken burger



10.2.12 Hyderabad Biryani

Hyderabad biryani is a type of biryani from Hyderabad. It is prepared from rice using the slow cooking method.

The ingredients used for preparation of Hyderabad biryani are....

Basmati rice, goat meat/chicken/beef, dahi, onions, cinnamon, cloves, cardamom, shahi jeera, biryani flower, lemon, saffron etc.



Fig. 10.43 : Hyderabad Biryani

The original dish is prepared with red meat but chicken, fish, prawns or vegetables can be used for change in taste.

It is of two types: Kacchi (raw) biryani and Pakki (cooked) biryani.

10.3 Egg Products

10.3.1 Egg omelet

Ingredients : Egg edible Oil, salt powder, chilly powder, onion pieces, coriander etc.



Fig. 10.44 : Egg Omelet

Procedure

1. Break the egg & transfer the content in a cup.
2. Add onion pieces, corianders, salt and chilli powder and mix it thoroughly
3. Smear the edible oil over the frying pan on fire.
4. Transfer the mixture from cup into the fry pan. Spread it evenly
5. Fry it by turning for two to three times. Add edible oil to it
6. Serve with bread

10.3.2 Egg curry

Ingredients : Boiled eggs, edible oil, condiments & spices, salt, chilly powder, onion pieces



Fig. 10.45 : Egg curry

Procedure

1. Pour the required quantity of edible oil in pot on fire.
2. Fry the onion pieces in edible oil.
3. Then fry the spices & condiments in the oil onion mixture.
4. Transfer the boiled eggs to the pot.
5. Add required quantity of water & boil it
6. Add salt and chilli powder as per the whole for short time.

Internet my friend

- Search for Egg Pizza, Egg sandwich, Egg burger.



Q. 1. Fill in the blanks

1. ----- is a Indian dessert milk product
2. Shrikhand is prepared from
3. Khoa is a..... type of milk product
4. ----- milk is more suitable for preparation of rabri
5. ----- is the frozen dairy milk product

Q.2. Match the pairs.**Group A**

1. Chakka
2. Ghee
3. Chhana
4. Stabilizer
5. Kulfi

Group B

- a. Rossogolla
- b. Lassi
- c. Clarified milk product
- d. Shrikhand
- e. Sodium alginate
- f. Indigenous ice cream

Q.3. Write true or false

1. Cream can be separated by centrifugal method.
2. Good quality paneer melts on heating.
3. Butter is fermented milk product
4. Basundi is a Indian dessert.
5. The milk fat in cream may vary from 18-85 %.

Q.4. Identify odd one

1. Egg, Beef, Chevon, Chicken, Pork
2. Boiled egg, Egg curry, Omelette, Meat loaves
3. Chickentikka, Chickenpatties, Chicken samosa, Meat ball
4. Dahi, Chakka, Shrikhand, Chhana
5. Rabri, Kheer, Basundi, Dahi
6. Cream, Butter, Ghee, Paneer.

Q. 5. Give examples.

1. Sweets prepared from Khoa
2. Sweets prepared from Chhana
3. Stabilizers used in Ice cream
4. Emulsifiers used in Ice cream
5. Concentrated milk products.

Q.6. Answer in brief

1. How will you prepare egg curry.
2. Why buffalo milk is used for preparation of Paneer?
3. How will you prepare Mutton curry?
4. How will you prepare chicken curry?
5. Which and why milk is preferred for Chhana making?

Q.7. Differentiate between

1. Kulfi and Ice cream
2. Chhana and Paneer
3. Meat Patties and Meat balls
4. Tandoori chicken and Chicken barbecue
5. Chicken kofta and Chicken tikka

Q.8. Answer the following questions in detail.

1. Write the flow diagram for preparation of Khoa.
2. Write the method of preparation of Chicken tandoori.
3. Write the method of preparation of Egg omelette.

Practicals (XII)

1. Methods of livestock identification
2. Demonstration of disbudding in livestock
3. Determination of weight and age of cattle
4. Demonstration of grooming, washing and clipping of livestock
5. Study of different milking methods
6. Study on different methods of restraining and casting of animals
7. Study of various farm records maintained on organized dairy farm
8. Study of housing systems for dairy animals
9. Study of housing systems for sheep and goats
10. Study of poultry housing and equipments required for poultry farming
11. Health control measures viz., vaccination, spraying and deworming
12. Identification of sick and healthy animal
13. Recording of body temperature, pulse rate and respiration rate
14. Grading of eggs
15. Study of physico-chemical properties of milk
16. Preparation of various fermented indigenous milk products
17. Preparation of various heat desiccated milk products
18. Preparation of meat and egg products
19. Visit to co-operative milk society, Govt. milk schemes and dairy plant.
20. Visit to meat factory and slaughter house



Project Work (XII)

1. Visit dairy and record different routine management practices followed on dairy farms in your locality.
2. Visit and study cattle/buffalo/goat housing systems used in your area.
3. Visit, observe and practice scientific milking method.
4. Vaccination of deshi birds against Ranikhet disease.
5. Visit and study functioning of co-operative milk sangh/Government milk scheme.
6. Visit broiler farm, layer farm and environmental control poultry house farm
7. Visit to Baby food factory and bakeries
8. Visit to slaughter houses and meat processing plants.

Teacher can allot any one of the above project work.



Specimen question paper (Practical)

Time : 3 hours

Marks : 30

Q. 1 Spotting/identification (06)

- A. Identify
- B. Sub question

Note: Total 6 specimens should be kept, each carrying 1 mark (1/2 mark for identification and ½ mark for sub question)

Q. 2 Solve any two of the following (each 3marks) (06)

- A) Draw a neat diagram/sketch and label it correctly
e.g. Sketch of dairy cattle/Goat/Poultry house
- B) Problem/Calculation from practical syllabus
e.g. Grading of eggs, weighing of cattle
- C) Theoretical question from practical syllabus
e.g. Method of disbudding /castration

Q.3 Practical exercise (any one) (06)

- a) Grooming and spraying of dairy animals
- b) Milking by different methods
- c) Determination of Specific gravity/Fat/SNF/Total solids
- d) Recording of body temperature/ respiration of given animal
- e) Determination of percent acidity in milk
- f) Preparation of indigenous milk products
- g) Preparation of meat/egg products

Q.4. A. Viva – voce (02)

B. Record book (Journal) (04)

Q.5 Project work (any one project from the list given in syllabus) (06)



References

1. Banerjee, G C. (2007) A Textbook of Animal Husbandry, 8 th edition, Oxford and IBM Publishing Co. Pvt. Ltd., New Delhi.
2. Bhat, P.N. and Khan, B.U. (2009) Goat production edn1st, Stadium press (India)
3. Bhikane, A.U. and Kawitkar, S.B (2016) Handbook for Veterinary Clinicians, 3rd edition, Krishna Pustakalaya. Udgir.
4. Bhikane, A.U. and Kawitkar, S.B. (2004) Textbook of Animal Science, Revised edition, Krishna Pustakalaya. Udgir.
5. Chakrabarti, A. (2003) A Textbook of Preventive Veterinary Medicine. Edn 3rd Kalyani Publishers, Ludhiana
6. Chakrabarti, A. (2006) A Textbook of Clinical Veterinary Medicine. Edn 3rd , Kalyani Publishers, Ludhiana.
7. Chauhan, D.S., Thombre, B.M., Mitkari, K.R. and Rotte, S.G.(2008) Livestock production and management, Jagarani publication, Bhokar, Nanded
8. Chauhan, H.V.S. (1993) Poultry diseases, diagnosis and treatment. Wiley Eastern Ltd., New Delhi.
9. Compendium, winter school (2005) an sustainable goat production strategies for Rural Development, MPKV, Rahuri.
10. Dubal Z B, Barbuddhe S B and Singh N P. (2014). Important Zoonotic Diseases: Prevention and control. Technical Bulletin No. 39.
11. Eckles, C. H.; Combs, W. B. and Macy, H. (2004) Milk and Milk Products. Tata McGraw Hill Publishing Co. Ltd., New Delhi.
12. GoI (2018) Integrated Disease Surveillance Programme, Ministry of Health & Family Welfare, India
13. Gupta, I. L. (2006) Sheep Production and Management. CBS Publishers and Distributors, New Delhi.
14. Handbook of Animal husbandry (2008) Indian Council of Agricultural Research, New Delhi, published by Directorate Information and Publication of Agriculture.
15. Jadoun, Y. S. and Bhadauria, P. (2018) Designer eggs. Special Bulletin, Hind Publications.
16. Kaur, P., Singh, J. and Bahga, C.S. (2002) Design considerations for a modern dairy farm, Livestock international 6(2):16-22.
17. Panda, P.C.(1995) Textbook of Eggs and Poultry Technology, Vikas Publishing House, New Delhi.
18. Prasad, J. (2000) Goat, Sheep and Pig Production and Management. Kalyani Publishers, Ludhiana.

19. Prasad, J. (2005) Poultry Production and Management. Kalyani Publishers, Ludhiana. Pvt. Ltd., New Delhi
20. Radostits, O.M, Gay C.C., Hinchcliff, K.W. and Constable, P.D. (2007) Veterinary Medicine, 10th edition, Saunders, Elsevier.
21. Raut, N.D., Jadhav. M.U., Gaikwad, U.S. and Wagh, P.P. (2020) A text book of Sheep, Goat and Poultry Production, Bhagwati Publication, Hingoli. (MS) 431 703.
22. Sastry N.S.R. and Thomas C. K. (2006) Livestock Production Management. Kalyani Publishers, New Delhi.
23. Sharma, B.D. (2003) Modern Abattoir Practices and Animal Byproducts Technology, 1st Edn., Jaypee Brothers Medical Publishers (P) Ltd., New Delhi.
24. Sharma, M.C., Yadav, M.P., Joshi, C. and Hussain, K. (2005) Health management practices of livestock during drought, Livestock international 9(8): 2-10
25. Singh, H. and Moore, E. N.(1978) Livestock and Poultry Production, Prentice-Hall of India Pvt Ltd, New Delhi.
26. Subramaniam, M. D., Vellingiri, B., Sang L. and Ho Kim (2014) An Outline of Meat Consumption in the Indian Population - A Pilot Review. Korean J. Food Sci. An.,34 (4): 507-515
27. Sukumar De (2002) Outline of Dairy Technology. Oxford University Press.
28. Verma, D. N. (2005) A Textbook of Livestock Production and Management in Tropics. Kalyani Publishers, Ludhiana (UP).
29. www.enwikipedia.org
30. www.thepoultrysite.com



