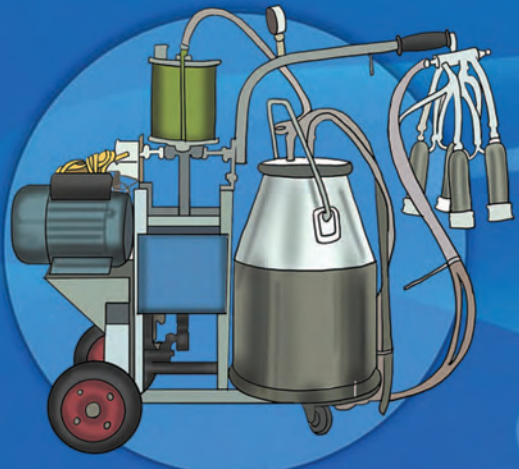
Animal Science and Technology

STANDARD XII



The Constitution of India

Chapter IV A

Fundamental Duties

ARTICLE 51A

Fundamental Duties- It shall be the duty of every citizen of India–

(a) to abide by the Constitution and respect its ideals and institutions, the National Flag and the National Anthem;

(b) to cherish and follow the noble ideals which inspired our national struggle for freedom;

(c) to uphold and protect the sovereignty, unity and integrity of India;

(d) to defend the country and render national service when called upon to do so;

(e) to promote harmony and the spirit of common brotherhood amongst all the people of India transcending religious, linguistic and regional or sectional diversities, to renounce practices derogatory to the dignity of women;

(f) to value and preserve the rich heritage of our composite culture;

(g) to protect and improve the natural environment including forests, lakes, rivers and wild life and to have compassion for living creatures;

(h) to develop the scientific temper, humanism and the spirit of inquiry and reform;

(i) to safeguard public property and to abjure violence;

(j) to strive towards excellence in all spheres of individual and collective activity so that the nation constantly rises to higher levels of endeavour and achievement;

(k) who is a parent or guardian to provide opportunities for education to his child or, as the case may be, ward between the age of six and fourteen years.

The Coordination Committee formed by GR No. Abhyas - 2116/(Pra.Kra.43/16) SD - 4 Dated 25.4.2016 has given approval to prescribe this textbook in its meeting held on 30.1.2020 and it has been decided to implement it from academic year 2020-21.

Animal Science and Technology

STANDARD XII

P9M2S8

Download DIKSHA App on your smartphone. If you scan the Q.R. Code on this page of your textbook, you will be able to access full text and the audio-visual study material relevant to each lesson provided as teaching and learning aids.

2020

Maharashtra State Bureau of Textbook Production and Curriculum Research, Pune.

First Edition : 2020

Reprint : 2022

Subject Committee

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Shri. Jaysing Tatoba Sawant

Shri. Gunvant Sangappa Biradar

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Committee of Authors

Dr Anil Udhavrao Bhikane, **Chairman**

Dr Ulhas Shivaji Gaikwad

Dr. Balaji Narayanrao Ambore

Shri Kumar Ramchandra Kulkarni

Dr. Suhas Shamrao Patil

Dr. Sanjay Dattatraya Mandakmale

Shri Gunvant Sangappa Biradar

Shri Jaysing Tatoba Sawant

Illustrations and Cover

Shri. Vivekanand S. Patil

Typesetting

DTP Section, Textbook Bureau, Pune

Co-ordination

Shri. Rajiv Arun Patole

Special Officer- Science Section

Subject- Animal Science and Technology

Paper

70 GSM Creamwove

Print Order

Printer

Production

Shri. Sachchitanand Aphale

Chief Production Officer

Shri. Prashant Harne

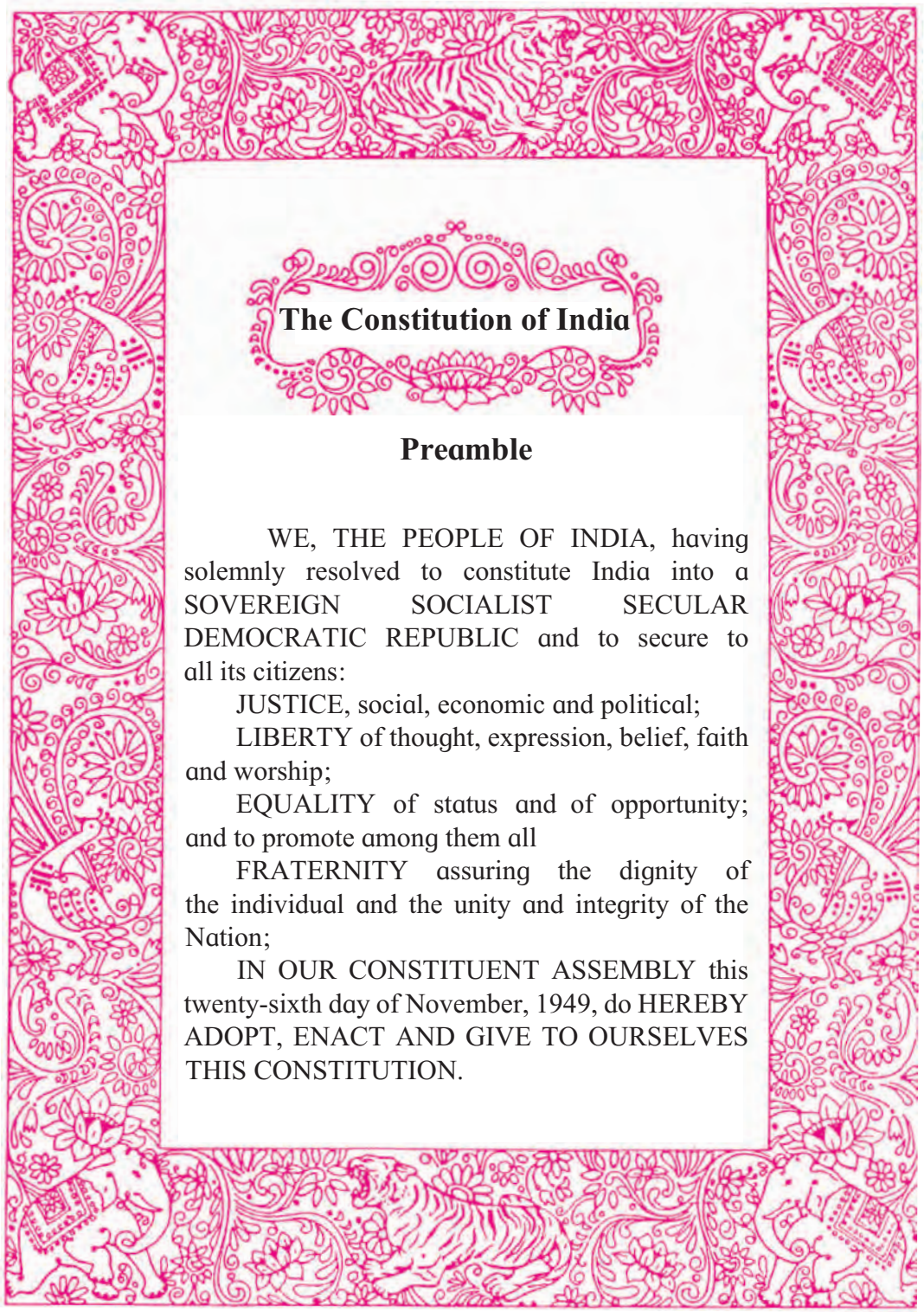
Production Officer

Publisher

Shri. Vivek Uttam Gosavi

Controller

Maharashtra State Textbook Bureau, Prabhadevi, Mumbai - 400 025



The Constitution of India

Preamble

WE, THE PEOPLE OF INDIA, having solemnly resolved to constitute India into a SOVEREIGN SOCIALIST SECULAR DEMOCRATIC REPUBLIC and to secure to all its citizens:

JUSTICE, social, economic and political;

LIBERTY of thought, expression, belief, faith and worship;

EQUALITY of status and of opportunity; and to promote among them all

FRATERNITY assuring the dignity of the individual and the unity and integrity of the Nation;

IN OUR CONSTITUENT ASSEMBLY this twenty-sixth day of November, 1949, do HEREBY ADOPT, ENACT AND GIVE TO OURSELVES THIS CONSTITUTION.

NATIONAL ANTHEM

Jana-gana-mana-adhināyaka jaya hē
Bhārata-bhāgya-vidhātā,

Panjāba-Sindhu-Gujarāta-Marāthā
Drāvida-Utkala-Banga

Vindhya-Himāchala-Yamunā-Gangā
uchchala-jaladhi-taranga

Tava subha nāmē jāgē, tava subha āsisa māgē,
gāhē tava jaya-gāthā,

Jana-gana-mangala-dāyaka jaya hē
Bhārata-bhāgya-vidhātā,

Jaya hē, Jaya hē, Jaya hē,
Jaya jaya jaya, jaya hē.

PLEDGE

India is my country. All Indians are my brothers and sisters.

I love my country, and I am proud of its rich and varied heritage. I shall always strive to be worthy of it.

I shall give my parents, teachers and all elders respect, and treat everyone with courtesy.

To my country and my people, I pledge my devotion. In their well-being and prosperity alone lies my happiness.

Preface

Dear Students,

Welcome to Std.XII. It is our great pleasure to hand over the Textbook of Animal Science and Technology based on the new syllabi. There was a standing demand from the students' community to have a Textbook of Animal Science and Technology besides the basic subjects of Physics, Chemistry, Biology and Mathematics so as to meet the demands and challenges of the present educational system. Therefore, Maharashtra State Bureau of Textbook Production and Curriculum Research, Pune has spearheaded the idea of constructive approach while designing the textbooks to bring a change at +2 standard of education to provide the students with the basic concepts and their applications in the daily life.

Livestock sector plays an important role in Indian economy and is an important sub-sector of Indian Agriculture. Growing population, changing lifestyles, expanding urbanization and hastened climatic changes created new challenges to sustain in the situation. Livestock provides stability to family income especially in the arid and semi-arid regions of the country. Animals are the part of our day-to-day life and contribute for stabilizing the agriculture income particularly when monsoon shows its vagaries. The study of their management from scientific views pays us valuable foods viz. milk, meat and eggs, manures and draft power for our agriculture, hides and bones for the country's economy. Hence, all such concepts of livestock are explained in this book. Further, the diseases of zoonotic importance and their prevention is also incorporated in this textbook from public health point of view to facilitate the learning of the students in a constructive manner.

The important feature of this textbook is that, it contains highly technical information and being presented in simple understandable and presentable form supplemented with emoji like 'Remember', 'Can you recall', 'Can you tell' 'Internet my friend' etc. Many other activities under the title like 'observe', 'try this', 'think about it' 'use your brain power' etc so as to stimulate the thinking power of students.

You can get additional information, knowledge and audio-visual information by using QR code as a supporting. The students from rural area choosing this subject will certainly get the advance knowledge regarding livestock and poultry management and thereby can educate their parents and farmers in the villages about scientific livestock farming so as to uplift their economic status. Moreover, some students in future may decide to opt for the entrepreneurship through livestock keeping.

The Maharashtra State Bureau of Textbook Production and Curriculum Research, Pune has restructured and upgraded the syllabi for Std. XII considering the need of recent and updated knowledge. The content of the book has been reviewed by the teachers and experts working in this field. The matter of the textbook has undergone stringent quality review by the eminent educationalists. This textbook will be beneficial to all the stakeholders such as teacher, parents and candidates appearing for various competitive examinations. The Bureau is grateful to the members of Board of Studies and also to authors without which this textbook would have not taken its present shape. The Bureau is also thankful to the Maharashtra State Bureau of Textbook Publication and Curriculum Research for the co-operation in bringing out this textbook.

(Vivek Gosavi)
Director
Maharashtra State Bureau of
Textbook Production and
Curriculum Research, Pune 4

Pune
Date : 21 February 2020
Bharatiya Sour : 2 Phalguna 1941

- For Teachers -

Dear Teachers,

We are happy, to introduce the revised Textbook of Animal Science and Technology for std. XII. This book is a sincere attempt to follow the maxims of teaching as well as develop a 'constructivist' approach to enhance the quality of learning. The demand for more activity based, experiential and innovative learning opportunities is the need of the time. The present curriculum has been restructured so as to bridge the credibility gap that exists in the experience in the outside world. Guidelines provided below will help to enrich the teaching - learning process and achieve the desired learning outcomes.

- To begin with, get familiar with the textbook yourself.
- The present book has been prepared for constructivism and activity based learning.
- Teachers must skillfully plan and organize the activities provided in each chapter to develop interest as well as to stimulate the thought process among the students.
- Always teach with proper planning.
- Use teaching aids as required for the proper understanding of the subject.
- Do not finish the chapter in short.
- Follow the order of the chapters strictly as listed in the contents because the units are introduced in a graded manner to facilitate knowledge building.
- Each unit is structured in a definite manner. It starts from the basic concepts of Animal Science required for each component comes under the subject. Application of technology is given in content. This knowledge will help students to understand further chapters in each unit.
- Each chapter provides various charts, pictures, diagrams for better understanding, so you can use this for effective teaching.
- Ask the students about the related information, background about the chapter. You are provided, for this with the different boxes like 'Can You Recall', 'Do you know?', 'Try this' etc.
- Encourage the students to collect related information by providing them the websites.
- Teaching - learning interactions, processes and participation of all students are necessary and so is your active guidance.
- Do not use the content of the boxes titles 'Do you know'? for evaluation.
- Exercises include parameters such as co¬-relation, critical thinking, analytical reasoning etc. Evaluation pattern should be based on the given parameters. Equal weightage should be assigned to all the topics. Use different combinations of questions.

Components of chapter :


Can you tell?


Can you think


Just do it


Try this


Can you recall?


Do you know ?


Remember


Internet my friend


Think about


Observe that


Use your brain power


Can you imagine ?

Competency Statements - Standard XII
Animal Science and Technology

Area/ Unit/ Lesson	After studying the contents in textbook students will .....
Routine Livestock Farm Management Practices, Housing and Dairy Cattle, Buffalo Management	• Understand the routine management practices followed on livestock farm • Know the importance of animal identification • Understand the new technologies in livestock identification • Determine the weight of cattle without weighing balance • Determine the age of cattle by dentition methods • Know various methods of disbudding and dehorning the cattle • Understand how to handle livestock safely as well as restraining and casting of animals for different purposes • Explain the process of body condition score (BCS) in cattle • Understand the body condition score in cattle • Understand the different methods of milking and process of clean milk production. • Understand the importance of vaccination, methods to control ecto- parasites and endo – parasites • Get acquainted with different types of records maintained on livestock farm and modern livestock management software • Understand the different methods of carcass disposal • Know the importance of housing for livestock • Know the different components required for dairy farm building • Built their own livestock house • Understand various housing systems with their pros. and cons • Able to start their own dairy farm • Know the methods of rearing of calves and heifers under different managemental conditions • Understand how to take general care and management in case of pregnant cows and buffaloes • Able to take care and also manage freshly calved cows and buffaloes • Get knowledge about nutritional requirements of lactating, dry and pregnant cows and buffalos • Able to select breeding bull for breeding purpose • Understand the general management of breeding bull • Know, how to manage livestock in different season • Know the effects of climate change on livestocks
Sheep and Goat Management	• Understands the importance of small ruminants in Indian farming • Know the different systems of goat rearing • Understand the management of breeding buck, doe, kids etc. • Understand the management of lambs, pregnant ewes, lactating ewes and breeding rams • Understand the health cover practices followed in goat and sheep rearing under different systems • Able to create housing for sheep and goat with scientific touch
Livestock Diseases and Public Health	• Explain livestock diseases in general • Able to classify the diseases on the basis of cause, way of spread and their duration and severity • Understand the signs of health and disease • Suggest general measures for prevention of contagious diseases • Explains the common livestock diseases caused by bacteria, viruses, protozoa and parasites • Explains the common poultry diseases caused by bacteria, viruses and parasites • Explains the causes, mode of transmission and common symptoms of important zoonotic diseases • Understand the special and general preventive measures and importance of personal hygiene and hand washing in prevention of zoonotic diseases • Explains the contingency planning for livestock so as to prevent the huge economic losses during natural disasters

Poultry Housing, Feeding and Management	• Explain importance of poultry housing • Understand the principles of poultry housing • Draw design for construction of poultry house • Explain systems of poultry keeping • Explain role of backyard poultry farming • Understand importance of Environment control housing • Identify different poultry equipments, with their importance and functions • Enlist factors considered while computing and feeding of poultry • Identify and classify poultry feed ingredients • Understand types of feeds and feed requirement • Explain method of poultry feeding • Explain selection and storage of hatching eggs • Understand incubation of eggs • Understand importance of brooding in poultry management • Explain layer management • Understand disease control and vaccination in poultry • Understand broiler growing programme • Discuss the role of contract broiler farming • Explain management of poultry according to season
Milk, Meat, Eggs and Value added livestock products	• Understand the importance of milk, meat and eggs in Indian economy • Know the composition and properties of milk • Understand the different methods of pasteurization of milk to make it safe for human consumption • Understand the importance and production of hygienic milk production • Understand the concept of organic milk production • Understand the methods for production of commercial milk and meat products • Understand the advanced technique in packaging of milk and meat products • Know the different types milk and meat products • Know the classification of Indigenous milk products • Able to prepare various milk products by scientific way • Able to start their own business by preparing various milk products like khoa, pedha, lassi, ghee, etc. • Able to prepare various commercial meat and eggs products

CONTENTS

1. ROUTINE LIVESTOCK FARM MANAGEMENT PRACTICES

Can you recall ?

- The term livestock, breed and animal husbandry
- Routine practices followed by farmers on their livestock farm

Animal husbandry or livestock rearing is as old as human civilization. The animals are dependent on humans for their sustenance and performance under domestication. Their feeding, housing, healthcare and routine management based on scientific recommended practices are essential for obtaining higher profit from dairy farming.

Management is the process of judicious decision making in an enterprise. Management is an art and science of combining ideas for planned proceedings with available resources to produce and market a worthwhile product.

Livestock management involves integrated application of principles of breeding, feeding, housing, organization and disease control in a manner suitable for a particular situation.

1.1 Identification of animals

Do you know ?

- How animals are generally identified on farm?
- Importance of animal identification.

A lot of farmers ignore animal identification which is very important. Giving names to farm animals may serve the purpose to an extent for a small herd, but may not be feasible for a large herd. So it is important to put some sort of identification marks on each farm animal soon after its birth.

Importance of identification

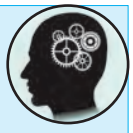
1. To identify the animal if lost or stolen.
2. To record the details of animal in respect of breeding, feeding, management and health cover.
3. To know pedigree of animal.
4. To record growth, reproduction and production performance of animal.
5. To make easy for treatment or culling of sick or unproductive animals from the herd.

Methods to identification

1) Ear tattooing 2) Ear notching 3) Tagging 4) Branding 5) Electronic Identification System

1) Ear tattooing : Ear tattooing is the process of puncturing desired number or letter on inside skin of ear with the help of tattoo forcep and then rubbing tattooing ink (black carbon pigment) over the punctures.

Remember...



Tattooing is most suitable for marking newborn calves and cattle having light coloured skin of the ear.

Technique

1. The animal is firmly secured to put the number.
2. The surface of the ear is cleaned inside with the help of soap water and then wiped with spirit swab to remove grease before tattooing.
3. The desired number is then fixed in the tattooing forceps and pressed on the inner side of ear in between two veins.
4. The tattoo puncture is then rubbed with tattooing ink with the help of thumb.
5. Tattooing is done on undersurface of tail in case of animals having dark or pigmented ear skin.

Fig. 1.1 : Tattooing forcep (Tattooer with digit)

6. Precautions should be taken to avoid injury to ear veins.

Advantages

1. It is easy and permanent method of identification.
2. It can be used in animals of any age, whether small or large stock.
3. It is less painful.
4. It is legally acceptable.
5. It is suitable for all livestock.

Disadvantages

1. Tattoo mark usually fades out in course of time.
2. It is less useful in animals having dark pigmented skin.
3. Reading of number needs close inspection.

2) Ear notching

- It is the method of making 'V' or 'U' shape cuts / notches along borders of ear with the help of scissor or pincers.

Remember...

Ear notching is commonly used for marking of buffalo calves and pigs.

Technique

1. Animal is firmly secured, ear is cleaned and disinfected with the help of spirit.
2. Then 'V' or 'U' shape cuts/notches are made at the border of ear by using sterilized ear punch/scissor/pincers.

Fig. 1.2 : Tattoo in ear

Fig. 1.3 : Ear notching

3. A single notch at lower side of right ear indicates the number '1' while of left ear indicates the number '3'
4. A single notch at the upper side of right ear indicates the number '10' while on left ear indicates the number '30'.
5. Notches should neither be made too small nor too large.

Advantage

- It is a permanent method for marking buffalo and pigs.

Disadvantage

- It causes injury to calf.

3) Tagging

- Tagging is method of fixing of numbered tag at ear / neck of animals.

Do you know ?

Tagging is mostly used for marking of sheep, goat and sometimes in young calves.

Types of tagging

a. Ear tagging b. Neck tagging

a) Ear tagging : It is the most popular method of identification of farm animals.

Technique

1. In this method, tags made up of light metal or strong coloured plastic having number engraved on it are used.
2. Tags are of two types i.e. self-piercing and non-piercing.
3. Prior to tagging ear is cleaned with spirit.

Fig. 1.4 : Ear tag

Fig. 1.5 : Ear tag with forceps

Fig. 1.6 : Ear tagging in cow and goat

4. Self-piercing tag is directly pierced and locked with the help of pincers.
5. In case of non-piercing tag, hole is made on the upper edge of ear with the help of ear notcher or ear punch and then tag is placed in the hole and fixed.
6. While tagging, number should be visible outside the upper edge of ear.
7. Tag should not be too tight or too loose.
8. Antiseptics solution like tincture iodine or benzoin should be applied at the site of tagging.

Advantage

- It facilitates easy supervision, management and accurate record maintenance.

Disadvantage

- Tags usually fall down or tear off the ear lobe.

b) Neck tagging

- In this method metallic or plastic tag is tied in the neck chain by the use of thread or wire.
- It is temporary method of marking animals as there is a chance that they may be lost.

Fig. 1.7 : Neck tagging in Goat

4) Branding

It is the method of imprinting number or any identification mark on the thigh of animal by hot iron, chemical or coolant. Branding is mostly used for marking of cattle, buffaloes, horses and camels.

Internet my friend

Techniques of branding

5. Electronic identification

The electronic identification system is started in the year 1970s. Radio frequency identification (RFID) is one of the most advanced method used in organized farm to identify and record the day to day data of animal.

Radio frequency identification (RFID) technology for cattle

Radio frequency identification (RFID) describes a system that wirelessly transmits the identity of an animal. These devices have an electronic number that is unique for an individual animal and link that animal to the database. Electronic ear tags, injectable transponders and boluses with a transponder, inside in the reticulum are the latest technologies for animal identification.

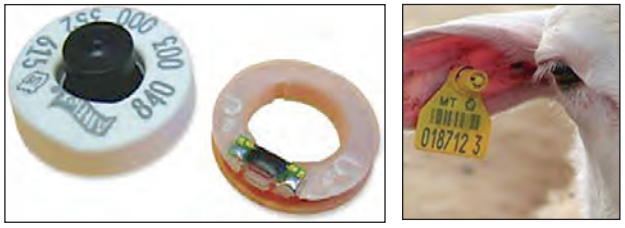


Fig. 1.8 : Parts of RFID ear tag

Do you know ?

RFID ear tags for cattle was first used by USDA (United States Department of Agriculture).

Types of RFID tags

1. Active RFID tags : Active RFID tags have a local power source like a battery and can operate hundreds of meters away from the RFID reader. They constantly transmits data.

2. Passive RFID tags : Passive tags don't have a local power source. It takes energy from the interrogating radio waves of a nearby RFID reader. A passive RFID tag needs to be "powered up" by a nearby reader before it can transmit data.

Internet my friend

Search different types of RFID tags used for animal identification.

Basic components of RFID system

1. **Transponder :** The transponder is the electronic data source that stays with the animal you want to identify. The transponder contains a microchip, where the identification number is stored. The transponder is embedded in the ear tag.
2. **Transceiver:** The transceiver (or reader) is used to retrieve the information stored in the transponder. This device is essentially a radio transmitter and an antenna. The transceiver could be part of a hand-held unit that is taken to the location of the animals with the RFID tags or a stationary unit that the animals pass by.
3. **Data accumulator:** This is a device where information received by the transceiver is accumulated or stored. eg. Computer, Personal Digital Assistant (PDA), Android/iOS Mobile etc.

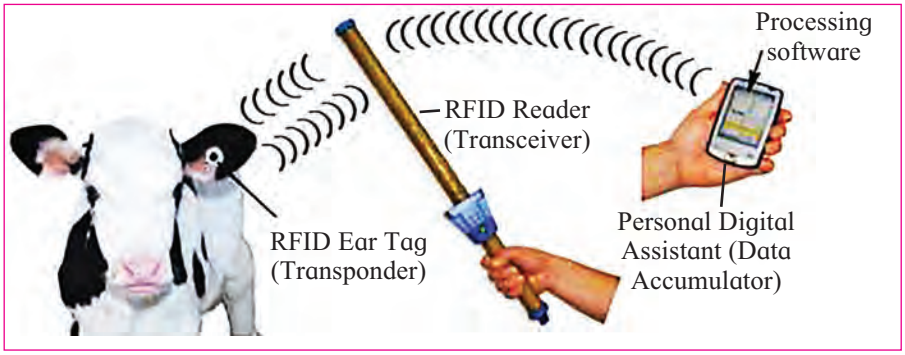


Fig. 1.9 : Basic components of RFID system

4. **Processing software:** This software transforms the accumulated data into recognizable and useful information and can be imported into a variety of data management programs like word, excel, spreadsheet or any other software etc.

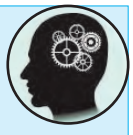
Advantages

1. It does not require direct contact or line-of-sight scanning.
2. It can be used to dispense feed automatically to animals.
3. It provide a higher level of security like giving password to access information
4. Production history can be located quickly.
5. Readers can process multiple RFID tags at once (Thousands of tags per second).
6. RFID tags can be read at a greater distance.
7. RFID tags can store larger amounts of data.
8. RFID tags have high durability and resistance to harsh environments.

Disadvantages

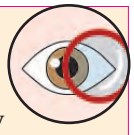
1. Initial cost is more.
2. It require software to access data.

Remember...



Other methods of identification
1. Use of leather neck strap
2. Keeling i.e. painting of horns
3. Photographing. 4. Muzzle prints.

Observe and Record...



The various methods used to identify animals in organized dairy farm near by you.

1.2 Weighing of cattle

Cattle should be weighed usually once in months.

Importance of weighing animal

1. It helps to record the growth rate.
2. It is essential for balanced feeding of livestock and also for computation of ration.
3. It guides the farmer regarding the general health of animal.

Methods of weighing

1. Direct Method

- In this method, animal is weighed directly on weighing balance/machine or platform scale.
- The animal should not be given feed for atleast 12 hrs. before weighing
- A few hours before weighing, animals should not be given water.

Limitations

1. Weigh bridge or platform scale is costly
2. It may not be commonly available at farm or near to farm.

2. Indirect Method /Alternate Method

- In this method, weigh of animal is indirectly calculated from body measurements.
- The common formulae used for estimating body weight are as below

a. Shaeffer's formula : It is widely accepted for estimating body weight of an adult cattle

$$\text{Live body weight (in pounds)} = \frac{\text{Length} \times (\text{Girth})^2}{300}$$

Where,

Length = Distance between point of shoulder to pin bone in inches

Girth = Entire circumference of the body behind the point of elbow in inches

b. Agarwal's formula: It is modified Sheffer's formula for Indian cattle.

$$\text{Live body weight (in pounds)} = \frac{\text{Length} \times \text{Girth}}{Y}$$

Where,

Y = 9 if girth is less then 1.62 meters

Y = 8.5 if girth is between 1.62 – 2.0 meters

Y = 8 if girth is more than 2 meters

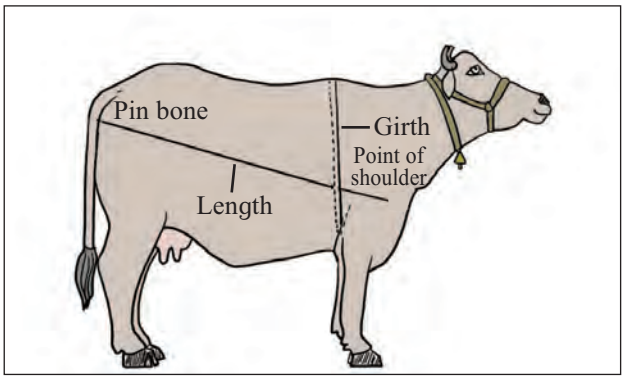


Fig. 1.10 : Body measurements for weighing of cattle

1.3 Disbudding and Dehorning

- Disbudding is the process of removing horn bud in young calves before its attachment to skull within 3-5 days after birth.
- Dehorning is the removal of horn after it has attached to the skull in older calves.
- However, in most of the dairy farms disbudding is practiced instead of dehorning as former is less painful.
- Moreover, in case of horn injury or horn cancer to check the spread of infection dehorning is practiced.

Can you tell ?

The purpose of disbudding in calves

Advantages

1. It makes animal safe for handling and management.
2. It protects other animals from injury due to fight.
3. It prevents body and udder injuries.
4. It is most convenient for the animals in loose housing.
5. It prevents occurrence of horn cancer.
6. It gives uniform appearance to all the animals.
7. It reduces floor space requirement in shed.

Disadvantages

1. Animals cannot make the defense when attacked by other animals.
2. Age determination from horn rings becomes impossible.
3. An important breed characteristic in the form of horn is lost.
4. Good look of animal in some breed of cattle is lost.

Methods of disbudding

1. Chemical method
2. Electrical method

1) Chemical method

- It is usually performed before 10 days of age.
- It is easy and inexpensive method.

Technique

1. Calf is properly secured and about 2 cm area around the horn bud is clipped.
2. Then spirit is applied on horn bud and grease or vaseline is applied around horn bud to protect encircling skin from chemical.

Do you know ?

Caustic potash (KOH) or caustic soda (NaOH) or silver nitrate ($AgNO_3$) sticks are used for chemical disbudding

3. A stick of caustic potash held in the caustic holder or with a piece of paper is rubbed on the horn bud in circular motion till little blood appears.
4. The cauterizing action of chemical destroys horn bud.
5. Bleeding is checked by applying tincture benzoin.

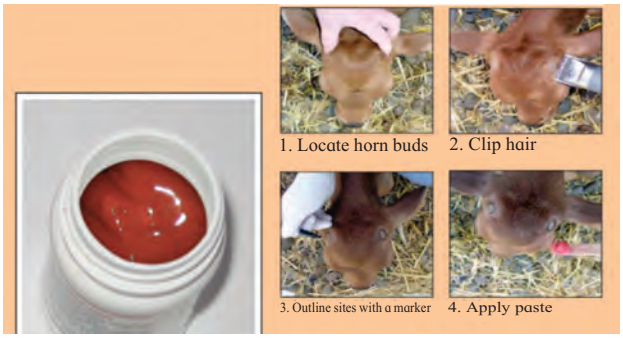


Fig. 1.11 : Disbudding with caustic soda

Fig. 1.12 : Chemical method of disbudding

2) Electrical method

- Disbudding may be done mechanically using red hot iron or electrical dehorner pressing on the horn bud.
- It is performed at three weeks of age in calf.
- It is quite safe, quick and most popular method.

Technique

1. Animal is secured well.
2. Horn buds are located properly and about 2 cm area around the buds is clipped.
3. Then horn buds are cauterized by applying red hot electric dehorner for 10 to 20 seconds.

Fig. 1.13 : Electrical dehorner

Fig. 1.14: Electrical dehorning

Do you know ?

Electrical dehorning is best as it requires only 10 minutes and less hazardous compared to chemical or hot iron method.

1.4 Determination of age

Knowing cattle age is useful for both cattle management and marketing in the absence of birth records.

Advantages/Importance

1. It helps in accessing the tentative age of animal when birth record is not available.
2. It helps in fixing the price and purchase of animals.
3. It helps to decide medicinal doses against diseases.

Limitations

1. Exact age of animal cannot be determined.
2. Purposeful attempt of hiding age may result in wrong assessment of age.

Methods of determination of age

1. General appearance method
2. Horn ring method
3. Dentition method

1. General appearance method : Dairymen make certain observations on the animal and its approximate age on the basis of breed, temperament and type of animal, shining and tightness of skin, activeness, vigor etc. are some of the characters suggestive for animal age. Based on general appearance, animals are categorized into age groups, such as very young, yearlings, adults, old etc.

Group of animals	General appearance
Younger animals	Smaller in size, having active disposition, smooth and tight skin, soft hair coat and full mouth.
Older animals	Large in size having normal look, rough hair coat, broken mouth, loose skin, weak joints, roughened stature etc.,

Limitations

1. Actual age of the animal cannot be determined by this method.
2. Clever preparation of animal adds to difficulty in determining age by appearance method.

2. Horn ring method : With the increase in age the horn rings grows in size and rings are formed on it. First ring appears on the horn at three years of age in cattle. There after one ring appears yearly. Hence following formula for estimation of age may be used.

Age of animal in year = N+2

Where,

N = Number of horn rings

Advantage

- It is easy to adopt

Disadvantages/Limitations

1. It cannot be used in dehorned and polled animals.
2. It is less reliable method.
3. In some breeds rings are either not clear or horns are small.

3. Dentition method

- In this method, age of animal is determined by examining the available incisor teeth in the mouth.
- In cattle, eight incisor teeth are present in the lower jaw.
- Cattle do not have incisor in upper jaw, instead of they have dental pad.
- Eruption of incisor teeth follows a specific sequence with the advancing age.
- At about 5.1/2 years of age all the permanent incisor are present in mouth, hence animal is considered to have full mouth.
- The age of cattle can be judged by observing the wear and tear of the permanent incisor from 6 to 12 years of age.

Dental formulae

1. Temporary teeth : incisors (I) 0/8 canines (C) 0/0 premolars (P) 6/6 molars (M) 0/0 = 20

2. Permanent teeth : incisors (I) 0/8 canines (C) 0/0 premolars (P) 6/6 molars (M) 6/6 = 32

Remember...

Ruminants do not have canines.

Table 1.1 : The age wise temporary and permanent incisor teeth eruption in cattle

Age	Teeth eruption
At birth	First pair of temporary incisors
One week	Second pair of temporary incisors
Two weeks	Third pair of temporary incisors
Four weeks	Fourth pair of temporary incisors
2 to 2.5 years	First pair of permanent incisors
3 to 3.5 years	Second pair of permanent incisors
4 to 4.5 years	Third pair of permanent incisors
5 to 5.5 years	Fourth pair of permanent incisors

Table 1.2 : Typical cattle ages when permanent incisors teeth erupt, develop, and wear

Teeth	Eruption	Full development	Wear
First pair	18 to 24 months	24 months (2 years)	Leveled at 5 to 6 years, noticeable wear at 7 to 8 years
Second pair	24 to 30 months	36 months (3 years)	Leveled at 6 to 7 years, noticeable wear at 8 to 9 years
Third pair	36 to 42 months	48 months (4 years)	Leveled at 7 to 8 years, noticeable wear at 9 to 10 years
Fourth pair	42 to 48 months	60 months (5 years)	Leveled at 9 years, noticeable wear at 10 years

Advantages

1. It is quite reliable method of age determination though the nutrition and management of animals influence it.
2. It is popularly accepted by most of the farmers.

Limitation

1. Loss of teeth due to accident or injury may mislead the age of animal.

Fig. 1.15 : Dentition of a 3 year old cattle with 2 pairs of permanent incisors

Fig. 1.16 : Dentition of cattle aged around 5 years with 4 pairs of permanent incisors

1.5 Approach, Restraining and Casting of Animals

Approach and restraining of animal

Principle

1. Proper method for approach, handling and control is necessary from the point of safety to veterinarian, attendant and also to the animal.
2. Animals should always be approached from behind and on their left side.

Various means of restraining the animals are as below.

a. Halter

1. Halter is used for proper controlling of animals.
2. The rope used for halter making should be about 3-3.5 m in length and 1.3 cm in thickness.
3. The rope is fixed around the face with one string around the poll.

Fig. 1.17 : Rope Halter

b. Anti-Cow Kicker

1. It is used to prevent kicking by the cow especially during milking.
2. It is made up of two metal clips connected together by chain.
3. Clips are fitted above the hocks with chain hanging infront of hocks.
4. A smaller clip is provided, to fix the tail at left clip.

Fig. 1.18 : Anti-Cow Kicker

c. Bull nose ring

1. It is used for better control of bull.
2. It consists of two semicircular pieces hinged together.
3. It is made from non-rusting metal like copper or aluminum.
4. Each year, existing bull nose ring is replaced by bigger size.

Fig. 1.19 : Bull nose ring

d. Mouth gag

- It is used for keeping mouth open by making the jaws apart.
- Its use is essential for examination of mouth or passing of the probang safely.
- Mouth gags are mainly of two types

1. Drinking water gag

1. These are made up of aluminum.
2. These are two in number. One for upper jaw and another for lower jaw.
3. These correspond to the shape of jaw.
4. Both are fitted with flanges to accommodate check teeth.

Fig. 1.20 : Drinking water gag

2. Probang gag

1. It is made up of wood.
2. It has hole in the center to pass probang.
3. It is also provided with a strap which go over the poll.

Fig. 1.21 : Probang gag

2. Casting of animals

Casting is defined as throwing of animal on the ground slowly and safely.

Objectives

1. To perform shoeing, branding and dehorning.
2. To perform various surgical operations.
3. To perform and dressing of wounds.

Remember...

- The animal should kept on fasting for 12 hours before casting to prevent injury to distended digestive organs.
- Casting of pregnant animals must be avoided.
- Animals should always be casted on grassed area or where smooth bedding is available

Methods for casting

1. Reuff's method : It is most commonly adopted method for casting of animal.

1. Make a running noose or knot at the end of 9 m. long cotton rope and put around the base of horns. In polled animal noose is placed round the neck.
2. Make first half hitch round the neck and tie with rigid knot that will not slip.
3. Make second half hitch around the chest behind the elbow.
4. Make third half hitch around the abdomen in front of udder or scrotum.
5. Turn the head opposite to the desired casting side.
6. Animal then falls steadily on the ground.
7. Pulls steadily the free end of rope backward and towards the desired side.
8. Then press the head to the ground or turn it over on the shoulder.
9. Pass the tail forward from in between the thighs and pull around the top side of thigh.
10. Secure the animal's feet along with the tail by another rope.

Internet my friend

Search alternate methods of casting the animals

1.6 Castration

- It is method of removing or dysfunctioning of essential reproductive organs in males.
- The optimum age for castration in male is 4 to 6 months for bloodless castration and 8 months for incision method.

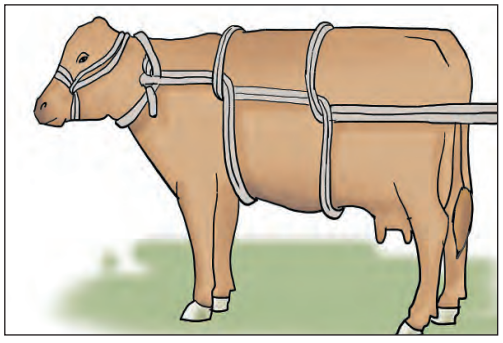
Advantages

1. Castration prevents indiscriminate and unwanted breeding from undesired males.
2. Male and female can be kept in one place.
3. It makes animal more docile and easy for handling.
4. It improves the growth rate and meat quality of animal.
5. It increases fat deposition in animals.

Step 1

Step 2

Step 3



Step 4

Fig. 1.22 : Reuff's method of casting

Can you tell ?

- Objectives of castration in cattle
- Proper age of bull for castration

Disadvantages

1. It produces pain to animals.
2. If proper care is not taken increases susceptibility to infection.
3. In surgical castration chance of tetanus is more.

Methods of castration

The following are five methods of castration.

1. Burdizzo method
2. Rubber band method
3. Surgical / open / incision method
4. Vasectomisation
5. Mulling

Can you tell ?

The bloodless method of castration in bull

1) Burdizzo method

- It is close method of castration.
- This is also called as bloodless castration.

Fig. 1.23 : Burdizzo castrator

2) Rubber band method

- This is also known as elastrator method.
- This method is mainly used for sheep and goat at about 2-3 weeks of age.

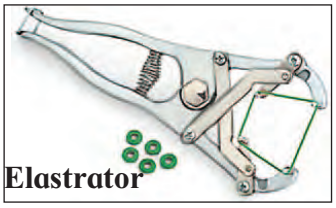


Fig. 1.24 : Rubber band method

3. Surgical/Open/Incision method

- In this method, testicles are removed by giving incision to scrotum.
- It is commonly used in dogs and horses.

4. Vasectomisation

- Vasectomisation is used for the preparation of teaser bull.

Remember...

- Vasectomised bulls are sterile but they maintain sex libido.
- The semen of vasectomised bulls does not contain sperms.

5. Mulling

- This is very old and crude method of castration
- In this method, testicles and spermatic cord are crushed between two hard objects like stone or wood till testicle is reduced to pulp.
- It is very painful, cruel and unscientific method

Internet my friend

Search additional information about technique used in castration

1.7 Grooming

Grooming is the careful brushing and combing of body hair coat and from scalp of animal.

Advantages

1. It improves appearance of animal.
2. It makes skin coat smooth, clean and glossy.
3. It stimulates the blood and lymph circulation of skin.
4. It removes dandruff, loose hair, dust, dirt and ectoparasites.

5. It helps to feel the animal fresh by reducing tiredness and fatigue.
6. It helps in clean and hygienic milk production.

Fig. 1.25 : Hand groomer

Fig. 1.26 : Mechanical groomer

Technique

1. Grooming is done with the help of brush and curry comb.
2. It includes brushing followed by combing.
3. It is always done in the direction of hair.
4. It is started at neck, behind ear and finished towards hind quarter.
5. Face is not brushed but wiped with a moist, clean cloth.
6. Brush and comb are cleaned after each 4-5 sweeps or strokes of grooming.
7. Rotating cow brush is also used in organized farm. It is easy to use, and rotate when cow moves the brush.

Do you know ?

Grooming generally practiced before milking along with washing to improve the clean milk production.

1.8 Body condition scoring

- Body condition scoring is a subjective scoring method based on visual assessment of animal for the amount of fat and muscle covering the bones of a cow, regardless of body size and evaluating the energy reserves of dairy animals according to 5 point scale.
- It provides a better understanding of biological relationship between body fat, milk production, reproduction and health status of animal.
- It helps in adopting the optimum managemental practices to derive maximum production.
- A low score may indicate diseases or improper feeding while a high score may indicate a high probability of breeding and metabolic problems.

Do you know ?

Traditionally, body condition scoring is done by looking at a cow and feeling it. This can lead to inaccuracies, particularly if the barn is crowded.

Important body parts of cow for body condition score

Backbone - Is it flat or is there a ridge? Can you see or easily feel notches?

Long ribs - Can you see or easily feel the ribs? If visible how many can you see?

Short ribs - Can you see the short ribs? What do they feel like? Are the rib ends sharp or rounded?

Hip bones - Are the hip bones rounded or angular?

Rump - Is the area between the pins and hip bones, flat, sunken or hollow?

Pin bones - Are they pointed, "tap" like or rounded?

Tailhead - Is there a hollow between the tail head and pin bones? Is it a deep V or shallow U shape?

Thigh - Is the area indented, flat or rounded? Is the muscle structure defined.

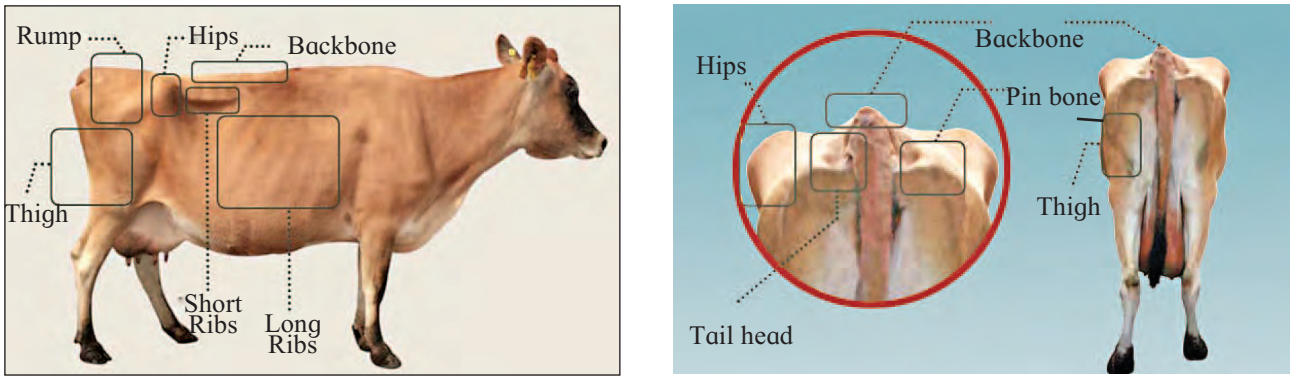


Fig. 1.27 : Important body parts of cattle for BCS

Table 1.3 : Body condition score in cattle

Score	Description of animal	Interpretation
BCS 1	• Animal is emaciated • Deep cavity around tailhead • Bones of pelvis and short ribs are sharp and easily felt • No fatty tissue in pelvic or loin area • Deep depression in loin 	• Not in good health • Will not milk well or reproduce • May be diseased and survival during stress is doubtful
BCS 2	• Animal appears weak • Shallow cavity around tailhead with some fatty tissue lining it and covering pin bones • Pelvis easily felt • Ends of the short ribs can be feel rounded and upper surfaces can be felt with slight pressure • Depression is visible in loin area 	• Health may be ok, but milk production is low • Poor reproduction

BCS 3	• No cavity around tailhead and fatty tissue easily felt over whole area • Pelvis can be felt with slight pressure • Thick layer of tissue covering top of short ribs which can still be felt with pressure • Slight depression in loin area 	• High producing, but fat may not be enough for peak production
BCS 4	• Folds of fatty tissue are seen around tailhead with patches of fat covering pin bones • Pelvis can be felt with firm pressure • Short ribs can no longer be felt • No depression in the loin area 	• May have more metabolic problems at calving
BCS 5	• Tail head is buried in thick layer of fatty tissue • Pelvic bones cannot be felt even with firm pressure • Short ribs covered with thick layer of fatty tissue 	• Extremely fat and will have metabolic and breeding problems

Remember...

Dry cows and calving cows should have a body condition score of 3.5

1.9 Milking

Milking is a skillful act of drawing milk from udder of lactating animal.

Principles of milking

1. Milking is a key operation on the dairy farm.
2. Milking is hormone related act. Oxytocin secreted by pituitary gland is responsible for letting down of milk.
3. Milking should be gentle, quick and complete.
4. Letting down of milk can be stimulated by gentle massage.

5. Milking should be completed within 7 minutes.
6. Before milking, hind quarters should be groomed and washed.
7. Tail should be tied with hind legs.
8. Udder should be washed with a weak antiseptic solution prior to milking.
9. Milking should be done by an experienced milker who is free from bad habits like spitting or smoking and communicable disease. He himself realizes cleanliness.
10. Milking is usually done from left side of the animal.
11. Full hand method of milking should be followed particularly for large animals.
12. First drawn milk strips are collected in strip cup to check any abnormality and should not be added in milk.
13. The last stripping of milk is rich in fat.
14. Milking time and interval between milking should be kept constant.
15. A concentrate mixture should be offered to animal during milking for calm and convenient milking.
16. Silage, leaves of onion, cabbage, cauliflower, parthenium etc. should not be fed just before milking.
17. Hind legs should be well secured before milking.
18. Animal should not be disturbed or excited during milking as it may cause inhibition of milk ejection due to action of adrenaline hormone.
19. Avoid excess noise/sound during milking.
20. At the end of milking teats should be dipped in antiseptic solution.

Methods of milking

There are two methods of milking -

1. Hand milking – done manually
2. Machine milking – done by milking machine

1. Hand milking

- It is most common method of milking.
- There are three methods of hand milking.
  - **a. Stripping or strip milking**
  - **b. Full hand milking**
  - **c. Knuckling**

a. Stripping or strip milking

1. In this method, teat is firmly held at the base between thumb and index finger.
2. It is then pulled downward along the length of teat with equal pressure thereby milk flows down in a strip.
3. The procedure is repeated in quick successions till that quarter of udder is evacuated.

Fig. 1.28 : Stripping or strip milking

b. Full hand method

1. In this method, teat is held completely in the fist with thumb raised hence method is also called as fisting.
2. Base of the teat is firmly held in ring formed by thumb and forefinger.
3. It is then pulled downward to tip of teat which causes milk ejection.

Fig. 1.29 : Full hand method

4. The procedure is repeated in quick successions till that quarter of udder is evacuated.
5. Avoid holding of teat with thumb bent in against the teat i.e. knuckling.

c. Knuckling

1. It is the modification of full hand method.
2. The thumb is folded inside and teat is pressed in between the bend of thumb and remaining fingers.
3. It gives more irritation to teats and if continuously used, teat become smaller at the centre with depression.
4. It is more troublesome and uncomfortable to the animal.

Fig. 1.30 : Knuckling method

Can you tell ?

- Hormone responsible for milk let down
- Hormones responsible for inhibition of letting down of milk

2. Machine milking

In this method, machine is used for milking instead of hands.

Method

1. Udder and teats are wiped with warm antiseptic solution half a minute prior to milking.
2. Two to three strips of foremilk are drawn from each teat.
3. Teat cups are then placed on teats.
4. Then the machine is operated at 10-15" vacuum with a pulsation rate of 50/ minute.
5. The negative pressure created by machine evacuates the milk from udder.
6. Teat cups are removed as soon as milk ceases to flow

Table 1.4 : Differences between full hand milking and stripping or strip milking

Sr. No.	Full hand milking	Stripping or strip milking
1	In this method, teat is held in fist.	In this method teat is held between thumb and index finger.
2	Milking is quick.	Milking is slow.
3	It is similar to natural suckling process of calf.	It is not similar to natural suckling process of calf.
4	It causes less irritation to teats hence animal is at comfort during milking.	It causes more irritation to teat, hence animal is less comfortable at milking.
5	It is suitable for high yielder having long teats.	It is suitable for very low yielder having small teats.

Fig.1.31 : Machine milking

Precautions to be taken

1. Teat cups should not be kept for long time.
2. Machine should be operated with optimum vacuum.

Advantages

1. Labour requirement is less.
2. Milking is rapid.
3. Milk production is hygienic.

Disadvantages

1. It is expensive method due to higher cost of milking machine.
2. There are many technical complexities in operation of milking machine.
3. Low yielders cannot be milked.
4. Requires technical person for milking of animal.
5. If part of machine coming in contact with milk is not properly cleaned regularly then there are chances of increase in micro-organisms in milk.

Remember

Full hand milking method is most suitable method of milking while knuckling method is most painful method.

Internet my friend

Prices of different types of milking machine are availabe in the market

1.10 Drying off

- It is the process of making a lactating but pregnant cow dry approximately 60 days before next calving.
- It is the best practice for high producing animals.

Advantages

1. It provides sufficient rest for organs of milk secretion before calving.
2. It helps to built up body reserve of nutrients.
3. It helps in better development of foetus.
4. It maintains good health of pregnant animal.
5. It reduces the occurrence of milk fever at or after calving.
6. It results into better milk production in future lactation.

Methods of drying off : Drying off in pregnant but lactating cow can be achieved by adopting any of the following method

Table 1.5 : Differences between hand milking and machine milking

Hand milking	Machine milking
1. Milking is done by hand	1. Milking is done by machine
2. It is economical method	2. It is expensive method
3. Milking is slow	3. Milking is rapid
4. Labour requirement is more	4. Labour requirement is less
5. It is suitable for smaller herds	5. It is suitable for bigger herds
6. Milk production is less hygienic	6. Milk production is more hygienic

1. Intermittent milking

2. Incomplete milking

3. Abrupt or complete cessation of milking

1. Intermittent milking

1. Initially the number of milkings are reduced to once in a day.
2. Milking once in a day is followed for about a weeks period.
3. Thereafter milking is done once in alternate day.
4. At about 60 days before parturition, milking is stopped completely.

2. Incomplete milking

1. In this method, for first few days milk is partially withdrawn from udder.
2. Then cow is milked intermittently but incompletely.
3. The intermittent and incomplete milking causes lowering of milk synthesis in udder.
4. Milking is stopped completely, when production is reduced to less than 1kg.

Do you know ?

Incomplete milking method is suitable for drying off high yielding animals.

3) Complete or abrupt cessation of milking

1. In this method, quantity of feed and water is reduced, which causes reduction in milk synthesis.
2. Milking is stopped abruptly or completely.
3. Sudden cessation of milking increases pressure in udder which results in decreased milk secretion.
4. The milk accumulated is reabsorbed from the udder till cow becomes completely dry.

Advantage : It is suitable for low yielder.

Disadvantages

1. It causes swelling and pain in udder.
2. It is not suitable for high yielding animals.

Remember

After last milking, teats should be washed thoroughly and suitable antibiotic is infused in a teat which prevents the entry of infectious organisms into udder.

1.11 Steaming up : Dry cows are fed in a nutritionally proper manner to get prepared for calving is called as steaming up.

- Separate dry cows from the milking herd and group them with the pregent heifers. Allow dry cows to get plenty of exercise.
- Feed judiciously mainly good quality roughages and recommended concentrate. Limit body gain to no more than 45 kg from late lactation to the next calving to reduce the problem of ketosis, milk fever, displaced abomasum and calving problem.
- Watch the cow closely for signs of calving.
- Calving-pen floor should not be slippery and should have proper bed of dry straw to ensure safe calving.
- Watch the cow for signs of milk fever, ketosis, or other health problem.
- Provide fresh water and hay/soft roughages/ wheat bran after calving.
- Care and precautions must be taken for prevention of udder edema. First calvers are more prone to edema.

1.12 Culling

- The word comes from Latin language word “colligere” which means “to collect”.
- Culling is defined as the process of removal of unproductive and undesirable animals from the herd.
- Culling is very important to run livestock farming in profitable manner.

Do you know ?

About 10 % of animals from the herd having undesirable characters should be culled each year.

The animals having following problems should be culled from herd.

1. Animals having low production.
2. Animals having anatomical defects.
3. Animals having breeding problems like infertility / sterility.
4. Animals having stunted growth.
5. Animals having contagious disease.
6. Animals having frequent abortions.
7. Old /senile animals.
8. Animals not exhibiting true breed characters.
9. Animals having short lactation length and longer dry and intercalving periods.
10. Hard milkers.

Remember

Culling helps to maintain purebred herds and prevents economic losses in terms of production and feed consumption.

1.13. Hoof trimming

- Hoof trimming is the process of cutting and shaping the over grown hooves with the help of hoof knife or hoof trimmer.

Remember

Hooves of stall fed animals should be trimmed once in two months while, animals allowed for grazing be trimmed once in four months.

Technique

1. Animal is casted and legs are secured tightly.
2. The foot is then rested on solid board.
3. Hoof is then trimmed / cut to its original shape and size by using hoof knife.
4. Rasper is then used to level the bottom of hoof.
5. Lastly turpentine oil is applied for conditioning and disinfection.
6. Over cutting should be avoided as it may lead to injury and lameness.

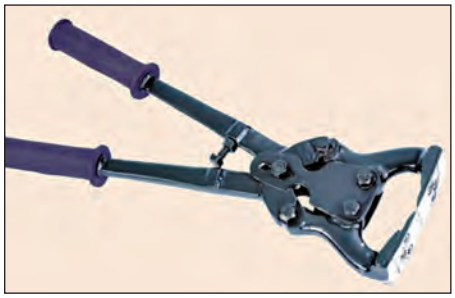


Fig. 1.32 : Hoof trimmer

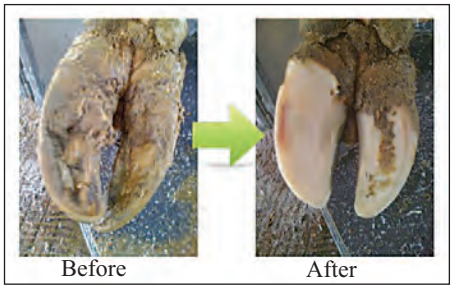


Fig. 1.33 : Hoof trimming

Do you know ?

Hoof trimming prevents uneven, overgrowth of hooves, thereby helping in comfortable walk and reduces the possibility of lameness and foot rot.

1.14 Ringing the bulls

- Ringing is the process of putting nose-ring to bull.
- Bull nose-ring is usually made from a non-rusting metal like aluminum or copper.
- Nose ring comprises of two semicircular pieces joined together by hinges.

Technique

1. Bull is first casted and legs are secured.
2. Nose holder is then used to stretch nose.
3. Then nasal septum is punctured by using nose punch or trocar sterilized with tincture iodine.

4. Nose-ring is introduced through puncture / hole and locked by screw.

Fig. 1.34 : Ringing of bulls

Advantages

1. It is very useful for control of breeding bull.
2. It keeps the head of bull extended and raised while restraining.
3. Leading rope or pole can be attached to nose ring.

1.15 Vaccination

Vaccine is a suspension of attenuated or partially killed organism such as bacteria, viruses, which is administered to individual for prevention against an infectious disease.

Do you know ?

Vaccination is a word derived from Latin language "vacca" which means cow. The cowpox material used for injections was then called vaccine and the process of injecting it into animal is called vaccination.

Principle of Vaccination

The principle behind vaccination is the introduction of pathogenic material in part or complete whose pathogenicity has been reduced by some mechanism, into a healthy animal so that body can form enough defense molecules (antibodies, defense cells, cytokines etc.) to counter the attack of the same pathogen. When body is exposed to small amount of foreign materials (pathogens) body's immunity is activated. Activated immunity lasts longer in the body which is capable of killing the pathogen.

Fig. 1.35 : Vaccination of cattle

Table 1.6 : Vaccination schedule for cattle and buffaloes

Sr. No.	Disease	Primary vaccination	Regular vaccination
1.	Foot and mouth disease	3 months onwards	Twice in a year i.e. September and March
2.	Anthrax	6 months onwards	Every year before monsoon in endemic area
3.	Haemorrhagic septicaemia	6 months onwards	Every year before monsoon
4.	Black quarter	6 months onwards	Every year before monsoon
5	Brucellosis	Only once at 4-8 months of age in female calves in problem herds	Every year in January.
6.	Theileriosis	3 months and above	Every year in endemic area

1.16 Deworming

- Deworming is the process of removal of endoparasites such as roundworms, tapeworms and liver flukes.
- Anthelmintic are used for deworming purpose.

Fig. 1.36 : Deworming in animal

Signs of worm infested animal

1. Diarrhoea
2. Loss of weight
3. Soil licking and eating pieces of cloth
4. Delay in puberty
5. Weakness and slow growth
6. Decrease in milk production
7. Death at an early age
8. Thin and rough skin

Advantages

1. An increase in milk production of the animal.
2. Regular de-worming of calves, increases their daily growth rate.
3. Regular de-worming keeps the animal healthy.

1.17 Spraying and dipping

a. Spraying

1. Spraying of insecticide controls all sorts of ectoparasites like ticks, lice, flies and thereby keeps animal healthy.
2. Spraying of insecticide should be done in cattle shed and on animal body at monthly intervals.
3. Insecticides like amitraz and deltamethrin are commonly used for animal spray.
4. All insecticides are toxic to animals hence should be used carefully.

Fig. 1.37 : Spraying of animal

b. Dipping

- Dipping is the process of offering a bath with a mild parasiticidal drug / chemical in a specially prepared tank.

Do you know ?

Dipping controls the ecotoparasitic infestation viz. lice, ticks, flies, mites etc.

Table 1.7 : Deworming schedule for cattle and buffaloes

Sr. No.	Type of worm	Schedule
1	Round worms	First dose at three days of age and thereafter at monthly interval up to 6 months of age
		Thrice a year in animals above 6 months of age
		From 1 year onwards, once in 4 months i.e. June, October and March
2	Tapeworms	Twice a year i.e. January and June in calves in problematic herds
3	Liver flukes	Twice a year i.e. May and October in disease prone area

Method

1. It is specially used for sheep however goat, cattle and buffalo may also be dipped.
2. The size and structure of dipping tank depends on type of animal.
3. The usual dimensions of dipping tank are depth 1.5 m, width 1.0 m, length at top 2.5 m and length at bottom 1.5 m.
4. The tank is usually made up of cement concrete, however tank made from wood or galvanized sheet are not common.
5. The various chemicals used for dipping are Lindane (0.03% for young stock and 0.05% for adults) Sumithion (0.05%) and Nicotine (0.1%).
6. The animal is allowed to pass through the dipping tank containing solution of desired concentration.
7. It is expected that animal should be in dip for at least 2 minutes for better results.

Fig. 1.38 : Dipping of animals

Precautions to be taken while dipping

1. Animals should be given sufficient drinking water before dipping.
2. Dipping to pregnant animals should possibly be avoided.
3. Sufficient rest should be given before dipping.
4. Animals with injuries or open wounds should not be given dipping.
5. Dipping should not be done immediately after shearing.
6. Dip should be provided for a specific period of time.

1.18 Record keeping

Record keeping is an important daily farm activity helpful for the evaluation of individual performance of cow and economic assessment of dairy farm as a whole. Keeping records is a key operation on dairy farms. Systematic arrangement of information of various events at the farm is known as recording. Application of computer has very crucial role in dairy record management. It is usually done by using prescribed forms and with the help of computer programme.

Advantages

1. Records provides basis for evaluation of animals for fixing proper prices of animal meant for purchase and sale.
2. It helps in systematic breeding programme for improvement of herd, in progeny testing of bulls
3. It helps in preparing pedigree and history record of animals.
4. It helps in detection of abnormal condition of animals leading to loss in body weight.
5. It helps in determining cost of milk production.
6. It is helpful in comparing the efficiency of labour and herd with other farms.
7. It helps to assess the present status of business.
8. The low producing animals can be identified.
9. It becomes easy to select the animals for culling.
10. Profitability or loss of business can be judged at any time of the year.

Types of registers

1. Livestock register (History sheet)
2. Daily heard register
3. Calf register
4. Growth record register (young stock)
5. Feed and fodder register
6. Cattle breeding register
7. History and pedigree register
8. Calving register

9. Milk yield register
10. Herd health register
11. Mortality register

Remember

Records should be accurate, up to date, less expensive, easy to handle and maintain.

1. Livestock register

Sr. No.	Animal No.	Date of purchase	Date of birth	Value (Rs)	Approximate age when purchased	Pedigree		How disposed off	Page of herd register	Remarks
						Dam	Sire			

2. Daily herd register

Date	Cow		Bulls	Calves		Heifers	Bullocks	Total Livestock		Milk yield (kg)	Addition during day from where	Deduction during day	
	Milch	Dry		Male	Female			AM	PM			No.	How

3. Calf register

Sr. No.	Date of birth	Animal No.	Sex	Breed	Sire No.	Dam No.	Birth weight (kg)	Disposed		Remarks
								How	Date	

4. Growth record register (young stock)

Animal No.	Date of birth	Birth weight (kg)	Weight at weeks (kg)						Weight at month (kg)				Weight at first service (kg)	Weight at first calving (kg)	Remarks
			1	2	3	4	5	12	4	5	6	24			

5. Feed and fodder register (month)

Date	No. of Animals	Green (kg)			Dry (kg)			Concentrate (kg)		
		Received	Issued	Balance	Received	Issued	Balance	Received	Issued	Balance

6. Cattle breeding register

Sr. No.	Cow No.	Date of last calving	Date of service	Time of service	Bull No.	Date of Pregnancy Diagnosis	Expected date of calving	Date of calving	Weight of the calf (kg)	Sex of the calf	Tatoo No. of calf	Remarks

7. History and pedigree sheet

Identification of animal	Date of birth / date of purchase	Sire No.	Dam No.	Dam's Milk yield (kg)	Dam's Lactation length (days)	Dam's Dry days	Paternal Grand Dam No. FLY & LL	Maternal Grand Sire No. FLY & LL	Maternal Grand Dam No. FLY & LL

8. Calving register

Cow No.	Due date of calving	Date of calving	Sire No.	Calf No.	Calf sex	Birth weight (kg)	Breed	Remarks

9. Milk yield register

Sr. No.	Cow No.	Date	Milk yield (kg)										Total Milk (kg)	
			1		2		3		.....		31			
			AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM

10. Herd health register

Animal No.	Admission Date	Symptoms	Diagnosis	Treatment details	Date of discharge	Treat. Cost	Remarks

11. Mortality register

Animal No.	Breed	Sex	Date of illness	Diagnosis	Date of death	Cause of death	Post mortem report no.	Book value	Remarks

Important applications of farm record analysis

1. In making decision about culling of animals.
2. In reducing feed cost.
3. In proper utilization of land and labour.
4. Comparing performance with standard values.
5. Proper breeding of herd.
6. Proper claiming from insurance companies.
7. Adjusting profitability and productivity

Livestock (Herd) management software

The livestock management software is a framework that helps the farmers to maintain and track the records of their livestock from born to till the time they are disposed.

The various herd management software's are now available in the market that includes milk recording, breeding, lactation reports, vaccination, breeding notifications, calf rearing program, income and expense reports, weight changes, etc.

eg. Herdman, Dairy Live!, Milk Manager, Farm 365, Herd intelligence,

Fig. 1.39: Herd management software

Advantages of herd management software

1. It is easy to enter day to day data in an organized livestock farm.
2. It is easy to handle data with the help of the software.
3. It help to store data securely.
4. It automatically generates information.
5. It generate production efficiency as an when required.
6. It allows to compare two individual or group of animal etc.
7. It remind about the scheduled activities.
8. It help to generate quick and easy need based daily, monthly and annual reports of the herd.
9. It is easy to transmit data and report for expert evaluation

Internet my friend

Search different open source livestock management softwares available in the market

1.19 Carcass disposal

The died animals or carcasses and parts that unfit for use as food should be disposed off within 48-72 hours and the premises should be cleaned promptly. Improper disposal of carcass increases the spread of zoonotic disease also contaminate surface and ground water. Therefore, it is necessary to dispose carcass of dead and slaughtered animals as soon as possible.

Methods of carcass disposal

1. Burial
2. Composting
3 Incineration
4. Rendering

1. Burial

- Burial is a common method of carcass disposal to manage mortalities, but it poses a groundwater contamination risk if the burial site is not selected and managed properly. Therefore, selection and maintenance of a burial site is very important.
- For example, areas with sandy or gravelly soil and a shallow groundwater table must not be used as burial sites.
- The bottom of the disposal trench must be 4 feet above any permanent water table, and the trench must be a minimum horizontal distance of 200 feet from the nearest surface water.

Fig. 1.40 : Burial method of carcass disposal

2. Composting

- Composting is a carcass disposal method that involves the placement of carcasses beneath organic materials in compost pits that are long, narrow windrows or trapezoidal shaped and above ground which promotes decomposition at elevated temperatures and destroys pathogens present in the carcasses.
- In this process, bacteria break down the carcass, leaving only feathers and bones.
- Composting has gained popularity in areas where burial and incineration are not practical or have become restricted.
- Proper composting techniques destroys most disease-causing bacteria and viruses.
- Composting is safe and produces fairly odorless, spongy, and valuable soil supplement as an end product.

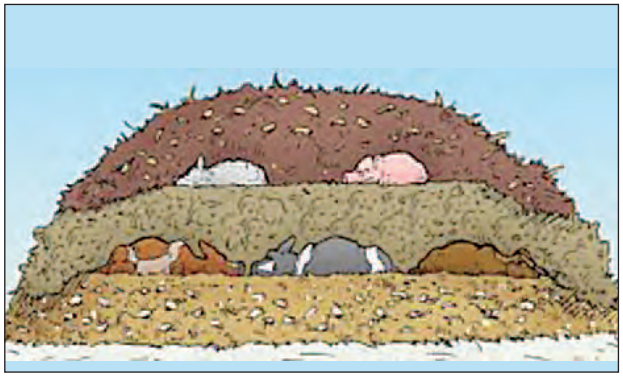


Fig. 1.41 : Livestock composting

3. Incineration

- Incineration is the thermal destruction of carcasses by auxiliary fuel such as propane, diesel or natural gas.
- Modern incinerators reduce carcasses to ash and are biosecure. However, incineration requires more energy as compared to other disposal methods hence, it is not considered as a viable economic disposal option due to cost and labor.
- Incineration is a preferred method for managing small carcasses e.g. poultry

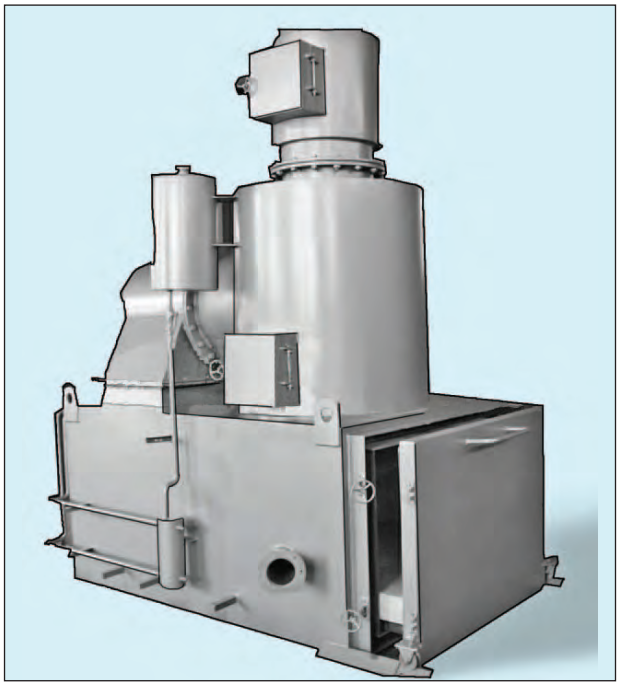


Fig. 1.42 : Incinerator for livestock

4. Rendering

- Rendering is the process of converting animal carcasses to pathogen-free, useful byproducts such as meat, feather, bone, and blood meal that can be used in animal feeds as a protein.
- In this process, the carcasses are exposed to high temperatures (about 130 ^{0}C or 265 ^{0}F) using pressurized steam to ensure destruction of most pathogens.
- It is an environmentally safe method for disposal of dead livestock. However, rendering poses biosecurity concerns due to the transportation of dead animals to multiple locations by road to the rendering plant.

Fig. 1.43 : Rendering plant

Internet my friend

Search the other options for disposal of dead animals on farm and carcasses from slaughter house.

Q.1 Fill in the blanks

1. Ear notching is permanent method of marking in ……..species.
2. The temporary method of marking the animals is ……
3. ……. is the most advanced method for identification and record the data of animals.
4. The mechanical dehorning is performed at……..years of age.
5. The old and crude method of castration is ……..
6. ……chemical is used for chemical dehorning.
7. Milking machine is operated at 10-15 vaccum with pulsation rate of …….per minute for successful milking.
8. …….method of drying off is suitable for high yielding cow in pregnant condition.
9. …….stimulates the blood, lymph circulation of skin and improves appearance of animal.
10. …….reduces the possibility of lameness and foot rot.

Q.2 Make the pairs

Group A	Group B
1. Ear notching	a. Puncturing desire letter or number
2. Tagging	b. U or V shape cut/ notches
3. Branding	c. Self-piercing and non-piercing
4. Disbudding	d Removing horn bud
5. Ear tattooing	e. Hot Iron, Chemical or coolant
	f. Dehorning

Q.3 State true or false

1. Dehorning is the removal of horn after it has attached to skull
2. Incisors are commonly used for estimation age
3. Casting of an animal means removing or dysfunctioning of essential reproductive organs in males.
4. Burdizzo castrator is used for bloodless castration.
5. Vasectomized bulls are fertile.
6. Knuckling is the best method of milking in dairy animals.
7. Ringing is the process of putting nose ring to the bull.

Q.4 Answer in brief

1. Define tattooing.
2. State types of tagging.
3. What is mean by disbudding?
4. What is mean by vasectomization?
5. Name the close and bloodless method of castration.
6. What is grooming?
7. Which method of milking is modification of full hand milking?
8. What is ringing of bulls?
9. Give the appropriate age of calf for first dose of dewormer?
10. Define dipping.
11. What precautions should be taken while dipping the small animals?
12. Hoof trimming increases productive life of cow, Justify?

Q.5 Answer the following questions

1. Write the importance of record keeping in livestock farm.
2. Differentiate between hand milking and machine milking.

3. Give the advantages and disadvantages of machine milking.
4. Enlist different methods of identification of animals and explain any one of them.
5. Enlist the criteria for culling of animals.
6. What do you mean by the term vaccination?
7. What is drying off? Write in details about drying off methods.
8. Explain the chemical methods of dehorning with advantages and disadvantages.
9. Give deworming schedule for cattle and buffalo.
10. Write the advantages of herd management software.
11. What are the common types of hand milking in dairy cows?

Q.6 Answer in detail

1. What are the methods of determining the age of animals? Give merits and demerits of each.
2. What are the methods of dead animal disposal? Explain any one.
3. Enlist the different name of the records maintained at a dairy farm with its objectives.
4. What do you mean by castration and write the different methods of castration?
5. What are the principles of milking in dairy animals?
6. Explain in detail the RFID technology used for cattle identification.

2. HOUSING OF DAIRY ANIMALS

Do you know ?

1. Importance of cattle housing
2. Types of housings for animals
3. Different components of farm building

An efficient management of dairy animals will be incomplete without a well planned and adequate housing. Improper planning of animal housing may result in additional labour charges and discomfort to animals. During erection of farm building, care should be taken to provide comfortable accommodation for an individual animal. Proper sanitation, durability and arrangements for the production of clean milk under convenient and economic conditions are also to be taken care off. Although expenditure on housing is unproductive it is essential to have proper housing for providing proper comfort to animals and their protection from severe cold, rain, temperature and predators.

Do you know ?

Housing protects animals from sun, rain, wind, snowfall, predators and provides comfort to get maximum production.

2.1 Objectives of housing

1. To protect dairy animals from extreme climatic conditions.
2. To protect dairy animals from wild animals and theft.
3. To provide maximum comfort to dairy animals so as to get more milk yield.
4. To produce clean and hygienic milk.
5. To increase the efficiency of labour.

2.2 Selection of site

The points to be considered for the selection of site and layout of dairy farm are as follows -

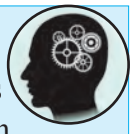
1. **Topography and drainage :** A dairy building should be at higher elevation than the surrounding area to offer good slope for rain water and proper drainage of the dairy wastes. This helps to keep barn dry. Land should be leveled.
2. **Soil type :** Well drained high elevated poor to medium type of land should be selected for construction of dairy farm structures.

Remember...

Floor must be moisture proof, easy to clean non slipery and predator proof

3. **Exposure to the sun and protection from wind :** Building should be planned in such a way that direct sunlight can reach the platforms, gutters and mangers in the shed so as to dry it at early.

Remember...



The long axis of the dairy barns should be set in the north-south direction to have maximum benefit of sunlight and ventilation.

4. **Accessibility :** Easy accessibility to main road preferably at a distance of about 100 meters is always desirable for a dairy farm. Dairy building should not be too close to road to avoid the disturbances.
5. **Durability :** Durability of the structure is an important aspect for building a dairy farm.

This will reduce the cost of maintenance and repairs to building.

6. **Water supply :** Supply of Sufficient fresh, clean and soft water should be made available. To avoid environmental dust and dirt, water tank should be covered. White wash should be given to tank weekly to keep water clean.
7. **Surroundings :** Areas nearby the dairy farm should be away from wild animals and marshy land. Fencing should be provided to dairy farm. Tree plantation should be done around the dairy farm.
8. **Labour :** Regular supply of honest, economic and skilled labour should be available for day to day work at farm.
9. **Marketing :** Dairy farm should be located in the areas from where the market place is nearer so that transportation cost is less and spoilage of milk can be avoided. This helps owner to sell dairy products profitably and regularly. He should be in a position to satisfy the needs of the farm within no time and at reasonable cost.
10. **Electricity :** Since a modern dairy always handles most of the electric equipments, it is desirable to have an adequate and regular supply of electricity.
11. **Facilities for feed storage :** Dairy farms should be constructed and designed in relation to feed storages, hay stacks, silo and manure pits.

Do you know ?

Sufficient space per cow and well arranged feeding mangers contribute not only to higher milk yield of cows but also to make the work of the operator easier and minimize feed expenses.

2.3 Systems of housing

The most widely prevalent practice of housing animals in India is to tie the cows with rope on a kaccha floor, thus they are exposed to extreme weather conditions leading to health problems and lower production except some organized dairy farms where proper housing facilities exist.

Dairy cattle may be successfully housed under a wide variety of conditions, ranging from close confinement to little restrictions except at milking time. At present following two types of dairy housings are in general uses -

1. Loose housing system
2. Conventional housing system

2.3.1. Loose housing system

1. In this system animals are kept loose in an open paddock except at milking time and treatment.
2. A covered shed is provided for shelter at one end of the paddock.
3. There is separate milking parlour where milking of animals is done.

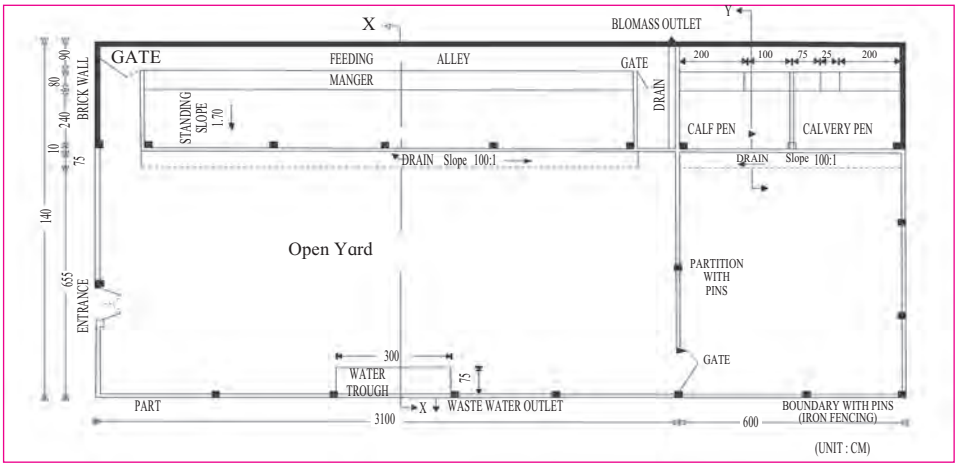


Fig. 2.1 : Layout of loose house for 40 dairy animals

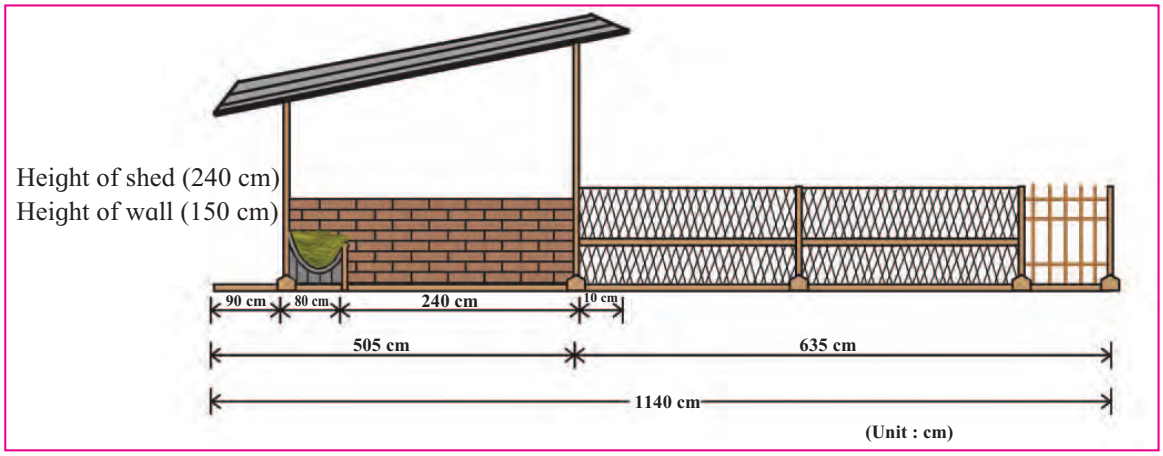


Fig. 2.2 : Sectional view of loose house

4. Feed and fodder is offered in a common manger.
5. A common water tank is provided at one side of byre for providing water to animals.
6. Total area is protected by compound wall.
7. Bedded area of about 60 sq. ft. /cow is provided to give comfort to cows.

Fig. 2.3 : Loose housing system with tin shed

Fig. 2.4 : Loose housing under tree

The floor space requirements for different categories of dairy animals are given in Table 2.1.

Table 2.1: Floor space requirement (per animal) for different categories of dairy animals

Sr. No.	Category	Covered area (sq.ft.)	Open paddock (sq.ft.)
1.	Calves (0-3months)	10.66	10.66 - 16.14
2.	Calves (3-6 months)	10.66-21.53	21.53 – 26.91
3.	Calves (6-12 months)	21.53	37.67 - 43.05
4.	Cows	37.67	75.35
5.	Buffaloes	43.05	86.11
6.	Breeding bulls	129.17	1291.71

The feeding and watering space requirements for dairy animals are given in the Table 2.2

Table 2.2 : Feeding and watering space requirements (per animal) for dairy animals

Category	Length of manger / water trough (feet)	Width (feet)	Depth (feet)	Height of the inner wall (feet)
Adult cattle and buffaloes	1.97 to 2.46	1.97	1.31	1.64
Calves	1.31 to 1.64	1.31	0.49	0.66

Advantages

1. Cost of construction is low.
2. Animal get free choice of green or dry fodder and water.
3. Heat detection in females is easier.
4. Animals feel comfortable and stress free as they are free to move.
5. Feeding and management is easier.
6. Sick animal can be easily identified
7. Labour requirement is less.
8. It is possible to expand the housing without much modification, and cost.
9. It is most suited in tropical climate.
10. It helps in clean milk production as cows are milked in milking parlour.
11. Animals also get sufficient exercise which is extremely important for better health and production.

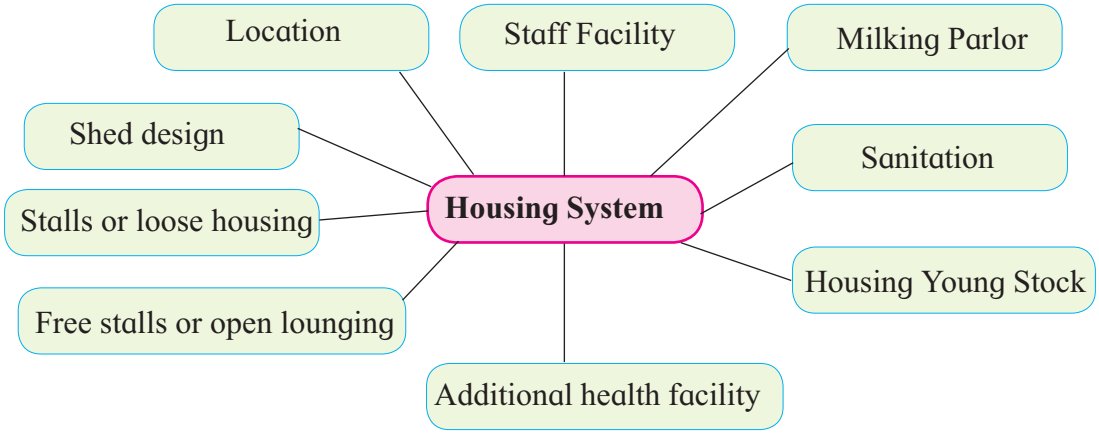


Fig. 2.5 : Points to be considered to develop housing systems for dairy farm

12. Incidence of mastitis has been recorded less in loose housing systems.
13. Injuries to the joints, feet and udder are found to be less.

Disadvantages

1. Total floor space required is more as compared to conventional housing system.
2. Spread of contagious diseases is likely to be more.
3. Females in heat may disturb other animals in the herd.
4. Display of animals in herd is not proper.
5. It is not suitable in heavy rainfall and temperate climate.
6. There are chances of fighting between the animals as there may be a competition for feed and fodder among them.
7. Individual animal attention is not possible

Fig. 2.6 : A cheap wooden fencing loose housing

Observe and discuss...

Visit nearby cattle farm and note down difference between loose and barn housing system

Internet my friend

Loose housing system is old method but now a days this method is used for milch animal

2.3.2 : Conventional housing system

The conventional housing systems is becoming less popular day by day as it is comparatively costly. However, by this system cattle are more protected from adverse climatic condition.

It is mainly of two types i.e. 1. Tail to tail and 2. Head to head system.

1. Tail to tail housing system : In this system of housing animals are arranged in a head out manner and there is a common passage between two rows called central or litter alley.

Advantages

1. Milking, collection of milk and its supervision is convenient due to central alley.
2. Collection of dung and cleaning of shed is easier due to central alley.
3. Heat detection and AI is easier.

Fig. 2.7: A view of tail to tail housing system

4. Spread of contagious diseases is less.
5. Animals are not disturbed by each other as all are facing out.
6. It is convenient for machine milking.
7. Animals get optimum ventilation.
8. Mechanization is easier.

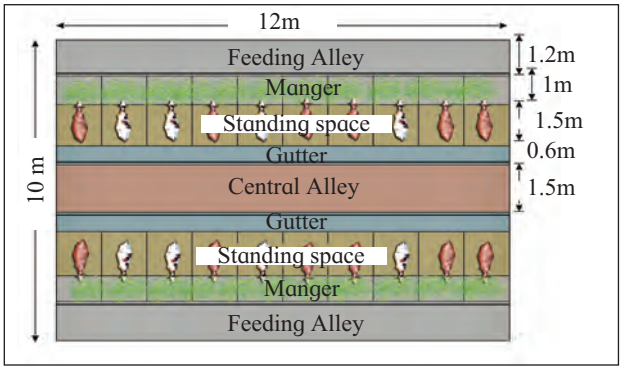


Fig. 2.8 : Layout of tail to tail housing system for 10 dairy animals

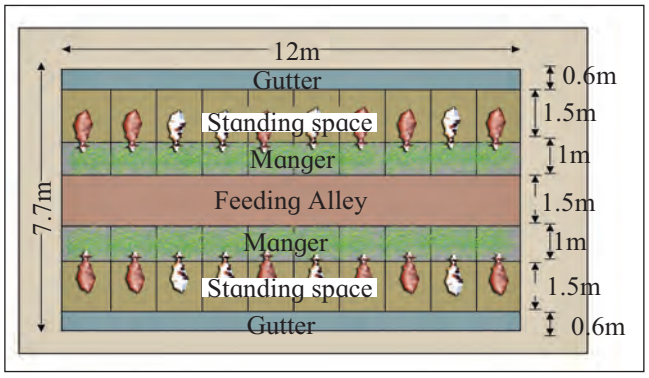


Fig. 2.9 : Layout of head to head housing system for 10 dairy animals

9. Supervision at the time of milking is easier for both the rows

Disadvantages

1. It requires more time for feeding.
2. It gives bad display to visitors.
3. Gutter remains moist as sun rays does not reach to it.
4. Entrance of animals is difficult.

Do you know ?

The Tail to tail housing system of animal is considered better than head to head housing system

Can you tell ?

Why tail to tail system is most suitable for cattle farming?

2. Head to head housing system

In this housing system animals are arranged in a head to head manner and there is common feeding passage at centre between two rows.

Advantages

1. It requires less time for feeding.
2. Gutters dry quicker as they are facing out hence more exposed to sunlight.
3. It gives better display of animals to the visitor.
4. The chances of spread of diseases are minimum.
5. Entry of animals is easier.

Fig. 2.10 : A view of head to head housing system

Disadvantages

1. Milking, collection of milk and its supervision is inconvenient.
2. Detection of heat and gynaeco-clinical problems is difficult.
3. While milking, animals may get disturbed by other animals facing to them.
4. Time required for cleaning of shed is more.

Internet my friend

Visit nearby Tail to tail and Head to head housing system and find out difference between them.

Table 2.3 : Difference between Tail to tail and Head to head housing system

Sr.No.	Tail to tail housing system	Head to head housing system
1	In this system of housing animals are arranged in a head out manner and there is a common passage between two rows called central alley	In this housing system animals are arranged in a head to head manner and there is common feeding passage at centre between two rows.
2	It gives bad display to visitor.	It gives better display to visitor.
3	It requires more time for feeding.	It requires less time for feeding.
4	Milking, collection of milk and its supervision is convenient	Milking, collection of milk and its supervision is not convenient
5	Heat detection and AI is easier.	Heat detection and AI is difficult.
6	Gutter remains moist as sun light does not reach to it.	Gutters dry quicker as they are more exposed to sunlight.
7	Entrance of animals is difficult.	Entry of animals is easier.
8	Animals are not disturbed by each other as all are facing out.	Animals are disturbed by each other as all are facing out.
9	Mechanization is easier.	Mechanization is difficult.
10	The chances of spread of contagious diseases are less	The chances of spread of diseases are minimum.
11	Animals get maximum ventilation.	Animals get optimum ventilation.

Table 2.4 : Difference between Loose housing system and Conventional housing system

Sr.no.	Loose housing system	Conventional housing system
1	In this system animals are kept loose in an open paddock except at milking time and treatment.	In this system animals are kept in the well protected shed
2	Cost of construction is low.	Cost of construction is high.
3	Heat detection in females is easier.	Heat detection in females is not so easier.
4	Feed and fodder is offered in a common manger.	Feed and fodder is offered in a separate manger.
5	Animals also get sufficient exercise which is extremely important for better health and production.	Animals does not get sufficient exercise which is extremely important for better health production.
6	It is possible to expand the housing without much modification and cost.	It is not possible to expand the housing without much modification and cost.
7	Animals feel comfortable and stress free as they are free to move.	Animals does not feel comfortable and stress free
8	Sick animal can be easily identified	Sick animal can't be easily identified

9	Incidence of mastitis is less in loose housing systems	Incidence of mastitis is more in conventional housing systems
10	Injuries to the joints, feet and udder are found to be less.	Injuries to the joints, feet and udder are found to be more.
11	Animal get free choice of green or dry fodder and water.	Animal does not get free choice of green or dry fodder and water.
12	Spread of contagious diseases is more likely to occur.	Spread of contagious diseases is less likely to occur.
13	Display of animals in herd is not proper.	Display of animals in herd is proper.
14	Individual animal attention is not possible	Individual animal attention is possible

2.4 Components of the animal house

The main components of farm building are floor, roof, manger, alley, gutters, doors, water trough and walls.

1. Floor

- It should be made from impervious material, easy to clean and should remain dry.
- It should be even but non slippery.
- A slope of 3 cm should be provided from manger towards the gutter.
- Floor space required per cow is about 1.5 x 1.2 m.

Cement concrete flooring with grooves or paved with bricks is preferred.

Fig. 2.11 : Murum floor with soft bedding loose housing

Fig. 2.12 : Brick floor of the conventional housing (Tail to Tail)

2. Roof

- Roofing material used are should be coated iron sheet, asbestos sheet, cement sheet or thatched roof.
- Corrugated iron sheet becomes hot in summer and cold in winter. Hence, it brings about extreme fluctuations in the temperature inside the shed. Roof should preferably be made up of asbestos sheet
- Height of roof should be 2.4 m at the sides and 4.5 m at the centre to permit sufficient fresh air and ventilation inside the house.
- Roof should be extended beyond wall by 0.75 m.
- Ventilation ridge (0.2 m wide and 0.2 m above) should be provided in the centre.

Fig. 2.13 : Tin shed

Fig. 2.14 : Green net shed

3. Manger

- Width of the manger should be 1.0 m.
- Height of rear wall of the manger should be 0.8 m and that of front wall should be 0.2 m (low front manger) to 0.4 m (high front manger).

Fig. 2.15 : Cheaper manger/feeding trough

- Low front type of manger is comfortable however high front type manger minimizes feed wastages.
- Slight slope should be provided to manger for cleaning purpose.

Fig. 2.16 : Common manger for feeding and watering

4. Alleys

- In tail to tail system the width of central or litter alley and feed alley should be 1.5m and 1.2m, respectively.
- Central or litter alley should have 2.5 cm slope from the centre towards gutters running parallel.
- In head to head system, the central alley or feed alley should have 1.5 m width.

5. Gutters

- Gutters is useful to collect and carry dung and urine of animals in the shed.
- Width and depth of the gutters should be 0.6 m and 0.2 m, respectively.
- Gutter should have 2.5 cm slope for every 3.3 m length.

6. Water troughs

- A water trough is simply a water container that holds water without affecting its quality, used for watering the livestock in shed.
- Various sizes water troughs are constructed or fitted in the centre or corner of animal sheds for drinking the water.
- These are may be of cement constructed/ fiber troughs / non-rusting metals.

- Now a day's automatic water troughs are available where troughs are get filled automatic.
- The capacity of the trough depends on the herd size of animals.

Fig. 2.17: Water troughs

Fig. 2.18 : Modern automated water trough

7. Doors

- Height of door should be 2.1 m.
- Width of the door for single row shed should be 1.5 m while for double row it should be 2.5 m.
- Doors should be fixed with wall by long hinges so that they should lie flat against external wall when full open.

8. Walls

- The width and height of wall should be 0.3 m and 1.5 m, respectively.
- The open space of 0.9 m should be kept between wall and roof except door side.
- The inner side of the wall should be smooth.
- White wash should be given to wall.

Fig. 2.19 : Iron pipe fencing for loose housing

9. Calving boxes

- Allowing cows to calve in the cowshed is highly undesirable as it leads to unsanitary condition for milk production and spread of disease is more.

Fig. 2.20 : Calving box

- Hence, special calving pen accommodation in the form of loose-boxes enclosed from all sides with a door should be provided to all parturient cows.
- It should have an area of about 100 to 150 sq.ft.
- It should have soft bedding with sufficient ventilation.

10. Isolation Boxes

- Animals suffering from infectious disease must be separated from healthy animals.
- For this loose boxes of about 150 sq.ft are to be provided.
- They should be situated at some distance from the farm.
- Every isolation box should be self contained and should have separate connection to the drainage disposal system.

11. Sheds for young stocks

- Calves should never be accommodated with adults in the cow shed.
- The calf house must have provision for daylight ventilation and proper drainage.
- Damp and ill-drained floors cause respiratory trouble to calves.
- It is useful to classify the calves below one year into three age groups, viz. calves below 3 months, 3-6 months and 6 months to 1year for a better allocation of the resting area.
- Each group should be sheltered in a separate calf house or calf shed.
- As far as possible the shed for the young calves should be quite close to the cow shed.
- Each calf shed should have an open paddock or exercise yard.
- An area of 100 square feet per head for a stock of 10 calves and an increase of 50 square feet for every additional calf will make a good paddock.
- An overall covered space of:
  1. 20-25 square feet per calf below the age of 3 months,
  2. 25 -30 square feet per calf of 3-6 months,
  3. 30-40 square feet per calf of 6-12 months and above, and
  4. 40-45 square feet for every animal above one year, should be made available
  5. Water troughs inside each calf shed and exercise ward should be provided.

12. Bull or bullock shed

- A separate accommodation for bulls or bullocks should be provided.
- A bull should never be kept in confinement particularly on hard floors. Such a confinement without adequate exercise leads to overgrowth of the hoofs creating difficulty in mounting and loss in the breeding power of the bull.
- A loose box with rough cement concrete floor with sufficient light and ventilation
- The shed should have a manger and a water trough.
- If possible, the arrangement of water and feed be served without entering the bull house.

Fig. 2.21 : Separate calf shed

Fig. 2.22 : Bull shed

Q.1. Fill in the blanks

1. A slope of ……. cm should be provided from manger towards the gutter.
2. ……. front type manger minimizes feed wastages.
3. The floor space required per cow is……. Square feet
4. In loose housing system length of the manger for adult cattle should be……. feet.
5. In ……. housing system animals are arranged in head to head manner.
6. Height of roof at centre should be …… feet.

Q.2. State True or False

1. Milker is the first man who handles the milk.
2. The long axis of dairy farm building should be constructed in east west direction.
3. Manger is meant to collect and carry dung and urine of animals in shed.
4. In loose housing system, animals are kept loose in open paddock except at milking time
5. In tail to tail housing system animals are arranged in head out manner
6. In head to head housing system supervision of milking is difficult

Q. 3. Make the Pairs

Group A	Group B
1. Manger	a. Shelter
2. Gutter	b. Cleaning
3. Central alley	c. Carry dung and urine
4. Roof	d. Feeding

Q. 4. Answer the following questions in short.

1. Mention the types of conventional housing system.
2. Write the meaning of loose housing system.
3. Give the covered area to be provided to an adult cow in loose housing system.
4. Name the housing system in which animals in heat can be detected easily.
5. Give the name of the housing system in which disease control of animals is better.
6. Which are the components of dairy farm buildings?
7. Write the objectives of housing.

Q. 5 Answer the following questions in brief.

1. Difference between loose and barn housing system
2. State points to be considered while selection of site for construction of dairy farm.
3. Give advantages and disadvantages of tail to tail system.
4. Give advantages and disadvantages of head to head system.
5. Explain in brief loose housing system for dairy animals.
6. Difference between Tail to tail and Head to head housing system

3. DAIRY CATTLE AND BUFFALO MANAGEMENT

Can you recall ?

1. The term management and routine management practices followed on livestock farm
2. Different types of cattle and buffalo breeds.

In India, livestock is an integral part of agriculture as both crop husbandry and animal husbandry are dependent on each other. The livestock industry in India depends on the economics of feeding, breeding, management and health care of animals. The animals need to be properly fed for the best production. The main thrust of livestock production depends on how they are managed for economic milk production.

3.1 Raising of calves

It is said that good animals are raised on the farm and not purchased. The future herd is developed from calves hence they are to be home made.

Objectives / Necessity of raising calves

1. To build a good dairy herd with pedigree animals free from hereditary defects
2. To achieve early maturity and productivity
3. To reduce mortality in calves due to poor management

Feeding and management of calf before birth

1. Take special care of feeding pregnant mother
2. The embryonic development in last three months of pregnancy of the mother should be fast enough so as to achieve the desired growth of foetus.
3. In last quarter of pregnancy cow should have free access to feeding and watering.

General care and management of new born calf

1. Remove mucus from nostrils and mouth immediately after birth for easy breathing.
2. Give artificial respiration, if necessary.
3. Allow the mother to lick the newly born calf.
4. Clean the body coat by gunny bag or cloth to provide warmth to the calf.
5. Remove front portion of yellow coloured tender hooves.
6. Help the calf to stand and suckle the mother.
7. Cut the naval cord 3 cm away from the body, with new blade or sterilized scissor and tie it. Apply tincture iodine on the cut portion.
8. Feed colostrum @ 10% of body weight to calf within two hours after birth.

Methods of raising calves

1. Suckling or natural method

2. Weaning or artificial method.

1. Suckling method : In this method, calf is allowed to suckle the dam. This method is adopted in following ways.

1. Calf is allowed to suckle one or two teats of dam during milking or allowed to suckle for a short period after milking.
2. Calf is allowed to remain with its dam for the whole day, so that calf suckles the dam whenever required. This method is adopted in case of low producing cows.
3. Two to four calves of similar age and vigour are kept in a stall or pen with one cow which is called as '**nurse cow**'.

Fig. 3.1 : Suckling method

Advantages

1. Calf suckling stimulates the mother.
2. Calf grows rapidly.
3. Most easy, safe and practical method of raising calves.
4. It requires least management skill.
5. Let down of milk is quick and easy.

Disadvantages

1. It is uneconomical or expensive method.
2. It may cause injury to teats.
3. Quantity of milk suckled by the calf is not known and according to the body weight of calf.
4. There is possibility of over or under feeding.
5. Exact amount of milk given by the cow cannot be recorded.
6. There is difficulty in regular milking of cow if calf dies.

b. Weaning method : Weaning is defined as separation of calf from its mother immediately after birth or within two to three days from birth.

Advantages

1. There is no problem in regular milking of cow, if calf dies.
2. With the help of milk substitutes calves can be raised if dam dies.
3. Feeding is controlled, hence less risk of over and under feeding of cow.
4. Hygienic milk production is possible.
5. When calves are weaned, cows become regular breeder.
6. Culling of calf is possible at an early age.
7. Actual milk production of cow can be recorded.

Disadvantage

- Labour requirement is more.

Table 3.1: Differences between suckling and weaning method

Suckling Method	Weaning Method
1. Calf is allowed to suckle milk directly from udder before and after milking.	1. Calf is separated from its mother immediately after birth or within 2-3 days from birth.
2. It is uneconomical method.	2. It is economical method.
3. Culling of calf is not possible at an early age.	3. Culling of calf is possible at an early age.
4. There is difficulty in regular milking of cow if calf dies.	4. There is no difficulty in milking of cow if calf dies.
5. Possibility of calf scour/diarrhoea is more	5. Possibility of calf scour/diarrhoea is less.
6. No control over milk feeding.	6. Control over milk feeding.
7. Actual milk yield can not be recorded.	7. Actual milk yield can be recorded.
8. Total milk yield is less.	8. Total milk yield is more.
9. It is unhygienic and unsanitary.	9. Milking without calf is more hygienic and sanitary.
10. Labour requirement is less.	10. Labour requirement is more.

Feeding of calf

1. Feeding of colostrum : Colostrum is the first milk of a dam immediately after parturition. It is the first feed for the new born.

1. Optimum time for feeding colostrum : Colostrum should be fed to calf within 2 hours after birth. Because during this period maximum antibodies present in colostrum are absorbed due to increased permeability of the intestinal wall. Later on this absorption rate goes on decreasing.

2. Rate of colostrum feeding : It should be fed @ 10% of calf body weight. About 2.5 kg of colostrum is sufficient for a new born calf.

3. Frequency of colostrum feeding : It should be given in 2 to 3 divided doses in a day. The interval between feeding should be maintained constant to avoid digestive complications.

4. Period of colostrum feeding : Colostrum should be given for at least 3 days and upto 7 days after birth.

5. Advantages / importance of colostrum feeding

a. It contains antibodies γ-globulins which provide immunity / resistance against usual calf diseases.

b. Its laxative action helps to remove meconium, i.e. first faeces of calf.

c. It also creates acidic medium in digestive system and thereby prevents diarrhoea.

d. Its protein content is about 3 to 5 times more than normal milk (about 20 %).

e. Its vitamin A content is very high i.e. about 5 to 15 times as that of normal milk. It also rich in riboflavin, choline, thiamine and pantothenic acid.

f. It also supplies some important minerals like copper, iron, magnesium and manganese.

6. Colostrum substitute

a. If colostrum is not available due to death of dam or non-secretion from the udder, then colostrum from other newly calved cow can be given. or

b. A mixture of the following ingredients can serve as colostrum substitute in emergency.

Water	----------	284 ml
Milk	----------	575 ml
Castor oil	----------	2.5 ml
Egg	----------	1 (One)

c. In addition to this, injection of 50 ml of dam's serum intravenously is also recommended.

Methods of milk feeding to calf

a. Pail feeding : In this method, milking bowl is used for feeding of milk to calf.

Technique

1. Warm the milk to body temperature of calf (39^{0}C. or 102.2^{0}F)
2. Take the required quantity of milk on the basis of body weight of calf (10% of body weight) in clean sterilized milking bowl.
3. Put forefinger in the mouth of calf and lower the head of calf, till the muzzle touches the milk in bowl.
4. The calf then starts licking the finger it and gradually sucks the milk from bowl.
5. Clean the mouth of calf after milk feeding.

Fig. 3.2 : Pail feeding

b. Nipple feeding : In this method pail with nipple attachment near the bottom is used for milk feeding to calf.

Technique

1. Warm the milk to body temperature of calf.
2. Take required quantity of milk in clean pail or bottle.
3. Then place nipple pail at a convenient height.
4. Allow the calf to suckle the milk through nipple.

Fig. 3.3 : Nipple feeding

Advantages

1. It facilities training of calves to suckle milk.
2. It reduces bad habit of calves to suckle each other.

Disadvantages

1. More time is required for cleaning and disinfection of pail.
2. There is occasional passing of milk into the lungs, if pail is placed too high while the calf is suckling.

Feeding of whole milk to calf

1. Give whole milk @ 10% of calf's body weight daily.
2. Provide milk up to 3 months of age.
3. Warm milk to body temperature of calf i.e. 39 ^{0}C or 102.2^{0}F.
4. Avoid contamination of milk by dirt or dust.
5. Use clean utensils (pail, bottle etc.)
6. Preferably give milk from calf's mother.
7. Feeding freshly drawn milk is preferred.

Feeding of skim milk to calf

1. Skim milk is fed after 2 weeks of whole milk feeding @ 10% of body weight daily.
2. Replacement of whole milk by skim milk should be gradual.
3. It may be discontinued at 12 weeks of age.
4. It lowers the cost of raising calves.
5. It can be used for partial replacement of whole milk.

Feeding of calf starter

1. It is first concentrate mixture fed to calves.
2. It should contain 20% DCP and 70% TDN.
3. It is used to replace whole milk.
4. It is fed from 2 weeks to about 4 months of age.
5. Rate of feeding – It is started with 100 gms/ day at 2 weeks, then gradually increased to 1 kg at 2 months and 2 kg at 3 months of age.
6. In the beginning, rub small amount of calf starter on the tongue, lips and muzzle of calf, which will induce it to eat more.

Table 3.2. Composition of an ideal calf starter

Crushed Barley / Maize	50 %
Groundnut cake	30 %
Wheat / Rice bran	08 %
Fish / Meat meal	10 %
Mineral mixture	02 %

Note : In this starter add 5-10 % molasses, 0.5 % salt, 0.2 % antibiotic powder and 10 gm of vitamin mixture per 100 kg of feed.

6. Feeding of milk replacer to calf

1. Milk replacer is a dry feed mixture that is reconstituted with warm water and fed to calf as a replacement for milk.
2. It lowers the cost of raising calf.
3. It can be fed to calves from 2 weeks to 2 months of age.

4. It should contain minimum 50 % spray dried skim milk, 10-15 % high quality fat and 22 % protein.
5. The milk replacer should be reconstituted with warm water.
6. It should be given @ 10% of calf's body weight twice daily.

Table 3.3 Composition of good milk replacer

Dried skim milk	70 %
Dried whey	18 %
Animal fat	10 %
Lecithin	01 %
Di-calcium phosphate	01 %

Note : In this milk replacer add Copper sulphate, Ferrous sulphate, Magnesium sulphate, Cobalt sulphate and antibiotics in traces.

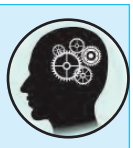
Feeding of roughages to calf

1. During early period of life calf rumen is not developed and hence it is nonfunctional.
2. At pre-ruminant stage, abomasum functions as true stomach and feeding habit is similar to that of simple stomached animal.
3. It is advantageous to make the rumen functional at an early age by giving good quality hay or green tender grass to calf from 2nd week of age.
4. Feeding of roughages establishes ruminal micro organisms and rumen becomes functional.
5. As the rumen starts functioning, efficiency of utilization of milk protein goes on decreasing.

Feeding of concentrates to calf

1. It is usually given to calf after 4 months of age.
2. The amount of concentrate given depends on roughage quality.
3. It should have 18 % DCP and 70 % TDN.

Remember...



- Rumen function starts at the age of 3 months of calf.

Table 3.4 : Feeding schedule for calves up to 3 months of age

Age of calf	Whole milk (g)	Skim milk (g)	Calf starter (g)	Good quality hay (g)
0-3 days	2500 (Colostrums)	----	----	----
4-7 days	2500	----	----	----
2nd week	3000	----	100	300
3rd week	3250	----	300	500
4th week	3000	----	400	600
5th week	1500	1000	500	700
6th week	----	1500	650	750
7th week	----	2000	800	850
8th week	----	1750	1000	1000
9th week	----	1250	1200	1100
10th week	----	----	1300	1200
11th week	----	----	1400	1300
12th week	----	----	1500	1500
13th week	----	----	2000	2000

Table 3.5 : Composition of concentrate mixture

Sr. No.	I		Sr. No.	II	
1.	Maize grain	30 %	1.	Oats	40%
2.	Wheat Bran	25 %	2.	Rice Bran	30%
3.	Groundnut cake	20 %	3.	Cotton Seed cake	20%
4.	Gram /Tur Chuni	22 %	4.	Linseed cake	7%
5.	Mineral Mixture	2 %	5.	Mineral Mixture	2 %
6.	Salt	1 %	6.	Salt	1 %

Housing of calf

1. All calves should be housed separately in calf pens.
2. Calf pens are of two types -
   a. Without run out side and
   b. With run out side.

Table 3.6 : The pen size per calf

Age group	Without run out	With run out
0 to 3 months	7.3 sq m	9.1 sq m
3-6 months	9.1 sq m	10.6 sq m

3. Calf pens should have proper ventilation, drainage and sufficient light.
4. Overcrowding of calves in a pen should be avoided (maximum 10 calves in a group).
5. Height of feed trough should be 0.5 m above the ground level.
6. Floor should be non slippery.
7. Height of partition wall between each pen should be 1.4 m.
8. Calf shed should be at the end of milking barn or somewhere near it.
9. Maintain the calf in individual pen at least up to 8 weeks of age.
10. Bedding of wheat bhusa or other suitable material should be provided in calf pen to keep warm and comfortable atmosphere inside.

General Management of calf

1. Perform tattooing at the age of 3 to 4 days for identification of calf.
2. Perform dehorning when calf is 4 to 10 days old.
3. Remove extra teats within 1-2 months of age.
4. Castrate calf at 8-10 weeks of age to develop for beef production.
5. Clean calf pen daily with disinfectant.
6. Provide clean and fresh water.
7. Record the body weights weekly.
8. In severe winter, protect the calves especially up to 6 days after birth either by providing bedding, heaters high wattage bulb or body cover/blankets.
9. Give supplementation of Vit A @ 10,000 IU once a week after calf is shifted to skim milk from whole milk.
10. Spray calf shed with insecticide to avoid tick or lice infestation.
11. Deworm calf first at the age of 8-10 days and thereafter every month till one year of age.
12. Vaccinate calf against Black quarter (BQ), Haemorrhagic septicemia (HS) and Foot and mouth disease (FMD) at the age of 3 months.

Management of calf after 6 months of age

1. Male and female calves should be housed separately.
2. Space requirement is 3 x 2 m for male calves and 4 x 2 m for female calves.
3. Calf ration (concentrate required)- 500 gm/day/calf.

3.2 Raising of heifers

Well grown and developed heifers are the best foundation stock of dairy herd. In view of this heifers must receive all necessary care to grow properly and attain full size.

Do you know ?

Heifers are often said to be future cow

Feeding methods of raising heifers

a. Grazing method or outdoor system

1. In this method, heifers are fed at the grassland or pasture by allowing grazing.
2. Number of heifers should be proportional to grassland available.
3. Sufficient amount of leguminous forages should be made available for feeding.
4. Rotational grazing should be preferred.

Fig. 3.4 : Grazing heifers

b. Stall feeding or indoor system

1. In this method, heifers are fed inside the byre and not allowed for grazing.
2. Legume hay and green fodders should be made available for feeding.
3. About 1-1.5 kg of concentrate mixture should be given daily.
4. Mineral bricks or mineral mixture should necessarily be provided to achieve maximum reproductive performance or fertility.
5. Extra amount of concentrates should be fed to heifers during last 3 months of pregnancy. This is called as **steaming up**. For this purpose additional 1.5 kg of concentrate mixture (18 % DCP, 65-70 % TDN) should be given daily.
6. The concentrate allowance is increased by 500 gm prior to 15 days of calving for building up of body reserves and to accustom for high concentrate feeding after calving.

Fig. 3.5 : Stall feeding heifers

Housing of heifers

1. Heifers up to breed-able age are to be housed separately.
2. Each heifer should get about 2 sq.m covered floor space and 4 sq.m open area.
3. One month before calving, heifer should be housed along with other milking cows.

General management of heifers

1. Branding should be done at the age of one year for identification.
2. Daily grooming should be practiced.
3. Culling of heifers having poor growth, late maturity and anatomical defects.
4. Heifer attaining weight of 250 kg may be considered for breeding.
5. Deworming should be done regularly as per schedule.
6. Periodical spraying of insecticides is necessary to avoid ecto-parasites.
7. Perform timely vaccination against disease like HS, BQ and FMD.

3.3 Care and management of pregnant cows and buffaloes

The proper care and management of cows and buffaloes during the last 2-3 months of their pregnancy is very important to harvest maximum milk during ensuing lactation besides the normal growth of fast developing foetus.

Housing of pregnant cows and buffaloes

1. A house for pregnant animal should be clean, well ventilated and properly disinfected.
2. House should protect animal from environmental stress like heat, cold, wind, rain or snow.
3. Flooring should be non-slippery.
4. Usually pregnant animals are transferred to calving pen or box, 2-3 weeks before the expected date of calving.
5. The number of calving pens required is 10% of cows on farm.
6. Calving pens should be located near to the labour quarters.
7. Calving pen should have covered area of 3 x 4 m and open paddock of 4 x 5 m.
8. Calving pen should have one feet bedding material on floor.

Feeding of pregnant cows and buffaloes

1. Provide light and easily digestible feed.
2. Animal should have free access for grazing on good pasture.
3. During initial 3/4th period of pregnancy, a maintenance allowance of concentrate mixture @ 1.25 kg / day for indigenous cow and 1.50 kg / day for crossbred cow is sufficient.
4. During last quarter (1/4th) of pregnancy, increase the concentrate allowance by 1.25 kg and 1.50 kg per day for indigenous and crossbred cows, respectively in addition to maintenance allowance.

Do you know ?

Extra allowance of concentrate mixture given during last quarter of pregnancy is called as **'steaming up'**.

Steaming up helps to fulfill additional nutrient requirement for growth of foetus, development of mammary gland and preparation of cow for incoming lactation.

Why steaming up is necessary?

1. It helps in better growth of pregnant heifer and also of foetus.
2. It helps for easy calving and expulsion of placenta
3. It also facilitates proper udder development for ensuing lactation.
4. It helps to regain energy lost during previous lactation.
5. It helps to produce more milk after calving.
6. It also increases lactation length and improves reproduction performance.

General management of pregnant cows and buffaloes

1. Pregnant animals should be housed separately as they need a special care.
2. Prevent the pregnant animals from injury due to slipping or mounting.
3. Avoid fighting, chasing with or by other animals.
4. Do not tire the pregnant animals by moving them for long distance for grazing and transportation.
5. Early and later quarter of pregnancy are critical, hence need great care.
6. Provide adequate clean and cold water.
7. Protect the animals from environmental stress.
8. Keep careful supervision of pregnant animals.
9. Dry off cows at least 60 days before calving.

10. Give injection of vit. D3 @ 10 million I.U. intramuscularly, a week before parturition to avoid milk fever in subsequent lactation.
11. Never allow the pregnant animal to mix with other animals which have the history of abortion or carriers of contagious diseases like brucellosis.
12. Deworm cows/buffaloes during advance pregnancy for prevention of worm load in newborn calves.

3.4 Care and management of newly calved cows and buffaloes

The proper care and management of freshly calved milch animal is the key for the success in dairy enterprise. The special attention of livestock owner is required towards the freshly calved females.

Housing of newly calved cows and buffaloes

1. During parturition, cow is kept in a calving box or pen.
2. Smooth and sufficient bedding is essential in house.
3. Make necessary arrangement in the house to protect cows from environmental stress.
4. Replace bedding material after thorough cleaning and disinfection of floor.

Fig. 3.6 : Newly calved cows

Feeding of newly calved cows and buffaloes

1. Mild laxative, palatable and energy rich feeds should be given immediately after calving.
2. Usually 2 kg bran plus 1 kg jaggary or molasses moistened with lukewarm water is given.
3. A little quantity of palatable and easily digestible green fodder should also be given.
4. After 2 days of calving a mixture of bran and oat mixed in linseed oil should be given.
5. Increase the quantity of concentrate mixture (16-18% DCP and 70 % TDN) gradually within 2 weeks after parturition, to get the cow full fed.
6. Give sodium propionate @ 60 gm daily for 8 to 10 days to prevent ketosis.
7. Provide enough calcium and phosphorus through mineral mixture to prevent milk fever in high yielders.

General management of newly calved cows and buffaloes

1. Immediately after parturition, wash external genitalia, hind legs, flanks and tail with a luke warm water containing few crystals of potassium permanganate (antiseptic wash) or neem leaves.
2. Provide luke warm water alone or mixed with jaggery to keep the freshly calved animal warm especially during winter.
3. Dispose off the placenta by deep burial.
4. Avoid ingestion or licking of placenta by cow.
5. Consult veterinarian, if placenta is not expelled within 8 hours of parturition.

Remember...

- Daily feed requirement of a adult cow is dry fodder 5-7 kg green fodder 20-25 kg concentrates 1.5 Kg as maintenance and additional 1 Kg for every 2.5 milk yield per day.

3.5 Care and management of lactating cows and buffaloes

Milking cows and buffaloes are sophisticated machines which convert feed to superior nutrients for human consumption. Therefore, it is mandatory to provide them balanced ration and comfortable housing.

Housing for lactating cows and buffaloes

1. Each cow requires 1.5 x 1.2 m standing space and 0.6 to 0.7 m feeding space.
2. The shed for milking animals should be at higher place and near to calf pen and milk collection room.
3. Floor should be hard, impervious non slippery and with normal slope.
4. House should be well ventilated and should protect the milking stock from rain, cold, strong sunlight, wind etc.
5. There should be separate manger for each cow.

Feeding of lactating cows and buffaloes

1. Feeding should be planned to obtain peak milk production in about 1.5 to 2 months of lactation and mature body weight in 2nd lactation.
2. While feeding green legumes provide dry fodder to ensure adequate consumption of dry matter and to avoid the possibility of bloat.
3. The interval between feeding of coarse roughages and concentrate should be at least 2 hrs, otherwise the digestibility of concentrates is also reduced.
4. Usually concentrate allowance is given at the time of milking which stimulates the process of letting down of milk.
5. In addition to maintenance allowance give 1 kg concentrate mixture (16 % DCP) for every 2.5-3 kg milk produced in indigenous cow and for every 2 to 2.5 kg milk in buffaloes and crossbreds.
6. The concentrate mixture should contain required quantity of important minerals like calcium and phosphorus.
7. Pelleted feed is generally preferred than mash feed for milking animals.
8. At about 15 days of calving, give slightly more quantity of concentrate than actual production which is called as '**challenge feeding**' or '**lead feeding**'.
9. A concentrate mixture should be soaked or sprinkled with water to reduce its dustiness before feeding at the time of milking.

General management of lactating cows and buffaloes

1. Milking cows should be handled with kindness.
2. Milking shed and cow should be washed before milking.
3. Grooming should be performed 2 hours before milking to avoid contamination of milk with filth (hair, dust or dung particles).
4. Before milking, udder should be wiped off with a cloth dipped in antiseptic solution.
5. Gentle, rapid and complete milking should be done by adopting full hand milking method.
6. Avoid excitement of cow before and during milking.
7. For safe milking, secure hind legs with anti-kicking device or 8 knot with rope.
8. Follow regular milking time and uniform interval between two milkings.
9. Usually cows are milked two times a day. However for cow giving more than 10 lit of milk per day 3 times milking is recommended which increases 10-15% milk production.
10. Cow/ Buffaloes should be inspected daily for any health problem.
11. Periodical (monthly interval) testing of milk for mastitis should be done.
12. Cows/Buffaloes in the herd should be tested each year for contagious diseases

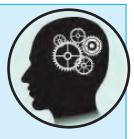
like Tuberculosis, Johne's disease and Brucellosis.

13. Dry off the cow/buffalo 60 days before expected date of next calving.
14. Routine vaccination and deworming schedule be followed.
15. Regular spraying of insecticides should be practiced for control of ecotoparasitic.

3.6 Care and management of breeding bulls

Breeding bull plays an important role in producing good livestock and thereby profitability from the animal husbandry. Physical and physiological maturity depends in how best the bull is cared for.

Remember



Bull is said to be '**half of the herd**' as it passes 50 % characters to the offspring.

Housing for breeding bulls

1. There should be separate pen for each breeding bull.
2. The location of bull pen should be such that, bull can view cows or heifers. This avoids bull becoming ferocious.
3. Bull pen should have covered area of 12 sq.m (3 m x 4 m) and open yard or paddock of 24 sq.m.
4. Flooring of pen should have rough cement concrete i.e. non slippery.
5. An open yard adjacent to bull pen be provided with 2 m height boundary wall or strong fencing.
6. Bull pen should have easy access for feeding and watering without entering inside.
7. Bull pen should have enough light and ventilation.
8. Bulls should have exercise ward.

Feeding of breeding bulls

1. Underfeeding as well as overfeeding of bull should be avoided for maintaining optimum breeding efficiency.
2. Overfeeding causes fattiness that leads to reduced sex libido as well as stress and strain on feet and legs.
3. Underfeeding may lead to nutritional deficiencies reflected by reduced breeding performance.
4. Feeding schedule of bull should be based on body weight and intensity of service (usually 2 kg DM intake / 100 kg body weight)
5. Feeding of good roughage like legume hay @ 1 kg / 100 kg body weight along with 2-3 kg concentrate mixture (12 to 15% DCP and 70% TDN) @ 0.5 kg / 100 kg body weight is sufficient.
6. Young bull must receive sufficient greens to satisfy higher need of vitamin A, other wise poor quality semen is produced.
7. During breeding season, the concentrate allowance should be increased and vice versa.
8. While feeding bull, care should be taken to avoid phosphorus deficiency which leads to infertility.
9. Excess of calcium in bull's diet may cause bone deformities, leading to poor mounting, hence may be avoided.
10. Bulls are not usually allowed for grazing with the herd because of difficulty in controlling them.

General management of breeding bulls

1. Ringing of bull with smaller nose-ring at 1 year of age and with larger nose-ring at maturity. Nose ring should be made up of copper metal as it is non rusting.
2. Regular trimming of hooves should be done.
3. Regular handling or leading the bull using a bull holder and string halter is necessary in bull exerciser.
4. Grooming and brushing should be regularly done.

Fig. 3.7 : Sahiwal breeding bull

5. Dehorning is performed before 10 days of age in bull calf.
6. Exercise: Moderate daily exercise is must for bull to keep active and in good breeding condition. Exercise also keeps bull toes well worn. For exercise to breeding bull provide an open yard (20 x 40 m) or exercise ring (bull exerciser).
7. Body weight should be recorded monthly.
8. Teasing the bull should be avoided.
9. Over grown of prepucial hair should be clipped or cut to 1 cm length to avoid interference with ejaculation and to reduce chance of mixing filth with semen.
10. During summer, 2 to 3 times splashing of cool water on body during hot part of the day should be done to avoid heat stress.
11. Paddock should be cleaned daily to avoid slipperiness.
12. Routine vaccination and deworming schedule should be followed.
13. Regular spraying of insecticides in cattle shed and on animal body should be practiced to control ecotoparasites.
14. Training of bull : For leading a bull, bull-leader or bull-holder should be used. Bull should be trained at an early age, so that they can be safely handled and easily teachable at this age.

Selection of breeding bull

1. Young bull should be preferred for breeding.
2. Bull should be true to the breed characters.
3. Bull should be healthy, masculine, vigorous, active and docile.
4. Bull should be free from physical deformities or defects.
5. Bull should be free from diseases like T.B. vibriosis, trichomoniasis and brucellosis.
6. Bull should have good pedigree record to get high inheritance.
7. Examine the quality and quantity of bull semen.

Breeding management

1. One bull for a herd of 50-60 cows is sufficient.
2. Bull can be used for breeding after 2.5 year of age.
3. The number of services should be restricted to one per week in young bulls and 2-4 per week in mature bulls.
4. Breeding efficiency of bull increases up to 4 years, maintained up to 6 year and then declines gradually.

Disposal of breeding bull : Bull can be successfully used for service up to 10 years of age and thereafter bulls should be culled or sold.

Do you know ?

Nutrient requirement of working bullocks?

a. **Heavy work :** 2.5 kg of concentrate and 12 kg of dry roughages.
b. **Light work:** 1.5 kg concentrate and 12 kg of dry roughages.

3.7 Care and management of livestock during different seasons

Management during Summer Season

Amongst the environmental factors, hot ambient temperature has significant impact on the productive and reproductive performance of livestock species. Several factors are responsible for causing heat stress and major factors are high ambient temperature and high humidity.

Heat stress is the point where the cow cannot dissipate adequate quantity of heat to maintain bodys thermal balance."

Symptoms of heat stress

1. Animal moves to shade
2. Water intake increased while feed intake reduced
3. Prefers standing than lying down
4. Increased respiration rate, pulse rate and body temperature
5. Increased production of saliva
6. Open-mouth breathing/panting

Effects of heat stress

1. Decreases in milk yield between 10-30 % along with lactation length.
2. Reproductive efficiency decreases
3. Dry period increases
4. Age at first estrous also increases
5. Negative impact on immunity and health

Fig. 3.8 : Signs of heat stress in animal

Strategies to reduce the negative effects of heat stress

Breeding management

1. It is necessary to adopt a good heat detection technique.
2. It is always advisable to continue artificial insemination instead of using bulls because in natural breeding both bull and cows suffers infertility due to summer stress.
3. Genetic selection of heat tolerant animals and inclusion of heat tolerance as a trait in selection programme.

Cooling systems in the farm

1. Fans in combination with water sprinkling facility provide the best cooling option.
2. Excessive sprinkling should never be practised as it can result into wet bedding making animal prone to mastitis and other diseases.
3. The farm should be well ventilated.
4. Provision for wallowing for buffallos.

Fig. 3.9 : Foggers and fan arrangement in cattle shed

Feeding management

1. Provide adequate green fodder
2. Feed during cooler times of the day
3. Increase the frequency of feedings
4. Keep feed fresh as much as possible
5. Provide high-quality forage and balanced ration.
6. Provide adequate fibre
7. Use of by–pass proteins can enhance the milk yield and protein content.
8. Provision of sufficient cool and fresh water.

Providing natural or artificial shade area

- Plantation of trees around the farm will help in alleviating heat load from the animals.

Selection of heat tolerant animals

- Genetic Selection of animals based on specific molecular genetic markers for heat tolerance will definitely be a boon to alleviate heat stress in cattle and buffaloes by identifying the heat tolerant animals.

Management during winter season

1. To protect animals from a sudden drop in temperature, keep the animals in a covered shed/area during the night.
2. Blankets can be used to retain body heat for individual animals.
3. Avoid keeping animals in a damp area, as well as protect them from smoke from fires which are led to provide warmth. The dampness and smoke increases their chances of contracting pneumonia.
4. Animals should be given lukewarm water to drink during winters.
5. To maintain the body temperature of animals in milk, they should be fed with a mixture of oil cakes and jaggery.
6. Provide salt mixtures in adequate quantities along with their feed.
7. This is the right time to deworm the animals.
8. If the animals have not yet been vaccinated against FMD, PPR, Haemorrhagic Septicaemia, Enterotoxemia, Black Quarter etc, ensure that this is being done now.
9. The bedding/hay in the animal sheds must be kept dry and changed/aired every day.
10. Take adequate care to prevent occurrence of mastitis in animals.

Management during rainy season

Common problems in a livestock farm during rainy season

1. **Feeding :** Grass, which sprouts during rainy season contain more of water and less fiber. The water fills up the stomach and hence, it is virtually useless. This causes animals to pass watery dung during wet seasons.
2. **Moisture :** Water leaking in the animal shed affects the comfort of the animals. Coccidiosis can also occur due to leakage of water from dirty shed. Hoof diseases are also common in animals kept on wet floor. Moisture present on ground produces a lot of bacteria that can cause diseases. Worms are mostly seen in rainy season.
3. **Tick problem :** Ticks spread faster in rainy season. They suck blood and eventually cause death due to haemoprotozoan diseases. Tabanus flies spread surra disease in cow
4. **Udder diseases :** Diseases of udder are very common in rainy season due to dirty sheds.
5. **Mouldy feeds :** If the feeds become wet due to leakage of rain water from damaged roof, then they develop moulds. This mouldy feed is harmful to the animals.
6. Slippery floor and floor with pebbles must be checked as the pebbles get lodged between the hooves of the animals

Preventive measures required during rainy season

1. Make the roof of livestock sheds leak-proof and clean.
2. Green grass cut during rainy season be dried in sunshine for some time before feeding as it reduces water in grass and it will turn into a good feed.
3. Deworming must be done in the beginning and throughout rainy season because worms multiply at a faster rate during this period.
4. Farmers should spray insecticides on their animals regularly for removal of ectoparasites.
5. Farm should be disinfected regularly.
6. It must be made sure that feeds are stored in a dry place.

Try this...

Visit the near by dairy cattle and buffalo farm and collect the information.

Exercises

Q.1 Fill in the blanks.

1. The colostrum should be fed at the rate of ……..% of calf's body weight.
2. The milk should be fed to the calf @ ……..% of calf's body weight.
3. Calf starter should contain……% crude protein.
4. Pregnant cow must be dried at least…….days before calving.
5. Breeding bull is said to be…….the herd.
6. To avoid ketosis in freshly calved cow……is given daily for 8 to 10 days.
7. Heifers attaining weight of…….. kg. should be considered for breeding..
8. Breeding bull should receive concentrate mixture @..... kg/100kg body weight.
9. Breeding efficiency of bull increases up to ……..…. years.
10. Lactating cow should be provided with additional allowance of concentrate @1kg for every ….kg of milk produced in buffalo.

Q. 2 Answer in one sentence.

1. Enlist methods of raising calves.
2. Mention methods of milk feeding to calves.
3. What is mean by weaning?
4. What are the methods of raising of heifers?
5. What is steaming up?
6. Give dimensions of calving pen.
7. Which is the easiest, safe and practical method of raising calves?
8. What is colostrum?
9. Enlist types of calf pen.
10. Give additional allowance of concentrate mixture to be given to crossbred cows during advanced pregnancy.

Q. 3 Answer the following questions in brief

1. Give the necessity of raising calves.
2. Differentiate between suckling and weaning method of calf rearing.
3. Write general care of freshly calved cows.
4. Give the advantages of steaming up in heifers.
5. How will you select breeding bull?

Q. 4 Answer the following questions in detail.

1. Write in detail care and management of newborn calves.
2. Explain in detail feeding, housing and management of pregnant cows and buffaloes.
3. Describe in detail care and management of lactating cows and buffaloes.
4. Write in detail the care and management of breeding bull.

4. GOAT MANAGEMENT

Do you know ?

- Scientific name of the goat is *Capra hircus*.
- Goat satisfies her 70 to 80 percent hunger through browsing

Goat is a versatile animal. It was the earliest domesticated (around 7000 B.C.) ruminant by man. The father of the Nation Mahatma Gandhi had candidly described it as "Poor man's Cow" considering its virtues and importance in rural economy. The goat is also termed as 'Wet Nurse of infants' in Europe, 'Mobile bank of the nomads on hoof ', 'mini cow' etc. Goat rearing requires low cost and hence suited for weaker section of the society. i.e. small, marginal farmers and landless labourers.

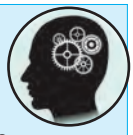
Remember terms pertaining to goat keeping

Flock / band	: Group of goat
Buck	: Adult male
Doe	: Adult female
Buckling	: Young male
Goatling	: Young female
Kid	: Young male and female up to 12 months
Wether	: Castrated male
Spayed	: Castrated female
Serving	: Act of mating
Kidding	: Act of parturition
Bleating	: Sound produced by goats
Chevon	: Goat meat

4.1 Importance of goat farming

1. Goat is versatile animal and provides meat, milk, skin, hide, hair (fur), mohair (soft white wool from Angora goats) and manure.
2. Goat is small animal, easy to handle and needs less capital investment. They have no specific demand for housing, feeding and management.
3. Goat is tolerant to harsh climatic conditions e.g. extreme cold and hot.

Remember...



Goat is considered as ATM for weaker section of the society as it provides any time milk and any time money to the owner

4. Goat farming generates employment opportunities for rural women and educated unemployed youth.
5. The market for goat is well established and it has increasing demand.
6. Goat meat has no religious taboos.
7. Goat is efficient converter of organic matter than other animals; it produces 185 kg milk / 100 kg digestible organic matter (DOM) as against cow (162 kg milk) and sheep (35kg milk).
8. Goat milk is easy for digestion to children and invalids due to its smaller sized fat globules (1.5 to 4.5 µ) and absence of clustering in milk.
9. Goat milk is alkaline and has medicinal value. It is recommended for patients suffering from dyspepsia, peptic ulcers, allergic eczema and infantile diarrhoea. It is also preferred in liver dysfunction, jaundice, acidosis and insomnia. Goat butter is used to cover rheumatic arthritis and neuritis.
10. Goat milk is rich in vitamin B_1 and contains three times more nitrogen, calcium, phosphorus and chloride than either human or cow milk.

11. Goat milk is suitable for preparation of various milk products viz. cheese, paneer and candy.
12. Goat hairs (fur) and mohair are used for preparation of blankets and garments
13. Goat hide is used for preparing different leather products.
14. Goat acts as an excellent experimental animal for physiological and biomedical research.
15. Goat meat contains less cholesterol which is desirable for health conscious people.
16. Goat manure contains 3 times more nitrogen, phosphorus and potash as compared to cow or buffalo manure.
17. Goat is eco-friendly animal under present scenario of global warming as it produces less methane than other ruminants.
18. Goat is tolerant to tannin and other toxic elements present in feeds of plant origin.
19. In high altitudes of Himalayas, goat provides draft power. Guddi goat can carry 10 kg of load on much steep slopes.
20. Goat is multi functional animal, all the body parts of goats have some utility e.g. intestine is used for preparation of catgut (a thread, used for suturing wounds in surgery), the hooves are used in paint industry and bones for bone meal production.
21. Goat is prolific breeder (giving twins/ triplets/quadruplets), matures at about 10-12 months of age and has short gestation period (150 days) and kidding interval (7 to 8 months).
22. Goat is efficient garbage converter as it utilizes the kitchen waste, waste of vegetable markets etc. very efficiently.
23. Goat is live seed drill as it spreads seeds of grasses and trees through pellets.
24. Goat is a fertigation machine as it drops the pellets and urine in grazing range.

4.2 Systems of goat rearing

The goats are reared under different feeding and management systems according to size of flock and resources available.

1. Tethering
2. Extensive system / Range system
3. Semi intensive system
4. Intensive system

1. Tethering : It is the method of grazing. It is followed only when 2-3 goats are maintained. In this method goat is tied to wooden peg with 3 to 5 m long rope for restricted grazing.

Advantages

1. Helps to keep the goats under controlled feeding
2. Utilization of grass is efficient
3. Other plants can be protected from notorious behavior of goat.
4. Goat keeper can carry out any other work while goat is grazing.

2. Extensive / Range systems : This system is commonly adopted in India. Goats are allowed to graze on pasture or free range, road sides. Small, marginal farmers and land less labourers take their goats and walk for long distance for feed and water.

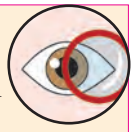
Advantages

1. Feeding cost is almost zero
2. Useful in low resources, capital and management
3. Most economical
4. Goat fertilizes the grazing land by dropping manure and urine.
5. Tree lopping can be used as fodder.

Disadvantages

1. Shrinkage of grazing land may not provide optimum nutrients to goats
2. The seasonal variations affect the quality and quantity of fodder which may lead to malnutrition.
3. The genetic potential remains unexploited due to poor nutrition.

Observe and Discuss



How the goat plucks leaves through thorny twig

3. Semi- intensive / Semi stall fed system : It is combination of extensive and intensive system. This system is most appropriate system of goat feeding under which the goats are allowed to graze for 5 to 6 hours during day time and stall fed during evening hours by providing tree lopping, concentrate mixture, kitchen wastes, crop residues etc.

Advantages

1. The shortage of nutrients under grazing can overcome by stall feeding
2. Helps to exploit the genetic potential of animal.

4. Intensive system / Stall feeding : The goats are reared by taking proper care of feeding and housing. The goats are fed in the stall by cultivated fodder. The goats can be grazed on cultivated pastures having good fodder availability.

Advantages

1. The energy diverted for grazing and walking can be used for growth and production.
2. The genetic potential of animal is properly exploited

4.3 Housing of goats

Goat is the most tolerant animal for all harsh climates. However, the shelter is needed to protect them from extreme sunlight, heavy rains, cold temperature and snowfalls. The housing requirement varies according to the varying climatic conditions.

- In hot arid environments, goat needs well ventilated house for protection from excess heat.
- In hot and humid, high rainfall tropics, goat needs raised bed house for protection from rains as excessive wetting by rains can cause the pneumonia and parasitic load.
- In snow clad areas of temperate region, goat needs raised-bed house with hopper windows for protection against direct snowfall and cold waves.

The housing helps to control the body temperature of goat which has direct relation with endocrine function and excretion of sodium, potassium and water loss.

The goat house does not need elaborate design and building material. Good houses can be constructed with available resources at cheaper cost. The bamboo stem, sugarcane trash, coconut fronds, babul, neem, subabul timber can suitably be used as building material.

Goat house should be well ventilated, well lighted, dry and protect the animal from adverse climatic condition.

Do you know !

The comfortable house is one where the inside temperature between 20 ^{0}C to 25 ^{0}C is maintained.

Methods of goat housing

1. **Individual housing :** Each goat is housed in individual pen. It is good for dairy goats.
2. **Loose housing :** A flock of 20-50 goats kept loose in a compartment.

Points to be considered for goat housing

1. The goat house should be located at high upland and dry areas to facilitate proper drainage and avoid water lodging during rainy days.
2. Under Maharashtra condition, the orientation of building should be East-West to facilitate optimum sun light and ventilation.
3. The site should be easily accessible for marketing and procurement of raw material.
4. The goat house should not be in the vicinity of residential area to avoid undesirable, unhygienic, offensive and ammonical smell of urine.

5. There should be optimum water availability.
6. The surrounding should be clean and safe.
7. The house should be so designed as to make the daily routine operations like cleaning, feeding, watering easy.
8. The house should be economical and durable too.
9. Provision of electricity supply be assured.
10. Fire control system with trained manpower should be established.
11. Width of house should be 5 to 6 m to facilitate proper ventilation to reduce heat load.
12. Height at centre in A shaped roof should be 3 to 3.5 m for maintaining proper ventilation.
13. Construct 'A' shaped roof to save other half side from solar radiation to control the heat.
14. Roofing material commonly used in our country is thatched, asbestos, painted and non painted tins.

Remember...

Roofing material in the goat shed determines the cost of construction and microenvironment within the shed.

15. Floor

- Afford more space in hot weather to control heat.
- Slatted or perforated, raised floor is best for hot and humid climate for good ventilation and easy cleaning.
- Cork brick floor for hot climate provides thermal resistance to maintain the temperature low.
- Concrete floor helps to keep the animal cool.
- Proper slope to the floor should be given for easy flow of urine and cleaning the floor with water.

Fig. 4.1 : Different Types of houses for goat

Table 4.1 : Optimum floor space requirement for goat

	Age group	Covered space (sq.m/goat)
1	Up to 3 months	0.5 to 0.6
2	3 to 6 months	0.7 to 0.9
3	6 to 12 months	1.0
4	Yearling goats	1.0
5	Adult goats	1.25 to1.5
6	Lactating does, Pregnant does and buck	2.0

Note- The open space should be double than covered space.

1. The height of side wall should be more than 3 feet to avoid the escape of goat outside.
2. Separate structures to house the goats according to age and stage of life are preferred.
3. The economical and convenient size of flock in one house is 50 to 60.
4. Kids with the stocking density exceeding the optimum level will adversely affect the health, growth productivity; hence they should be kept in group of 15 to 25 to avoid overcrowding.
5. The advance pregnant does (3 to 4 weeks before kidding) and the breeding bucks should be housed separately.
6. The size of manger should be 15 inches wide with height 2.5 to 3.0 feet.
7. Service passage/ feed passage should be 5 feet wide.
8. Gates for adult pens should be 9 feet wide.
9. Make provision for continuous supply of clean drinking water.
10. Watering space requirement per animal is as follows-
    a. Adult goat 40-45 cm
    b. Kids 30-35 cm

Internet my friend

Collect the information and photographs of different Goat byres under various climatic conditions

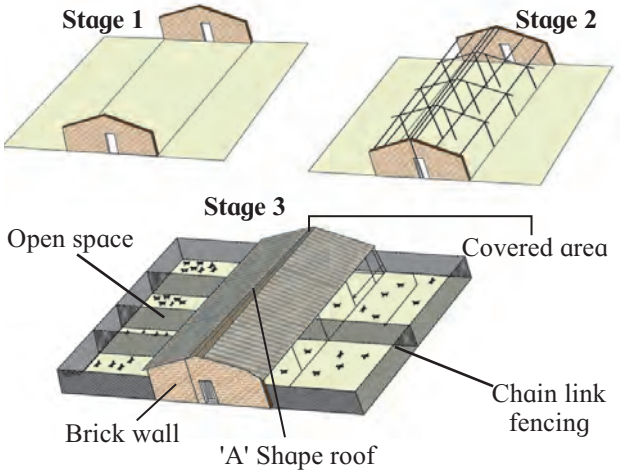


Fig. 4.2 : Ideal goat shed

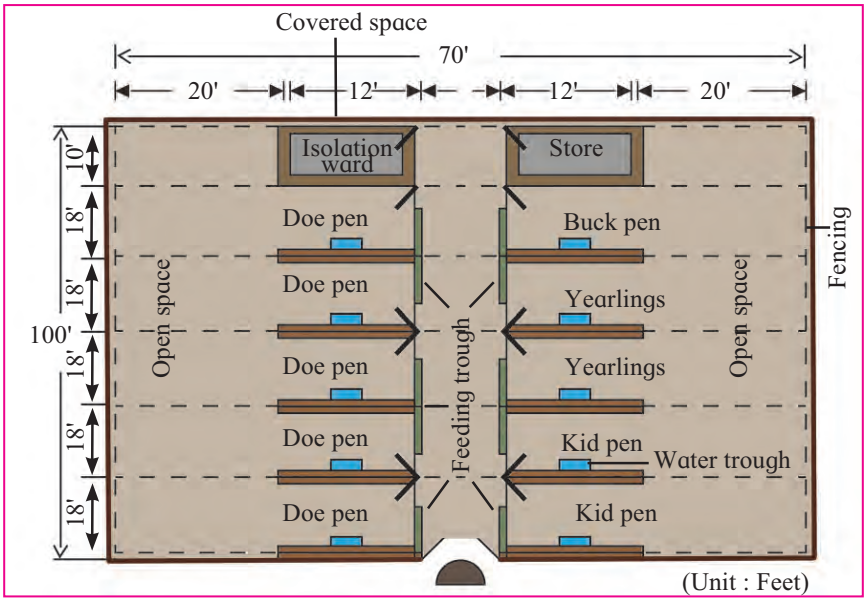


Fig. 4.3 : Plan of goat house for 50 goats

Structural components in goat house

An ideal goat house should comprise of following compartments -

1. Kid pen 2. Buck pen 3. Doe pen

4. Kidding pen 5. Yearling/ goatling shed

6. Store (grain, bran, hay etc.) 7. Weighing balance room 8. Record room 9. Office

10. Isolation room

1. Kid pen

- Weaned kids are kept in kid pen for proper feeding and management.
- Maximum 25-30 kids should be kept in one pen.
- The kids nearing maturity should be housed in separate groups.
- Protection against cold temperature should be provided by putting curtains or light during winter.
- Overcrowding in kid pen should be avoided.
- Dampness should be avoided to protect kids from pneumonia.

2. Doe pen

- The adult does are kept in doe pen
- The advanced pregnant does should be housed separately.
- Maximum 50-60 does should be housed in one shed.

3. Buck pen

- Buck should be housed in individual pen.
- The height of sidewall should be 4-5 feet.

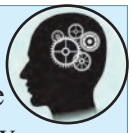
4. Kidding pen

- The does due for kidding are housed in kidding pen.
- Kidding pen should have bedding material of dry grasses and straws.
- Bedding material should be changed every day.
- Feeding and watering arrangement should be done in kidding pen.

4.4 Care and management of kid

The care and management of kids starts from the womb of the mother. About 70 % growth of kids takes place during last two months of pregnancy. Hence, pregnant doe should be provided leguminous fodder along with 450 g concentrate daily.

Remember...



The kid is the product to be harvested for sale. To have healthy kids with less mortality (less than ten per cent) is the key of success of goat enterprise.

1. Feeding

Feeding of colostrum : Feed the colostrum within 30 min to 1 hr of birth as after that absorption rate of immunoglobulin slows down.

Do you know ?

Colostrum is the first milk, thick and yellowish in color, rich in Vitamin A and D. It provides antibodies to kid to develop immunity against infection.

2. Feeding of milk

1. Feed milk @ 10% of body weight of kid 3 to 4 times at an interval of 6-7 hrs for first week.
2. The temperature of milk should be 95 to 100^0 F.

Can you think ?

- The orphan kids (whose mother is died or lost after parturition) and the kids of the mother having less or no milk may be fed with cow milk or milk replacer.
- After 8 to 10 days of age allow the kid to nibble soft and tender grasses, hay and start the starter ration after 15 days of age.

3. Methods of kid rearing

The following are the two methods of kid rearing-

A. Suckling : Kids are allowed to suckle the milk from their mother directly.

Fig. 4.4 : Suckling kid

B. Weaning : Kids are separated from mother and milk fed with the nipple bottle.

5. Milk replacer : The artificially prepared substitutes of milk prepared from milk powder, cereals and flour having 24 per cent crude protein help to fulfill the nutrient requirements of kids to reduce the cost of feeding.

6. Starter ration :The ration given first time to the kids is called starter ration. It should have 18 to 20 per cent DCP, 72 per cent TDN. It should be palatable and easily digestible. The composition of an ideal kid starter ration is as follows

Table 4.3 : Composition of an ideal kid starter ration

Sr. No.	Ingredients	Parts
1.	Maize	22
2.	Gram	20
3.	Ground nut cake	35
4.	Wheat bran	20
5.	Mineral mix	2
6.	Common salt	1

7. Feeding of growing kids

From 3 months onwards, kids are fed leguminous roughages to supply enough nutrients for their normal growth. Low quality roughages if available should be supplemented with concentrate mixture (@ 300 to 400 g daily) having 12 to 14 % DCP and 62 to 65 % TDN fed. Over feeding should be avoided. Growing kids should be given following concentrate mixture.

Maize	:	20 parts
Gram	:	32 parts
Wheat bran	:	30 parts
Groundnut Cake	:	15 parts
Mineral mix	:	2.5 parts
Common salt	:	0.5 parts

Table 4.2 : Feeding schedule for kids

Body weight (Kg)	Goat milk (g)		Starter ration (g)	Green fodder (kg)
	AM	PM		
2	200	200	-	-
3	250	250	-	-
4	300	300	50	*Ad-libitum*
5	300	300	100	*Ad-libitum*
6	350	350	150	*Ad-libitum*
7	350	350	200	*Ad-libitum*
8	300	300	250	*Ad-libitum*
9	250	250	350	*Ad-libitum*
10	150	150	350	*Ad-libitum*
15	100	100	350	*Ad-libitum*

8. Finisher ration : Finisher ration is given to the kids which are to be slaughtered. Since goat are slaughtered mostly for lean meat, the roughages containing 25 to 30 % dry matter and concentrate mixture containing 6 to 8 % DCP and 60 to 65 % TDN needs to be provided.

2. Management practices

1. Cleaning mucus: Allow the mother to lick the kid. Remove the mucus from nostrils and body of kids by clean gunny bag. Tickle the tongue of the kid to stimulate respiration.
2. Cutting navel cord: for cutting the navel cord use sterilized blade or scissor, apply tincture iodine on cut end.
3. Remove meconium with soft and moistened cloth daily to clear the passage of excreta during first week of birth.
4. Allow the kids to remain with mother for 4-5 days so that close association with each other will develop.
5. Disbudding: Disbudding means removal of horn buds. It is being done to avoid horn growth to prevent the nuisance of fighting. It is usually done by applying Potassium hydroxide (KOH) stick. Disbudding is done at one week age in kids
6. Identification marks: In large flocks to maintain the record, identification marks are essential. The identification marks are given at the age of 7-10 days by tattooing or ear tags

Internet my friend

Collect the information on ear micro chip (RFID)

7. **Castration of male kids :** The male kids not useful for breeding are castrated with Burdizzo's Castrator. The appropriate age for castration is 2 to 4 weeks. The advantages of castration are as follows -

a. Male becomes docile.

b. Avoids indiscriminate breeding

c. Obtains faster weight gain

d. Skin becomes superior in quality

e. Improves the chevon quality

f. Increases profitability

g. Facilitates to keep male and female together

Can you think ?

- How to protect kids from cold weather during winter season viz.

1. Use of electrical bulb, heater,
2. Covering of byres by gunny bags/ tarpaulin/
3. Smoking in byres

3 Health care

1. Deworming of kids : To protect the kids from endoparasites (worms), deworming should be done as per schedule. Deworming should be carried out before and after the rainy season. (Table 4.4)

Table 4.4 : Deworming schedule for goat

Sr. No.	Type of worm	Schedule
1	Round worms	Once in a month from 1 to 6 months of age
		From 6 – 12 months of age, once in 2 months
		From 1 year onwards, once in 4 months i.e. June, October and March
2	Tapeworms	Twice a year i.e. January and June in lambs in problem flocks
3	Liver flukes	Twice a year i.e. May and October in disease prone area

2. Dipping : For controlling ectoparasites like ticks, lice, flea etc. dipping is carried out by dipping kids in suitable insecticide solution.

3. Vaccination : Follow the vaccination schedule given in Table 4.5.

4.5 Management of pregnant does

Care and management of pregnant does is very important to have the healthy kids and increased milk. After confirmation of pregnancy, the pregnant goats should be separated from flock and kept under special feeding and management regime. Gestation period in goat is 150 days.

1. Feeding

1. Feed laxative and leguminous and nutritious roughages along with 450 g concentrate daily.
2. Graze them on separate legume rich pasture, if the pregnant animals are allowed for grazing.

Fig. 4.5 : Grazing goats

Fig. 4.6 : Browsing goats

Remember...

The daily feed and fodder requirement of one adult goat is

- 3-4 Kg green fodder
- 1-2 Kg dry fodder
- 250-350 gm concentrate mixture

3. Clean and hygienic drinking water be made available at all the times.
4. Avoid over feeding or under feeding to prevent metabolic disorders. Weak goats give birth to weak kids while the fatty goats give birth to heavy kids leading to difficult kidding.
5. Provide extra ration to the pregnant goats during last 4 to 6 weeks to have proper growth of kid.
6. Reduce the concentrate mixture for goat to 100 g/day during last week of gestation.

Table 4.5 : Vaccination schedule for goat

Sr.No.	Disease	Primary vaccination	Regular vaccination
1.	Foot and mouth disease	3 months onwards	Twice in a year i.e. in March and September
2.	Peste des petits ruminants(PPR)	3 months onwards	Every 3 years
3.	Anthrax	3 months onwards	Every year before monsoon in endemic area
4	Enterotoxoemia	3 months onwards	Every year before monsoon-two doses at an interval of 15 days
4.	Haemorrhagic septicaemia	3 months onwards	Every year before monsoon
5.	Black quarter	3 months onwards	Every year before monsoon
6	Contagious caprine pleuro-pneumonia	3 months onwards	Every year in January.

Can you think ?

Goats prefer leguminous fodder and meet out its appetite through browsing hence it is called as **browser**

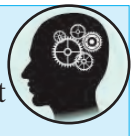
2. General management

1. House the pregnant goats in separate pen to avoid hazards of crowd and facilitate better care.
2. Dry off the lactating doe before 4 to 8 weeks of kidding; it helps proper development of kid and increased milk production during next lactation.
3. The advance pregnant goats should not be permitted for grazing.
4. Make provision of soft bedding material i.e. dried grass or straw for pregnant goats during last two weeks of pregnancy.

3. Health care

1. Deworming thrice a year/ change in season. Advance pregnant animals should not be dewormed.

Remember...



- Clean the kidding place with hot water added with disinfectant.
- Dispose off the placenta. If placenta is not dropped naturally don't pull it or tie any weight like chappals, wait for 24 hrs. and then consult veterinary doctor.
- Wash the hind quarters with warm water and antiseptic solution.
- Protect the animal from harsh climate (extreme cold or hot).
- Provide cooked bajara grains + jaggery + oil containing small amount of ginger, salt and mineral mixture.
- Provide 500 g concentrate and fodder as per the choice.

2. Follow vaccination schedule (Table 4.5). Do not vaccinate the does during first 2-3 months of pregnancy.
3. Carry out the screening of animals for tuberculosis, Johne's disease and brucellosis.
4. Frequent washing, brushing and grooming should be done to keep the animal free from ectoparasites.

4.6 Care of lactating does

The lactation starts immediately after kidding. For first 3-4 days colostrum is produced and then it is converted into milk .

1. Feeding

1. Provide adlib green fodder to lactating does or allow free grazing for 6-7 hrs.
2. Provide milk allowance to lactating does @ 400 g/lit. of milk produced.
3. The milk allowance should contain-

Maize - 37 %, Gram - 15 % , Groundnut cake - 25 %, Wheat bran - 20% , Mineral mixture 2 % and salt 1 %.

2. General management

1. Wash the udder with disinfectant solution (KMnO4).
2. Clip the hairs from the hind quarters.

Fig. 4.7 : Modern stall feeding

3. Milk the doe completely till the udder is fully collapsed.
4. Clean the body and groom the animal which enhances blood circulation and helps in eradication of ectoparasites.

5. Keep the lactating does away from buck to avoid goaty smell to the milk.
6. The does may show signs of heat after 30 days but do not breed the goat before 45 days after kidding.
7. House the goats in clean vicinity, free from flies, ticks, fleas etc.

3. Health care

1. Take care of mastitis.
2. Follow deworming and vaccination schedule (Table 4.4 and 4.5 respectively).
3. Screening of goats for brucellosis, tuberculosis and Johnes disease at least once in a year should be carried out.
4. Dipping of goats in ectoparasiticidal solution before and after monsoon for control of ectoparasites.

4.7 Management of breeding buck

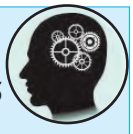
"The breeding buck is half of the flock" and decides the future of the goat farm. Management of breeding buck starts from its selection.

1. Selection of buck

The buck is selected on the basis of following criteria - **ABCDE**

1. **A -Age :** The breeding buck should be above 12 months. Up to 2.5 years, the buck should be allowed to breed to 25 to 30 females and from 3 to 5 years to 40 to 50 females.

Remember...



1. The breeding age of buck is 5 to 7 years.
2. Replace the buck by every two years to avoid inbreeding

2. **B -Body conformation :** Buck should be heaviest animal in flock, having wide chest, strong and straight legs, masculine look and rugged mane i.e. with profuse growth of hairs on neck.
3. **C - Characteristics of true to type breed:** The buck should fulfill all the breed characteristics and there should not be any abnormalities.
4. **D - Defects:** The buck should not have any deformities or defects. e.g. twisted leg, narrow chest and back, over shot or under shot jaws, pendulous scrotum and sheath, cryptorchidism or having poor quality semen etc.

Fig. 4.8 : Breeding buck

5. **E -Efficiency for economic traits :** The buck should be twin born, progeny of the prolific female having good milk yield and mothering ability. The growth rate should be higher than its contemporaries.

Can you think ?

One buck is sufficient to bred 25-30 does

2. Feeding of breeding bucks

The feeding of breeding buck is very important as the energy level needs to be managed in such a way that the buck should not get too fatty and the vigor and vitality must be maintained.

1. Buck requires 7 to 8 kg. green, 1 kg. dry roughages daily.
2. No extra ration than 250 to 300 gm should be provided to buck during non breeding season where good quality pasture is available to avoid fattening.
3. During breeding season grains, oil cakes should be provided @ 450 to 900 g/ head depending on body weights.

4. Bucks should not be over or under fed which affects the health and vigor.
5. Provide enough salt and vitamins (A and E) especially in breeding season
6. Mineral mixture @ 15-30 g be provided du ring breeding season.
7. Sprouted kidney bean @ 50 to 100 g helps to enhance vigor and vitality.
8. *Adlib* clean drinking water should be provided throughout the year.

Remember...

- Well ventilated house with 'A' shape roof with well drained floor is comfortable for goat. The floor space required for goat is 1.5 to 2.0 m^2
- Proper feeding, vaccination and deworming enhance the profitability in goat farming.

3. General management

1. Keep the bucks in separate pens to avoid fighting injuries particularly during breeding season.
2. Breeding buck should not be tethered.
3. Bucks should not be housed with females. Take them to females only during breeding period.
4. Sufficient exercise must be given to avoid fattening and subsequent sluggishness.
5. Regular grooming / brushing help to keep the bucks clean and free from ectoparasites. It also helps to make the buck docile.
6. Hoof trimming helps to avoid lameness.
7. Cleanliness and feeding of plenty greens helps to minimize goat's smell.

4. Health care

1. Follow deworming and vaccination schedule.
2. Screening for brucellosis, tuberculosis and Johne's disease at least once in a year should be carried out
3. Check semen quality regularly
4. Clean the buck regularly.
5. Dipping of bucks in ectoparasiticidal solution before and after monsoon for control of ectoparasites.

Try this...

Visit the nearby goat farm and collect the information on income and expenditure/economics

Exercises

Q.1. Fill in the blanks

1. Goat milk is easy for digestion because ……
2. The very famous goat milk product in France is ……
3. Young male of goat is termed as ……
4. Comfortable goat house is one where internal temperature is ……
5. The feeding system in which goat tied to peg by rope is called as ……
6. The floor space required for adult goat is …… m^2
7. The DCP content of concentrate mixture for goat ……
8. The lactating goat should be fed with milk allowance @…… g / lit of milk.
9. The meaning of rugged mane is ……..
10. The gestation period in goat is _____ days.

Q.2. Match the pairs

Group A	Group B
1. Chevon	a. Female goat
2. Doe	b. Male sheep
3. Spayed	c. Male goat
4. Buck	d. Removal of horn bud
5. Disbudding	e. Meat of goat
	f. Castrated female of goat
	g. Male of goat

Q.3. State True or False

1. Goat milk is acidic in nature
2. Browsing is feeding habit of goat
3. One buck of age 2.5 years is used for mating of 30 does
4. Dipping is used for controlling of endoparasites
5. Breeding buck is half of the flock

Q.4. Answer in brief

1. Give the scientific name of goats
2. Name the most economical goat management system
3. Which term is used for male of goat?
4. What is the term used for goat meat?
5. Why the goat meat is suitable for calorie conscious peoples?
6. What is colostrum?
7. How much covered and open area is required for breeding buck?
8. Name the important diseases in goat
9. What do you mean by deworming?
10. Define milk replacer

Q.5. Answer the following questions

1. Why the goat is called as versatile animal?
2. Enlist different feeding and management systems of goat and elaborate any one.
3. Elaborate the floor space requirement for goats at different stages.
4. Describe different systems of kid rearing
5. Give the importance of goat farming.
6. Write in short care and management of lactating doe.
7. Write a brief note on feeding of pregnant goat.
8. Give the desirable characteristics of buck.
9. Give vaccination schedule for goat
10. Why deworming is essential for goat?

5. SHEEP MANAGEMENT

Sheep is one of the important livestock species. It contributes greatly to agricultural economy of India, especially in the arid/ semi-arid and mountainous areas where crop and dairy farming are not economical. Sheep are unique among livestock because they can be maintained under diverse environmental conditions. They are reared for variety of purposes viz. meat, wool and pelt production. Sheep rearing can be recommended as an occupation to the rural people especially to the weaker sections of the group in hilly, drought prone and desert areas, as they do not need expensive housing and on the other hand require less labour than other kinds of livestock. Sheep rearing helps in improving rural economy as it gives helping hand to the farmers at the time of crisis arising from crop failure.

Can you recall ?

Scientific name of Sheep is *Ovis aries*

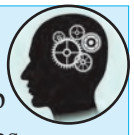
Remember terms pertaining to sheep keeping

Flock / band	: Group of sheep
Ram	: Adult male
Ewe	: Adult female
Lamb	: Young male and female
Lambing	: Act of parturition
Mutton	: Sheep meat
Bleating	: Sound produced by sheep
Tupping	: Act of mating
Whether/ Wedder	: Castrated male
Spayed	: Castrated female
Docking	: Removal of tail

5.1 Importance of sheep farming

1. Sheep are economical converters of natural grasses and crop residues into meat and wool.
2. Sheep graze close to the ground and consume different herbs and shrubs. Hence, they act as natural weed killer.
3. Initial investment is less.
4. On an average one sheep produces 680 g of wool per annum.
5. Sheep contributes nearly 10 per cent of the total meat production of the country.
6. Sheep manure contains twice the quantity of nitrogen and potassium than cattle manure.
7. Sheep meat have no religious taboos. It is consumed and relished by all communities.
8. Sheep do not require expensive building to house.
9. Sheep farming requires less labour.
10. Unlike goats sheep hardly damage any tree.
11. Production of wool, mutton and manure provide source of income.

Remember...



Sheep possesses a typical lip structure (nibbling habit) which helps them to clean grains lost during harvesting and thus converts waste feed into valuable products.

5.2 Housing

Generally sheep do not require elaborate housing facilities. However, proper shelter will definitely increase the productivity. Therefore, it is necessary to protect sheep against sunrays, wind and rain. Generally sheep flocks are

penned in open during the fair weather and some temporary shelters are used in monsoon and summer. Orientation of shed should be preferably East-West. Shed should be properly ventilated, lighted, drained and easy to clean. Feeding manger and water trough should be provided.

Sheep can be economically reared under range system or loose housing system. Normally sheep are kept in the shed during night and taken out for grazing during day time.

Different components of sheep housing

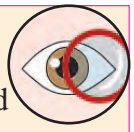
1. Slatted housing

1. Sheep are housed in slatted housing where rainfall is heavy and sheep need protection against possible water logging.
2. It is elevated type of housing.
3. The slatted floor is prepared (0.9 to 1.5 m) above the ground level to facilitate cleaning.
4. Wooden strips of (7.5cm x 2.5cm) size or bamboos may be used for a floor.
5. A floor space of 0.75m x 0.35m is sufficient for each sheep.

2. Ewe shed

1. In one shed 50-60 adult ewes can be accommodated.
2. The roof should be 'A' shape with 3-4 meter height in the centre.
3. The floor should be made up of murum and brick on edge.
4. In heavy rainfall region and low lying areas, the ewe shed should be constructed at higher level than surrounding area.
5. In temperate regions floor should be of strong wood.

Observe



Visit the different Sheep farms and record the housing systems

3. Ram pen

1. Rams should be housed in separate pen.
2. Partition can be made in large shed for housing of rams.
3. An area of 2.25m x 1.5m is sufficient for housing one ram.

Fig. 5.1 : General sheep shed

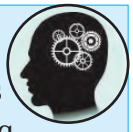
4. Lambing pen

1. These are the maternity pens.
2. Pregnant and newly lambed ewes are kept in lambing pens.
3. During cold/winter season, to protect the lambs, some warming devices like room heater should be fixed.
4. Provide bedding of straw in the lambing pen.

5. Lamb shed

1. Weaned lambs up to maturity should be housed in lamb shed.
2. Maximum 75 lambs should be housed in one shed.
3. It is better to house the lambs according to growth stages viz. un-weaned, weaned but immature and lambs nearing the maturity into separate groups.

Remember...



- Provide bedding of dried grasses or gunny bags to lambs during winter season
- Use electric bulb and cover the open area of lamb shed for warming the lamb pen

6. Isolation box (sick animal shed)

1. To prevent spread of contagious diseases, sick animals should be isolated.
2. The isolation box should be away from main shed.
3. The size of isolation box should be 3m x 2m.
4. Depending upon the size of flock, number of isolation boxes should be constructed.
5. It should be well ventilated, lighted and provided with feeder and water trough.

7. Shearing shed

1. It is a place where sheep are shorn.
2. The floor of shearing shed should be paved and smooth.
3. The shed should be fenced from one side where sheep should be collected before and after shearing.
4. There should be passage of 1.5m wide for entrance of sheep in the shed.

In addition to these building there should be office room, store room for feed, fodder, medicines and other items. At organized farm one dipping tank should be constructed.

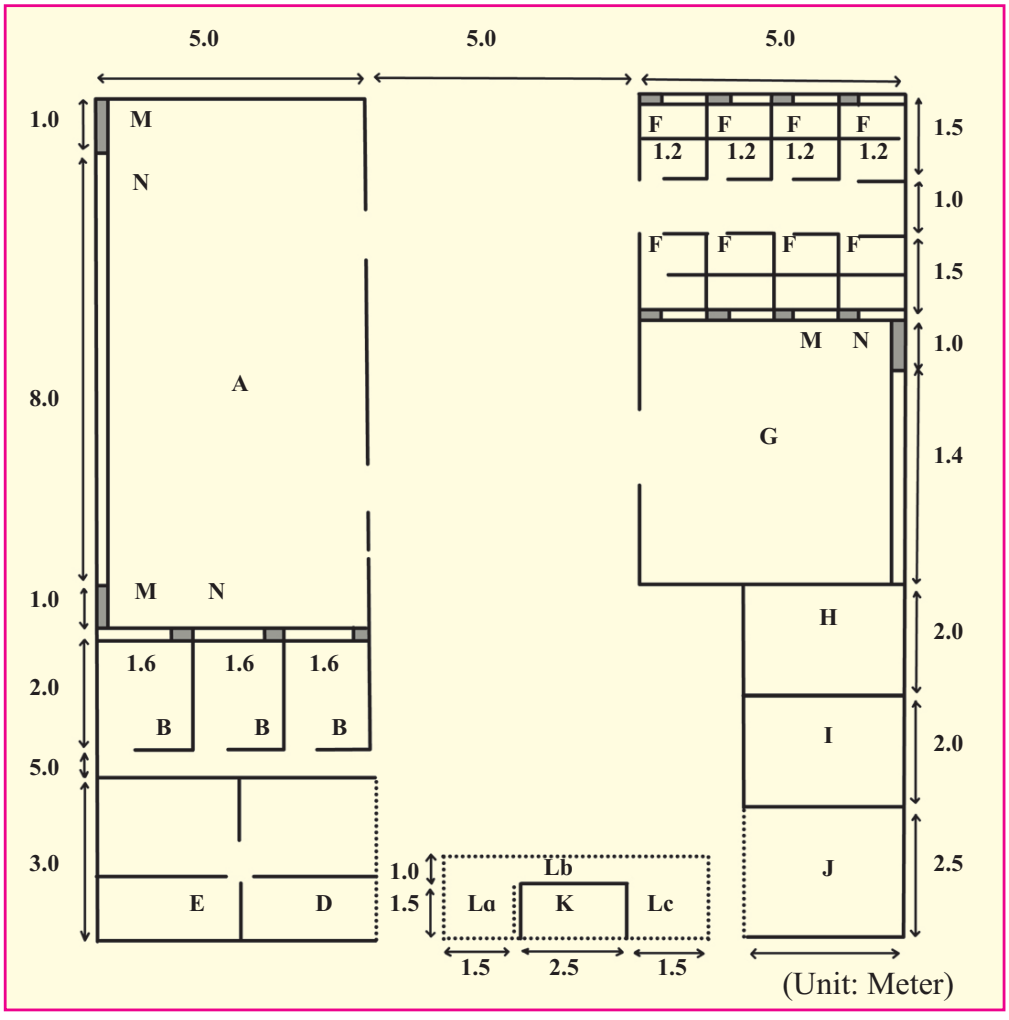


Fig. 5.2 : Lay out for Housing of 50 ewes

A. Ewe pen, **B.** Ram pens, **C.** Passage leading to ram pens, **D.** Shearing room, **E**. Wool store, **F.** Lambing pens, **G.** Lamb pen, **H.** Office, **I.** Store, **J.** Hay/straw, **K.** Dipping tank (1m deep), **La.** Assembly pen, **Lb.** Corridor for sheep movement, **Lc.** Draining platform, **M.** Water tank (1/10th length of manger in each pen), **N.** Manger.

5.3 Management of lambs

For successful sheep farming proper management of lambs is essential. It is better to raise the lambs on the farm rather than purchase because we know the pedigree of particular lamb. Care of lamb starts from the pregnancy of ewe. Therefore, care of pregnant ewe is also essential.

Fig. 5.3 : Lamb pen

1. Feeding

1. Provide sufficient colostrum and ensure proper suckling of lambs. Colostrum provides immunity to lambs.
2. For orphan lambs foster mother may be used. Goat can also serve as an excellent foster mother. Over feeding and under feeding should be avoided.
3. Provide creep feed with fresh tender legume fodder to increase weight gain and faster growth rate up to 6 months.
4. Provide extra creep ration with 16% D.C.P. to the stunted lambs.

Internet my friend

Collect the information on colostrum feeding

a. Feeding of suckling lambs

In early part of life lambs are dependent on their mother's milk. Colostrum should be fed @10 % of the body weight four times in a day for four days. Colostrum is the first milk drawn and fed to lamb within 30 min to 1 hour after its birth. Milk should be fed @ 10% of body weight up to two months. After two months milk should be fed @ 5% of body weight. Lambs are weaned after three months of age.

Fig. 5.4 : Suckling lamb

It is most economical to put the lambs on good quality pasture. If the pasture is of poor quality, then the ration may be supplemented with starter feed. Starter feed should include 42 parts maize, 35 parts groundnut cake (GNC), 10 parts wheat bran, 10 parts fish meal, 2 parts mineral mixture and 1 part common salt.

b. Feeding early weaned and orphan lambs

Lambs are usually weaned at 3 months of age. Some lambs may be orphaned due to the death of ewes or due to disowning by the mother. Early weaners and orphan lambs must be well fed.

Up to six weeks of age, grains should be crushed before feeding to lambs. After this, grains can be fed as such except hard grains. The infant lambs should get good pasture or high quality legume hay in addition to grain. If only poor roughages are fed, give them additional feed supplement with 12 % DCP and rich in vitamins.

A few recommended rations for the creep feeders and weaners are as follows:

i. Maize 40% + Oat 30% + Barley 30% + Lucerne hay adlib.

ii. Oat 20% + Maize 40% + Barley 20% and GNC 20%, supplementation with vitamins.

iii. Maize 20% + Oat 40% + wheat bran 20% + GNC 20%, supplementation with vitamins.

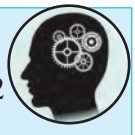
Do you know ?

Orphan lamb means a lamb who lost his mother

2. Management

1. After the birth of lamb, allow the ewe to lick the lamb to clean the body. Within few hours, lamb will stand on legs and start suckling.
2. Cut the naval cord 2-3cm from the body and apply tincture iodine.
3. To facilitate defecation and passing out of meconium easily, give a teaspoonful of castor oil.
4. Do not handle the lamb frequently, allow them to stay with mother for maximum period in early stage.
5. Protect lambs from adverse climatic condition.
6. Ear tattooing and castration should be carried out at 2 to 3 weeks of age.
7. Monthly body weight should be recorded.
8. Lambs having stunted growth should be culled at 6 months of age.

Remember...



- Age of puberty in ewe is 6-12 months.
- Length of oestrous cycle is 17- 19 days.
- Breeding season is June-August and January- February.

3. Health Care

1. Cleaning

Sanitation and cleaning are key to good health. Unhygienic conditions provide scope for development of pathogens which cause many diseases. Regular cleaning and disinfection of animal sheds prevent infection. Following steps should be taken to ensure cleaning.

- Empty the water troughs and scrap the sides and bottom with brush.
- Wash it with clean water and apply white wash inside.
- Clean the floor, gutter, manger by removing dung, urine and left over feed carefully.
- Scrap the floor with brush and broom and wash with clean water.
- Remove the cobwebs with the help of long broom.

2. Deworming

Worms are present in the stomach and intestine of sheep. They are called endoparasites. They suck the blood and cause many diseases in sheep. To control endoparasites follow deworming schedule given in table 5.1.

3. Vaccination

Vaccination is done to protect the lambs and sheep against many diseases like enterotoxemia, black quarter, haemorrhagic septicaemia, foot and mouth disease, peste des petits ruminants etc.

Table 5.1 : Deworming schedule for sheep

Sr. No.	Type of worm	Schedule
1	Round worms	Once in a month from 1 to 6 months of age
		From 6 – 12 months of age, once in 2 months
		From 1 year onwards, once in 4 months i.e. June, October and March
2	Tapeworms	Twice a year i.e. January and June in lambs in problem flocks
3	Liver flukes	Twice a year i.e. May and October in disease prone area

Table 5.2 : Vaccination schedule for sheep

Sr.No.	Disease	Primary vaccination	Regular vaccination
1	Foot and mouth disease	3 months and above	Twice a year i.e. in March and September
2	Peste des petits ruminants(PPR)	3 months and above	Every 3 years
3	Sheep pox	3 months	Every year in December
4	Anthrax	3 months and above	Every year before monsoon in endemic area
5	Enterotoxaemia	3 months and above if dam is vaccinated.	Every year before monsoon-two doses at an interval of 15 days
6	Haemorrhagic septicaemia	3 months and above	Every year before monsoon
7	Black quarter	3 months and above	Every year before monsoon

3. Control of ectoparasites (Ticks, Fleas etc)

- Ticks, lice, fleas and flies can be best controlled by keeping the surrounding clean, regular cleaning of sheds, proper disposal of dung and dipping of animals in insecticide solution.
- Use chemical dip or spray with solution of deltamethrin @2-3 ml/L on animal body and @ 5ml/L in lamb shed or Amitraz @ 2-4 ml/L on animal body and @ 4 ml/L in lamb shed to kill the ticks and fleas.
- Avoid dipping in very young lambs.

Remember...

- Dipping is the process of immersion of animals in medicated water.
- In this method the insecticide is diluted in a big water tank and animals are dipped in it one by one for at least 2 minutes.
- Head should not be dipped.
- Drinking water should be provided to animals before dipping.
- Keep head above the level of dipping solution.

5.4 Management of pregnant ewes

To have healthy and vigorous lamb production, pregnant ewes have to be looked after very carefully. Gestation period in sheep is 150 days

Feeding

1. Grazing on good pasture can fulfill the nutritional requirement of pregnant ewes.
2. Provide sufficient green leguminous fodder.
3. Proper nourishment during pregnancy to avoid lambing paralysis.
4. In the last two months of pregnancy, 70% growth of foetus takes place. To fulfill the nutritional requirement of growing foetus additional ration of 250-300 gm should be given.
5. In the last month of pregnancy, ration of pregnant ewes must be supplemented with ad lib green fodder.
6. Provide fresh and clean drinking water.

7. Flushing

It is generally done in small ruminants (especially sheep and goat) and can be practiced in other livestock. Flushing is a gradual increase

in the total concentrates provided to the livestock 2 weeks prior to mating. Flushing not only helps in maintaining the body condition of the animal after conception but also enhance the conception rate. Further, it has been seen that the ovulation rate increases after flushing. For flushing, give 100 grams concentrate over the normal concentrate ration and gradually increase it to 250 grams.

Remember...

Inadequate and poor nutrition may result in pregnancy toxemia, abortion and premature births of weak lamb hence in the last month of pregnancy, the growth of foetus is very fast. Therefore, additional provision of 250-300 gm of concentrate should be made to increase number of viable lambs, growth rate and birth weight of lambs and milk yield in coming lactation.

Management

1. Frequent handling of pregnant ewes should be avoided.
2. Advance pregnant ewes should be separated from main flock.
3. Grazing at long distance should be avoided.
4. Protect pregnant ewes from extreme cold and hot climate.
5. Keep houses of pregnant ewes clean and well ventilated.

Fig. 5.5 : Grazing sheep

Fig. 5.6 : Feeding at farm

Health Care

1. For control of internal parasites, regular deworming should be carried out. However deworming should be avoided during early pregnancy
2. Vaccination against enterotoxemia is advocated during pregnancy in order to transfer passive immunity to newborn lambs
3. Avoid dipping of sheep in advance pregnancy

5.5 Management of lactating ewes

To have healthy and vigorous lamb production, lactating ewes have to be looked after very carefully.

Feeding

1. Grazing on good pasture usually fulfills the nutritional requirement and increases the milk production of lactating ewes.
2. Provide sufficient hay preferably legume hay to ewes during lactation.
3. As the lactating ewes drink more water, provide plenty of fresh and clean water for 4 to 5 times in a day.
4. Provide concentrate to lactating ewes @ 200-300 gm to meet additional nutritional requirement for milk production.

Remember...

The daily feed and fodder requirement of one adult sheep is

- 2-3 Kg green fodder
- 1-1.5 Kg dry fodder
- 250-350 gm concentrate mixture

Do you know ?

Flushing is the process of putting ewes on a grain ration or move them to fresh pasture area where feed is more abundant, 2 weeks before onset of breeding season to…

- Increase ovulation rate.
- Brings all the ewes into heat at nearly the same time resulting in uniform lamb crop.
- Increases incidence of multiple births in the flock.
- Helps in effective flock management.

Management

1. Lactating ewes should be separated from main flock and kept in separate pen.
2. After lambing let ewe lick the lamb and keep the lamb with mother for 7-10 days to develop maternal instinct.
3. Keep houses of ewes clean and well ventilated. Protect the lactating ewes from extreme cold and heat.
4. After lambing, ensure the expell of placenta. If placenta is not expelled within 8-10 hrs treatment should be given.
5. Shearing should be done twice a year preferably in the month of March- April and September- October.

Do you know ?

Removal of wool from the body of sheep with the help of shearer is known as shearing.

Fig. 5.7 : Shearing

Internet my friend

Collect the videos of machine and hand shearing

Health Care

1. In high yielding ewes, calcium supplement may be given.
2. Vaccination should be done against commonly occurring contagious diseases.
3. Deworming should be done as per schedule given in Table 7.1.
4. For control ectoparasites, dipping of sheep in insecticide solution, removal of vegetation from surrounding area and spraying of animal shed should be done.

5.6 Management of breeding Ram

The ram is the half of the flock, hence proper management of ram is necessary.

Feeding

1. Feed the rams as like the feeding of ewes.
2. Provide supplementary feeding to ram for a month before as well as during breeding season.
3. Feed concentrate with 14 to 16% DCP at the rate of 300-500 gm per day during breeding season.
4. Feed them with mineral and vitamin mixture.

Management

1. Give regular exercise to ram to maintain vigour.

2. Use the ram for service at the age of 18 to 24 months.
3. Up to the age of 5 years ram can be used for breeding.
4. Keep one ram for 30-40 ewes.
5. Examine testicles for poor libido.
6. Use highly pedigreed ram for breeding.
7. Before start of breeding season ringing, eyeing and shearing is practiced.
8. Change the ram after every two years to avoid inbreeding.

Do you know ?

Hand mating, Pen mating, Flock mating and Artificial inseminations are the different mating systems followed in Sheep and Goats

Health Care

1. Testing for Brucellosis, Jhone's disease and Tuberculosis should be carried out regularly.
2. Regular vaccination against F.M.D., Enterotoxaemia, sheep pox, PPR (Peste des petits ruminant) should be carried out.
3. Dipping should be followed at least twice in year for control of ectoparasites.
4. Deworming should done as per the schedule given in Table7.1.

Exercises

Q.1. Fill in the blanks.

1. On an average sheep produces …….. g of wool per year.
2. Sheep manure contains …… the quantity of nitrogen and potassium than cattle manure.
3. Ideal age of ram for breeding purpose is…….
4. Gestation period in ewe is ……days.
5. Vaccination against enterotoxemia is recommended in the month of..…
6. Feed the concentrate @.... gram per day during breeding season to ram
7. Lambs are usually weaned at an age of …..
8. Sound produced by sheep is called……
9. …… is also called as maternity pen.
10. In one ewe shed maximum number of ……ewes can be accommodated.

Q.2. Match the pairs

Group A	Group B
1. Ram	a. Control of endoparasites
2. Lambing	b. Removal of hairs
3.Tupping	c. Control of ectoparasites
4. Shearing	d. Act of mating in Sheep
5. Deworming	e. Male Sheep
	f. Removal of wool
	g. Act of parturition in Sheep

Q.3. State True or False

1. Young male/female of Sheep is called as Lamb.
2. Twinning is most common in Sheep.
3. Orphan lamb means a lamb with its mother.
4. Flushing means removal of fecal materials from byres.
5. Deltamethrin is used for deworming.

Q.4. Answer in brief

1. Why sick animals should be shifted to isolation box?
2. Give the ideal ratio of ram to ewe?
3. Which is the proper time for shearing?
4. How much area is required for housing of ram?
5. Why docking is followed in sheep?
6. Define flushing.
7. What do you mean by dipping?
8. Name the chemicals used for dipping.
9. Write the breeding season of sheep.
10. Define shearing.

Q. 5. Answer the following questions.

1. Give advantages of sheep farming in India.
2. Enlist different components of sheep housing with their uses.
3. Give advantages of flushing.
4. Write in brief about feeding management of lambs.
5. Explain in brief management of lactating ewes.

6. POULTRY HOUSING AND FEEDING

Can you recall ?

What do you mean by poultry?

Commercial chicken lay more than 310 eggs in a laying year cycle. This high egg production can best be achieved if a comfortable housing is provided for them. Housing provides comfort and protects them from sun rays, rain, wind and predators. The poultry house should be well ventilated, reasonably cool in summer, warm during winter and free from drafts. In our country open sided poultry houses are very popular except in very cold areas. In conclusion, we can say that poultry is housed for comfort and protection to achieve efficient production and convenience to the poultry farmer.

Do you know ?

Housing protects birds from sun, rain, wind, predators and provides comfort to get maximum production.

Essentials of good poultry housing

1. Comfort : The best egg production is secured from birds that are comfortable and happy.The house should remain dry and must provide adequate accommodation and sufficient fresh air.

2. Protection : House should protect the birds from extreme weather conditions. It should safeguard against theft and attack from natural enemies.

3. Convenience : The house should be located at a convenient place and the arrangements of equipments in house should allow cleaning and other operations easily.

6.1 Principles of poultry housing

In planning a poultry house the following principles should be taken into consideration.

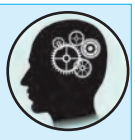
1. **Location of house :** The house should be located on a infertile, well drained ground, safe from flood water and should have easy access from the road.
2. **Long axis of the house :** In hot parts of the country, the long axis of the house should run from East to West and in cold parts it should be North to South.

Can you tell ?

Why long axis of the house should run from east to west in hot parts of the country?

3. **Relation to other building :** The distance between the two houses for the birds of the same age group should be at least 20 m to allow proper ventilation. The houses of young stock should be at least 50 to 100 m away from adult stock house. This helps to prevent disease transmission.

Remember...



The brooder house should be at least 50 – 100 m away from house of adult stock.

4. **Width of house :** The width in open sided houses should not be more than 9 m.
5. **The height of house:** It is ordinarily 2.5 to 3.3 m from the foundation to the roof line. However, the height of the roof depends on the temperature of the place. A high ceiling keeps the inside temperature low.
6. **Floor of house:** The floor should be moisture proof, free from cracks, easy to clean and rat proof, especially in deep litter system.

7. **Shade and protection:** The climatic conditions and age group of birds will determine the extent of side opening. In open side deep litter houses two third and cage houses the maximum of the area of the side walls is kept open and fitted with wire mesh for proper ventilation, where temperature is continuously high. An overhang of 1 m will prevent the rain water splashing inside the house.

8. **Durability and cost:** A poultry house should be durable, comfortable, safe and low cost.

Do you know ?

Why floor must be moisture proof, easy to clean and rat proof in deep litter system?

6.2 Construction of house

The poultry houses are designed and constructed for protection of birds from extreme weather, infective organisms, parasites, predators and thieves. It is necessary to know, identify and select proper material for construction of poultry house.

1. **Foundation :** It should have enough hold on the ground for supporting the building and hence permanent poultry house should have concrete foundation. Foundation should be at least one feet above the ground level.

2. **The floor :** The floor of house should be smooth, free from dampness, without cracks, easy to clean and disinfect, rat proof and durable.

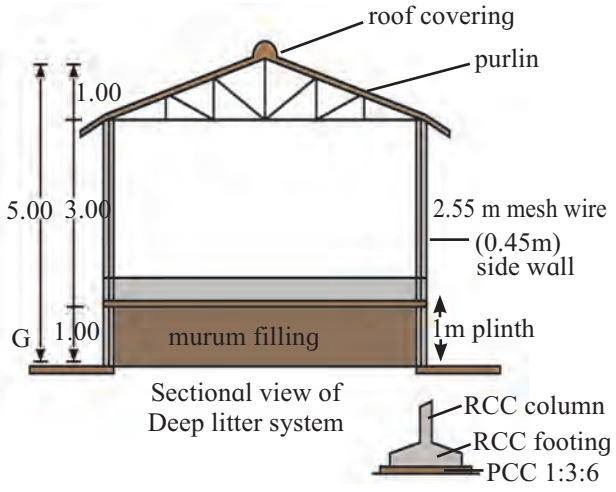
i. **Concrete floor :** A well laid concrete floor is the safest way to meet these requirements and is recommended in preference to any other kind of floor.

ii. **Wire mesh floor :** Wire mesh floor or preferably mesh of expanded metal is the best for portable houses. The expanded metal although more expensive, is stronger, more durable and does not sag like the wire mesh.

3. **Walls :** The wall should be water proof, wind proof, and finished with interior surfaces that are easy to clean and disinfect. The lower portion of the side walls up to height of 1 – 1.5 feet is built with solid bricks. The upper portion of the wall is made up of chicken wire mesh supported by bricks and pillars.

4. **Doors :** The door of the house must be on the south or north and made up of an angle iron frame covered with half inch mesh. The size of the door should be always large enough to allow a man to conveniently get through.

5. **Water tank :** Water tank should be constructed nearby shed as per capacity of farm.



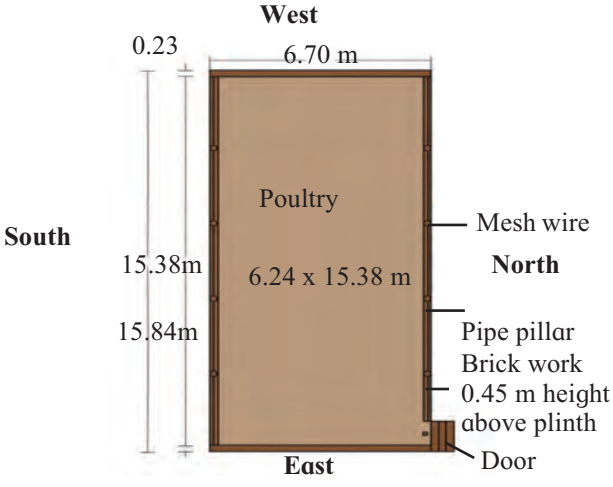


Fig. 6.1 : Ground floor plan for 1000 broilers in Deep litter system

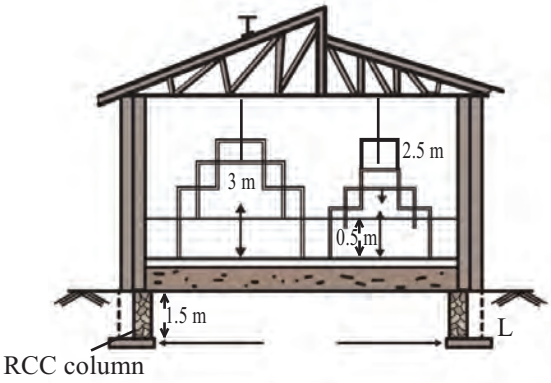


Fig. 6.2 : Sectional view of cage system

Space requirement

The weight of a day old broiler chick is about 40 grams and it attains a weight of about 2000 grams in period of 42 days in meat type birds. So as the chicks grow in age and size, they require increased space. If there is insufficient space, chicks do not get fresh air, enough feed and water.

The space for floor, feeder and waterer for different age group of birds is shown in Table 6.1.

Do you know ?

The chicken is a wild jungle fowl, sought safety and rests on the high limbs of a tree.

6.3 Systems of poultry keeping

The type of housing adopted depends on the availability of land, type of bird and the capital. There are four systems of housing generally followed in the poultry farming.

1. Free range system
2. Semi intensive system
3. Intensive system :
   A. Deep litter system B. Cage system
4. Environment control housing system

Observe and discuss...

Visit nearby poultry farms and note down difference between deep litter and cage system of poultry.

Table 6.1 : Space requirement for different age groups of birds

Type of bird	Age (weeks)	Floor space (Sq. ft.)	Feeder space		Waterer space	
			(inch)	(cm)	(inch)	(cm)
A. Deep litter system						
Layer i) Chicks	0 – 4	0.50	1.00	2.50	0.50	1.25
	4 – 7	1.00	2.00	5.00	0.50	1.25
ii) Grower	8-12	1.50	3.50	8.00	0.75	2.00
	13 – 20	2.00	5.00	12.00	0.75	2.00
iii) Layer	21 – 72	2.50	6.00	15.00	1.00	2.50
Broiler	0 – 4	0.60	2.00	5.00	0.50	1.25
	4 onwards	1.20	3.50	8.00	1.00	2.50
B. Cage system						
Layer i) Chicks	0 – 7	0.24	1.00	2.50	0.50	1.25
ii) Grower	8 – 20	0.48	2.00	5.00	0.75	2.00
iii) Layer	21 – 72	0.72	3.00	7.50	1.00	2.50

1. Free range system

This method is the oldest of all and has been used for centuries by general farmers, where there is no shortage of land. This system allows great but not unlimited, space to the birds on land where they can find an appreciable amount of food in the form of herbage, seeds and insects. At present due to advantages of intensive methods this system is almost out-dated, but it plays important role in rural area.

Advantages

1. Less capital investment.
2. Minimum expenses on feed.
3. Less labour is required.

Disadvantages

1. Low egg production and growth.
2. More chances of infectious diseases including parasitic infestation.
3. No protection from predatory animals and birds
4. Sometimes birds lay eggs outside the area.
5. Risk of theft of eggs and birds.
6. More loss of energy in movement of birds.

Backyard poultry farming

1. Backyard poultry farming means rearing chicken in small numbers (10-20) by each household in the backyard under free range system.
2. The birds are allowed for foraging provided with supplementary feeding and clean water during the day time, while at night they are provided with shelter, made of locally available low cost.
3. Backyard poultry farming is an old age profession of rural India.
4. It is having tremendous potential to increase poultry production and can definitely contribute to poverty reduction.
5. Backyard poultry can easily be started with improved backyard poultry breeds such as Giriraja, Grampriya and Swarnadhara.

Remember...

Chicks from improved backyard poultry breeds need brooding and care during initial four weeks of age. After four weeks, they can be let free for scavenging in backyard. The night shelter should have good ventilation and protection from predators and plenty of clean water should be made available. The birds must be vaccinated against Mareks and Ranikhet disease. There should be periodic deworming at 3-4 months interval.

Advantages

1. Low initial investment.
2. Less expenses on feed.
3. Labour requirement is nil. It can be managed by farming members, women, childrens and old aged persons.
4. Production from backyard poultry farming fetches higher price as compared to those from intensive poultry farming.
5. Birds under backyard farming efficiently convert the wastage material (insects, ants, fallen grains, green grass, kitchen wastage, vegetable wastage etc) into high quality protein for human consumption.
6. Backyard farming can minimize environment pollution which is a problem with the intensive poultry farming.

Disadvantages

1. Low production and growth.
2. Chances of infectious diseases.

Fig. 6.3 : Free range rearing system

2. Semi intensive system

This system is adopted where the free space available is limited, but it is necessary to allow 10 square feet per bird for outside run. Shed should be constructed to protect birds at night time, birds lay eggs in the shed. Feed and water is made available in outside the run area.

Remember...

This method is used for organic eggs and meat production.

Advantages

1. Less space is needed than free range system.
2. Capital investment is low as compared to intensive system.
3. Protection from predatory animals and birds.
4. Reduced chances of spread of diseases than free range system.
5. Protection from cold, sunshine and rain.
6. Useful for both egg and meat production.

Disadvantages

1. Low egg production and growth as compared to intensive system of housing.
2. High expenses on labour as compared to free range system.
3. Daily cleaning of run is necessary.

Fig. 6.4 : Semi intensive system

3. Intensive system

In this system, the birds are confined to the house entirely, with no access to land outside and it is usually adopted where land is limited and expensive. The traditional system of maintaining poultry under free range or semi intensive has been replaced to a large extent by the intensive system. Under intensive system, large number of birds are reared under deep litter or cage system.

There are two types of intensive system namely. A) **Deep litter system B) Cage system**.

Observe and discuss...

Visit deep litter and cage house poultry farm and find out differences between them.

A. Deep litter system

In this system the floor of house is covered with bedding material like rice husk, straw, saw dust, ground nut kernels or leaves up to depth of 4-6 inches; the birds are reared on it at all times. It is called deep litter. Deep litter system is commonly used all over the world. It is economical, hygienic, comfortable and safe to the birds. Right number of birds should be housed to keep litter always dry. The house should be well ventilated. The litter should be stirred at least twice in a week.

Do you know ?

Why the litter should be stirred?

Fig. 6.5 (a) : Inner view of deep litter system

Fig. 6.5 (b) : Outer view of deep litter system

When birds are housed on deep litter, placement of waterer should receive due attention to keep litter dry. At the end of the laying or after selling broilers, litter can be used as manure.

Can you think ?

Why deep litter system is preferred for broilers?

Advantages

1. **Safety of birds :** The birds and eggs are safe in deep litter house.
2. **Litter as a source of nutrient :** The build up deep litter also supplies some nutrients to the birds.

Remember...

Deep litter system increases eggs and meat production efficiency of birds.

3. **Disease control :** The level of worm infection is much lower than the birds kept in semi intensive method.
4. **Labour saving :** There is no need to clean a pen for a whole year or up to selling of broilers. The only attention required is the regular stirring and adding of same litter material as needed.
5. **Temperature control :** This is an important feature in a hot climate. The litter maintains its own constant temperature, so birds burrow into it when the air temperature is high and thereby cool themselves. Conversely, they can warm themselves in the same way when the weather is very cool.

Can you tell ?

Why deep litter house remains cool in summer and warm during winter?

6. **Organic manure :** Poultry droppings get mixed with the litter produces valuable organic manure at the end of growing cycle. Organic manure is an important source of income to poultry farmer in deep litter system.

Disadvantages

1. Requirement of balanced feed at all times.
2. It remains moist and full of foul smell if not cared properly.
3. It is difficult to control vices of birds like cannibalism, feather pecking, egg eating.
4. It increases chances of disease spread like coccidiosis, salmonellosis etc.

B. Cage system

Do you know ?

The cage system of rearing is considered as a best for layer birds.

In this system hens are confined in a cage compartment just large enough to permit hen required movement and allow her to stand and sit comfortably. Both food and water is provided from outside of cage. Cage floor has a slope from back to the front, so that the eggs as they are laid, roll out of the cage to a receiving gutter.Cage system can be used for all age groups of layer type birds in all agro climatic conditions.

California type of cages is better than the three or four tier battery cages as it saves labour. Provision of automatic watering and

feeding system increases the efficiency of cage system for commercial egg production.

Advantages

1. Economy in space.
2. Better prevention and control of diseases like coccidiosis.
3. Less mortality rate and expenses on medication are minimum.
4. Reduced feed consumption and less labour requirement.
5. Increased laying efficiency.
6. Better flock supervision and easy maintenance.
7. Cannibalism is minimized.
8. Convenient for daily farm work.

Can you tell ?

Why California cage system is most suitable for layer farming?

Disadvantages

1. High initial capital investment.
2. Chances of cage layer fatigue and lameness are more.
3. Skilled labour is required.
4. Control of odour and flies is difficult

Fig. 6.6 : Cage system of housing

4. Environment control housing

Environment Control (EC) housing is the modern method of housing in which inside conditions are maintained as near as possible to the bird's optimum requirements. Much of the structural make up of the EC house is similar to

Table 6.2 : Difference between deep litter and cage system

Sr. No.	Parameters	Deep litter	Cage system
1	Floor economy	Less	More
2	Disease prevention	Less	More
3	Mortality rate	More	Less
4	Expenses on medication	More	Less
5	Saving of feed	Less	More
6	Labour saving	Less	More
7	Supervision	Good	Better
8	Feather pecking	Yes	No
9	Maintenance	Easy	Easier
10	Investment	Low	High

that of the house with open sides. Insulation is must in environment control house.

Salient features of EC house

1. This type of house is completely enclosed with no windows.
2. Air must be moved through the EC house to increase oxygen to remove moisture and ammonia.
3. Optimum temperature is maintained with the help of exhaust fans and fresh air is brought in through (cooling pads) inlet opening.

Observe and discuss...

Visit nearby EC house and record advantages over open sided house.

4. Artificial light, rather than natural day light is used to illuminate the interior.
5. Usually the house is not heated in the cooler month, the heat from the birds being used to keep inside temperature within a comfortable range.
6. In EC house, there are different systems such as automatic feeding, watering and lighting.
7. Ventilation, temperature and humidity are auto controlled as per birds requirements.

Advantages

1. Less floor space requirement (0.65 sq.ft. per broiler birds).
2. Better prevention and control of diseases.
3. Less mortality rate and expenses on medication.
4. Faster and uniform growth.
5. Increased egg and meat production efficiency with improved FCR.
6. Better and consistent performance throughout year.
7. Easy for management.
8. Improves profitability with reduced challenges.

Disadvantages

1. High initial investment.
2. Skilled labour is required.
3. It requires continuous electric supply.

House with cooling pads

House with exhaust fans

Inner view

Inner view

Fig. 6.7 : Environment control poultry housing system

6.4 Poultry house equipments

The poultry house should be equipped with brooder, feeders, waterers, nest box, grit box, and other items which are essential for optimum production. They should be simple in operation, cheap, movable,durable and can easily be cleaned and disinfected.

1. Feeder

Feeders are usually of two types:

1. Round or circular (Automatic round plastic feeder)
2. Round or circular Chick feeder
3. Linear feeder (long feeder)

Essential features of an ideal feeder

1. It should avoid wastage.
2. Prevent the birds from getting their feet into the feed and from resting on it
3. Easy to clean
4. Easy for the birds to eat from bottom of the feeder

1. Round or circular feeder : It is suitable for birds of all age group. It can be easily cleaned and the frequency of refilling is fewer. These type of feeders are invariably suspended and the height from the feeder is adjusted according to height of birds.

Fig. 6.8 : Round feeder

Fig. 6.9 : Chick feeder

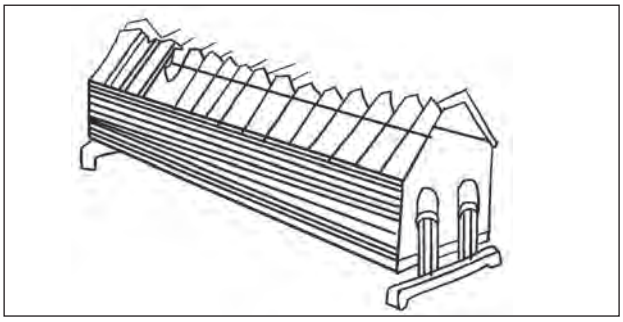


Fig. 6.10 : Linear feeder

2. Round or Circular chick feeder : Small plastic feeder of 2 to 3 kg capacity is suitable in the first and second weeks of brooding. Feeder height can be adjusted by the stand. Generally one feeder is sufficient for 75 chicks in first and second week.

3. Linear feeder : It is a horizontal long feeder, made up of galvanized sheet and grill with adjustable stand. It is durable and height can be adjusted with the help of stand. Feeder should have convex bottom so that the birds can reach the feed even when it is in small amount.

Do you know ?

Features of an ideal watering device

- Should be large enough for a full day water supply.
- Should keep the water clean and cool.
- Does not rust or break easily.
- Does not topple over readily.
- Does not allow the birds to contaminate the water.

2. Waterer or drinker

The following watering devices are used.

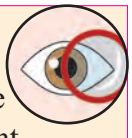
1. Chick drinker : Small plastic drinker of 1.5 to 5 liters capacity are suitable in the first and second weeks of brooding. Drinker height can be adjusted by stand. Generally one drinker is sufficient for 75-100 chicks in first and second week.

Fig. 6.11 : Chick drinker

Fig. 6.12 : Automatic drinker

2. Automatic round drinker : It is an ideal watering device. It is very easy to clean. Automatically water comes in the drinker as per adjustment. Drinker height can be adjustable so that it is suitable for birds of all age groups.

Observe and discuss...



Nipple and cup waterer are ideal for cage and environment control houses.

3. Nipple : Bird press the button of the nipples by their beak and every time one drop of water is released. The bird repeat the process for drinking enough quantity of water. One nipple is sufficient for three birds.

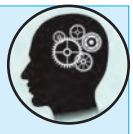
Fig. 6.13 : Nipple system of water drinking

4. Cup waterer : Small drinking cup of about two inch diameter. A valve is situated in the bottom of cup which opens and closes and maintain the fixed water level in cup, even after drinking by the birds.

3. Brooder

Chicks are unable to maintain their body temperature in first three weeks of their life. So artificial heat should be provided to them.

Remember...



The equipment which produces artificial heat is known as brooder.

The different types of brooder are as follows

1. Hover type electric brooder : It is a cone or dome shaped piece of tin sheet standing on legs or hanging by a wire over chicks as canopy with bulb in the middle to radiate all heat down. A six feet hover can accommodate nearly 500 chicks.

Do you know ?

In electric brooder 2 watt light per chick is required

2. Gas brooder : It is dome shaped. Heat in this brooder produced with the help of LPG.

3. Battery brooder : These are built in tiers. The floor and walls are made of expanded metal. Every tier of brooder has a tin tray to collect faecal matter. Heat is provided with electric lamps.

Fig. 6.14 : Electric Brooder

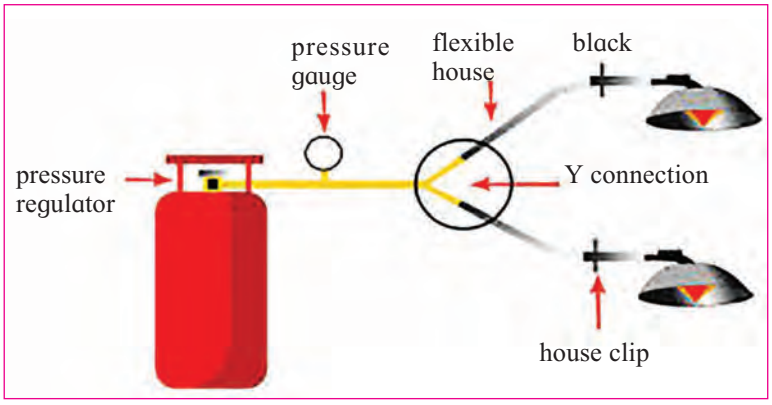


Fig. 6.15 : Gas brooder

4. Nest box

Nest box is a place where birds lay their eggs. Nest boxes are placed at least one month before the start of lay in order to encourage the birds to lay eggs in the nest boxes.

Remember...

Nest boxes are of two types – Open nest and Trap nest

Trap nest is provided with trap doors, by which birds shut themselves in when they enter for laying, later the attendant removes the bird and marks its identity on the egg. They are used for breeding purpose whereas open nest are used in commercial flocks.

Fig. 6.16 : Nest Box

5. Debeaker

An automatic electric machine known as debeaker is used for debeaking.

Fig. 6.17 : Debeaker

6. Filler flats

The eggs are collected from nests by the poultry worker and kept in special type of trays known as filler flats.

Do you know ?

Filler flats are of two types – paper pulp and plastic.

Each flat has capacity to hold 30 eggs. Individual egg is kept in separate hole, with broad end up. Once the egg is embedded in the hole of the flat, it does not move. Thus the chances of breakage in egg are minimized.

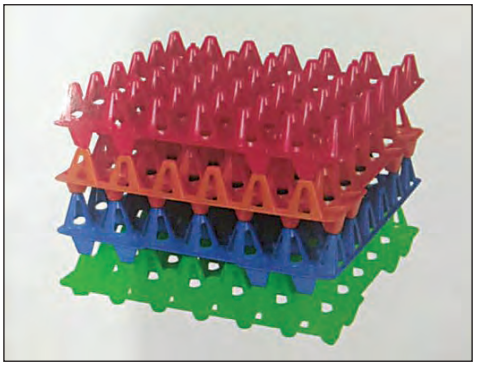


Fig. 6.18 : Filler flats (Plastic)

Fig. 6.19 : Filler flats (Paper)

7. Egg boxes

The purpose of egg boxes is to hold the eggs contained in the filler flats so that eggs can be transported to long distance safely. The dimensions of egg boxes are such that 6 to 8 trays can be accommodated one over the other in one box.

8. Egg candler / Candling box

It consists of a container or wooden box closed from all sides but has an hole of 2.5 to 3 cm in a diameter on one side facing the bulb fitted on opposite side. It is used for candling of eggs.

Remember...

- Eggs are candled with the help of candlers during the incubation period.
- Eggs that are infertile and those in which the embryos have died are removed.

9. Incubator

Incubator is a machine used for eggs incubation to produce chicks on large scale. Optimum and uniform temperature, humidity, turning of eggs and proper ventilation are maintained in a machine. Cleaning, disinfection and fumigation are the routine practices for incubation to produce healthy chicks.

Remember...

Incubators are of two types namely setter and hatcher

Fig. 6.20 : Outer and inner view of Incubator

a. Setter : In this machine eggs are placed for first 18 days. Optimum temperature and humidity is maintained with turning of eggs.

b. Hatcher : Eggs are transferred from setter to this machine on 19th day. Eggs are placed in trays to receive chicks. Optimum temperature and humidity is maintained in hatcher up to 21 days for better hatchability.

10. Vaccinator

The equipment is used for giving vaccine or injectables to chicks and hens. The required amount of dose can be adjusted. It works continuously and it has self refill mechanism.

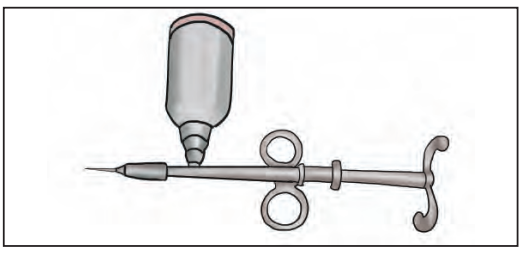


Fig. 6.21 : Vaccinator

11. Grinder

It is also called as hammer mill. A hammer mill is a machine used to grind or crush feed ingredient in to smaller pieces by the repeated blows of hammers.

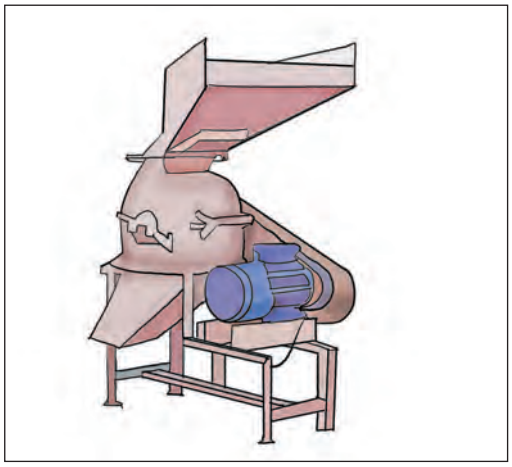


Fig. 6.22 : Grinder

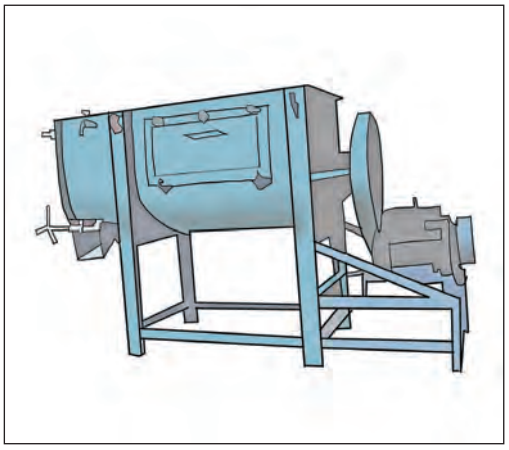


Fig. 6.23 : Mixer

12. Mixer

Mixer machine is used in feed mills for the proper mixing of feed ingredients and premix. Proper feed mixing being the key to balance feed production.

Feed mixers are of two types – vertical mixer and horizontal mixer.

Do you know ?

If feed is not mixed properly, ingredients and nutrients will not be properly distributed.

13. Sprinkler

They are used for sprinkling of water on the roof to cool the house.

Fig. 6.24 : Sprinkler

Fig. 6.25 : Fogger

14. Foggers

Line of foggers laid across the house at truss level, which deposit a fine mist of water on which cools poultry house. Fogging system is useful in dry climatic condition.

6.5 Poultry feeding

The poultry production is mainly dependent on the nutritional quality and the quantity of feed fed to the birds. In addition to scientific breeding and many other factors, efficiency in feeding is one of the key factors, for successful poultry production.

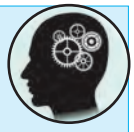
Do you know ?

Feeding alone costs about 70% of the total cost of production.

The birds require the feed mainly for the purpose of maintenance, growth, egg production, building up of new body cells and increasing resistance against diseases.

6.6 Principles of poultry feeding

Remember...



Nutritional requirement are quite specific and more precise in poultry due to their simple stomach.

Following factors should be considered, while computing ration and feeding of birds.

1. Birds have no lips or teeth, hence they require a more concentrated ration.
2. Digestive tract of bird is comparatively short, digestion is quite rapid, so their requirements are more precise and specific.
3. Due to higher rate of metabolism, birds require more exact ration as per recommended standards.

Do you know ?

Birds are non-ruminants and hence feed should not contain more than 6 to 8 per cent crude fibre.

4. Feed must be palatable and free from aflatoxins.
5. Feed must have all essential nutrients in balanced form.
6. Clean, fresh and cool water must be made available at all times.

6.7 Classification of poultry feed ingredients

The poultry feed ingredients are classified into following major groups…

1. Carbohydrates or energy rich
2. Protein rich
3. Fat sources
4. Feed supplements
5. Feed additives

Classification of Poultry Feed stuffs

Energy rich	Protein rich	Fat sources	Feed supplements	Feed additives
a. Cereal grains • Maize • Sorghum • Wheat • Barley • Oat **b. Cereal by products** • Rice polish • Molasses	**a. Vegetable source** • Soybean meal • Groundnut cake • Sunflower cake • Coconut meal • Sesame cake **b. Animal source** • Fish meal • Meat meal • Blood meal • Liver residue	• Vegetable oil • Lard • Tallow	• Vitamin supplements • Mineral supplements	• Antioxidants • Antibiotics • Coccidiostats • Anthelmintics • Toxin binders • Enzymes • Flavouring agents • Growth promoters

Fig. 6.26 : De-oiled rice bran

Fig. 6.27 : Maize

Fig. 6.28 : Shell grit

Fig. 6.29 : Soybean extraction

6.8 Balanced ration for poultry

Do you know ?

Ration is the allowance of feed given to the bird for a period of 24 hours

Definition

Ration which supplies the essential nutrients in right proportion according to the requirements for maintenance and various productive functions is called 'balanced ration'.

The term "nutrient" means any single class of feed, or group of like feeds that supports the life and makes it possible for birds to produce meat or eggs.

Remember...

Feed additives are not a nutrient, but added to enhance the quality of the nutrients.

Types of feeds

Layer chicken of different ages require different levels of nutrients.

Layer feeds are of the following three types

1. **Chick feed (chick mash / crumbs) :** A ration to be fed to chicks from 0 to 8 weeks of age.
2. **Grower feed (grower mash / crumbs):** A ration to be fed to grower birds in between 9 to 19 weeks of age.
3. **Layer feed (layer mash) :** A ration to be fed to laying birds after 20 weeks of age.

Broiler feeds are of the following three types

1. **Pre-starter ration :** A ration to be fed during the 0 - 7 days.
2. **Starter ration (mash / crumbs) :** A ration to be fed 8 - 21 days .
3. **Finisher ration (mash / pellets) :** A ration to be fed from 22 days onward up to sale of broiler.

Table 6.3 : Nutrient requirements for chicken feed

Type of bird	Age (Weeks)	Crude protein (%)	Metabolic Energy (Kcal/ kg)	Feed Quantity (kg)	Water requirement
Layer					
Chicks	0 – 8	20	2800	2.0	Twice the feed consumption
Grower	9 – 19	16	2500	5.0	
Layer	20 up to culling (72 weeks)	18	2600	40.0	
Broiler					
Pre-starter	0 – 7 days	23	3000	0.150	Twice the feed consumption
Starter	8 – 21 days	22	3100	0.750	
Finisher	22 days onward up to sale	20	3200	3.00	

Feed requirements

Nutrient required for different types and age group of chicken as per BIS 2007 has been given in Table 6.3

Principal points for consideration of feed formulation

- Easy availability of ingredients.
- Palatability of ingredients.
- Maximum inclusion level in feed.
- Cost of ingredient
- Nutrient composition and quality of each ingredient
- Nutrients requirement for poultry according to age, weight, class, breed, type etc.

Methods of feeding chicks, broilers and layers

A well balanced ration will give the most satisfactory results only when it is properly fed to the birds. Some of the popular methods of feeding are described below

1. Whole grain feeding

This is the oldest method of feeding in which birds are allowed to have free choice of ingredients as per their protein and energy requirement. Ingredients are kept in separate containers. Birds are permitted to balance their ration according to individual needs, however, it appears doubtful.

Advantage

This saves energy in grinding.

Disadvantages

1. Several feed hoppers are required.
2. More time is required to fill feed hoppers separately.

2. Grain and mash feeding

This method is slightly better than whole grain method. It involves feeding of grain mixture along with balanced mash.

Advantage

Protein level can be increased or decreased.

Disadvantages

1. Poultry man should be skilled.
2. It is inconvenient for handling and is time consuming.

3. All mash feeding

This method is common and desirable for all types of birds grown under litter and cage system. All the feed ingredients are ground, mixed in required proportion to form balanced ration and fed as a single balanced mixture.

Fig. 6.30 : Mash feed

Fig. 6.31 :Crumbs/Pellet feed

Advantages

1. Selective eating can be avoided.
2. Well balanced ration can be provided.

4. Crumbs / Pellet feeding

Do you know ?

Pellet feeding reduces the wastage of feed

Feeding mash is followed by feeding pellets or crumbs. Mash is pressed under steam to make crumbs or pellets. Chicks are given mash or crumb up to 4 weeks and thereafter they may be given pellets.

Advantages

1. Improves weight gain and efficiency of feed utilization.
2. Reduced feed wastage.
3. Prevents selective eating.

Disadvantages

1. Destroys vitamin A.
2. Problems of wet litter develops.
3. Increases cost of feed.

5. Restricted or controlled feeding

The method involves restriction of feed given to broiler, breeder and grower to control body weight of breeder and to reduce the feed cost instead of adlibitum feeding. Feed restriction to birds can be achived by two ways.

1. **Quantitative method :** Feed restriction on basis of quantity of feed
2. **Qualitative method :** Feed restriction on basis of nutritive quality of feed

Advantages

1. Delays age of sexual maturity.
2. Decreases the weight of bird at first egg and saves feed.
3. Slightly increases egg production and better egg weight.
4. Lower layer house mortality.
5. Increases feed efficiency.

Disadvantage

Restricting feed during starter age especially before 6 weeks causes severe stress

Q. 1 Fill in the blanks

1. Space requirement in cage system for a layer should be ------ sq. ft.
2. In hot part of the country, the long axis of poultry house should be in ----- direction.
3. The distance between two houses for the birds of same age group should be at least ------ m.
4. The first debeaking (touching) operation is done at the age of ---- days
5. The width of open sided houses should not be more than ---- meter.
6. The distance between two poultry houses for young and adult stock should be at least ---- meter.
7. ……is the modern method of poultry housing.
8. A broiler requires …….sq.ft. of floor space in the environment control house.
9. ……is a machine used for egg incubation.
10. Nutrition alone costs about ------ % of the total cost of egg and meat production.
11. A ration which supplies the nutrients in right proportion according to the requirements of bird is called as ------ ration.
12. --------- is rich source of energy in poultry feed.
13. Layer chick feed should contain minimum ------ % crude protein.
14. ---------- is the best example of vegetable protein source.

Q. 2 Match the pairs

Group A	Group B
1. Energy source	a. Minerals
2. Protein source	b. Coccidiostats
3. Feed-supplements	c. Sunflower cake
4. Feed additives	d. Vegetable oil
5. Fat source	e. Rice polish

Q. 3 Identify the odd one out

1. Maize, Sorghum, Groundnut cake, Wheat
2. Antibiotics, Enzymes, Vitamin supplements, Antioxidants
3. Soybean Meal, Fish meal, Sesame cake, Lard
4. Vegetable oil, Tallow, Lard, Coconut meal
5. Fish meal, Meat meal, Liver residue,Soybean meal

Q. 4 Answer the following in brief.

1. Write short note on brooder.
2. Enlist the principles of poultry housing.
3. Write in brief about deep litter system of poultry rearing.
4. What are the essentials of good poultry housing?
5. What are the essential features of an ideal poultry feeder?
6. Write short note on backyard poultry farming.
7. What are the advantages of free range poultry housing system?
8. Enlist the systems of poultry keeping.

9. Give feed requirement of chicks/ growers / layers.
10. Give minimum crude protein and energy content of broiler feed.

Q. 5 Answer the following in detail.

1. Distinguish between deep litter and cage system.
2. Write about environment control housing with its advantages and disadvantages.
3. Describe cage system in detail.
4. Give classification of poultry feed ingredients.
5. Write in detail about methods of poultry feeding.

7. POULTRY MANAGEMENT

Can you recall ?

What do you mean by broilers and layers?

The management practices for commercial layers and broilers are different, but breeder management in both the cases remains the same to a considerable extent as maximizing the chick production is the ultimate object. Poultry management usually refers to the husbandry practices to maximize the efficiency of production by satisfying the basic needs of the birds. However, the success would depend on the judicious implementation of practices combined with personal discretion and experience.

Do you know ?

Good management means the judicious combination of all the available resources and their proper utilization to earn maximum return on the total cost invested on poultry farm.

7.1 Hatchery Management

Hatching is production of baby chicks from fertile eggs. In early days, eggs were hatched by placing them under broody hens but only 10 to 12 eggs can be put under one hen. At present incubators are used for large scale chick production. Incubators can hatch several thousand eggs at a time.

7.1.1 Selection of hatching eggs

1. Select eggs from young flock.
2. Extremely large or very small size or abnormal eggs are avoided
3. Eggs having dirty, poor texture and thin shells should not be selected
4. Eggs stored for long time should not be selected.

Remember...

Soiled or dirty eggs should not be used for hatching and if used should be first cleaned with a dry cloth or polish paper.

7.1.2 Storage and sanitation of hatching eggs

Can you think ?

Why eggs are stored with broad end up hatch better?

Embryonic development starts by the time the fertile eggs are laid. The fertile eggs therefore should be collected as frequently as possible, fumigated and stored in a cool place. Temperature for holding fertile eggs before incubation varies from 50-70^{0}F. Better results are obtained with 60^{0}F when eggs are stored for 7 days or less and with 50^{0}F when stored for more days. Relative humidity of storage chamber should be maintained at 70 to 80%.

Do you know ?

Duration of storage after a week is inversely proportional to per cent hatchability.

7.1.3 Incubation

For better hatch and healthy chicks, the machines should be neat, clean, free from microbial load and should function properly. The practice of cleaning, disinfection and fumigation of eggs before storing and after transfer of eggs to the machine also reduces the incidence and spread of diseases. Incubation period of chicken egg is 21 days.

For successful incubation, optimum and uniform temperature, humidity, gaseous environment and turning of eggs are very essential. The details are given below

Sr. No.	Particulars	Setter	Hatcher
1	Incubation period	1 to 18 days	19 to 21 days
2	Temperature	99.5^{0}F to 100^{0}F	98^{0}F
3	Relative humidity	60%	70 to 80%
4	Turning	8 times / day	--

Abnormal temperature conditions over a long period adversely affect the hatchability by increasing the embryonic mortality, weak and deformed chicks. Due to uncertainty in electric supply, use of a standby generator is advocated. Moisture content of the incubator affects hatchability. The relative humidity should be optimum for better hatchability.

Developing embryos require oxygen for their metabolism. Since ordinary air which contains about 21% of oxygen is sufficient, flow of fresh air into the incubator should be ensured. Eggs are loaded into the incubator with broad end up. Entry to the hatchery complex should be restricted as far as possible.

Remember...

Fumigation is usually done with formaldehyde gas using 40 ml of 40% commercial formalin and 20 gm of potassium permanganate for each 2.8 cubic meter of space inside the machine.

7.1.4 Candling of eggs

Viewing through egg by holding it in front of source of light in a dark room is called candling.

The eggs are candled from fifth to seventh days of incubation to remove infertile eggs and on the 18th day to remove dead ones.

Observe and Record...

In most commercial hatcheries, candling is done on 18th day of incubation i.e. at the time of transfer of eggs to hatchers.

Eggs are classified as follows on the basis of candling

a. Infertile : Clear and transparent,

b. Fertile : Radish brown web like developing embryo on 7 th day and on 18th day egg appear opaque

c. Dead in germ (0 to 10 days of incubation): Eggs with slight opacity, brownish, black in colour but no movement translucent

d. Dead in shell (11 to 21 days) : Dark shadow of embryo with no movement

Fig.7.1: Candling of eggs

7.1.5 Sexing of chicks

Sexing of day old chicks is the most common practice with hatcheries dealing with egg type chickens.

There are two methods of sexing of chicks.

1. **Japanese or Vent method :** It is commonly used method. It involves the identification of rudimentary copulatory organ in the cloaca of male chicks. Since the structure is very small at day old stage, it requires a considerable skill and experience.

Do you know ?

Vent sexing method is used on commercial basis.

2. **Sex linked character/auto sexing:** Sexing can also be done with the help of sex linked characters such as rapid and slow feathering, barring and non-barring. For example when a Rhode Island Red male is mated to barred Plymouth Rock female, all the female progeny will be black and male progeny barred.

7.2 Rearing of chicks

Management of the farm is necessary, not only when chicks are kept but before bringing them is also very important. All in all out and multiple brooding are the two types of system of poultry farming.

Remember...

All in all out system is important because there is no chance of spreading infection from one flock to other flock.

After selling the birds and bringing the new batch of chicks to the farm, following important procedure should be followed for preparation of shed.

1. Collect all the litter material from the house and transport to the manure pit located away from the farm.
2. Scrap the floor and walls of house to remove all the waste materials present in it.
3. Wash the floor, walls and roof of the house with suitable sanitizer solution.
4. All metal windows should be blow lamped.
5. Clean the area of approximate 1-2 meters around the house.
6. The entire house should be white washed.
7. Poultry house and all equipments should be cleaned, disinfected and fumigated.
8. Brooding / lighting arrangement of the brooder house should be made at least 24 hours before arrival of the chicks.
9. Temperature of the chick house should be maintained before the arrival of the chicks.
10. Chick should be procured from good hatcheries.

Chick Management

It is also known as brooding management. The chicks are transferred to a " brooder house" immediately after hatching and reared up to 6 to 8 weeks of age.

Do you know ?

Chicks cannot maintain their body temperature due to under development of thermoregulatory system.

There are two general systems of brooding.

A. Natural brooding

B. Artificial brooding

A. Natural brooding : Requisites for natural brooding are as follows

1. Deshi / broody hen
2. Number of chicks: 10 to 15 per hen.
3. Coop box / basket with soft clean litter

Advantages :

1. Reduces lot of responsibilities of owner as hen takes care of chicks.
2. Suitable for small number of chicks.

Disadvantages :

Not suitable for commercial scale.

B. Artificial brooding

Fig. 7.2 : Brooding

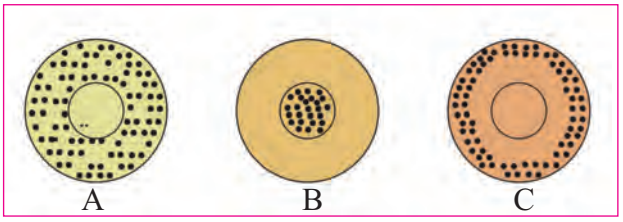
Requisites for artificial brooding are as follows

1. Optimum temperature : The optimum temperature for chicks in brooder is 95^{0}F. The effect of optimum, low and high temperature in brooder (Fig. 7.3) is as follows.

a. Optimum temperature : Chicks evenly spread out under the brooder.

b. Low temperature : Chicks huddling together in center under the brooder.

c. High temperature : Chicks are found at the edge / away from the centre.



A: Optimum temperature B: Low temperature C: High temperature

Fig. 7.3 : Distribution of chicks under the brooders at various temperature

Age-wise temperature requirement in brooder is as follows

Sr. No.	Week	Temperature
1	First	95^{0}F
2	Second	90^{0}F
3	Third	85^{0}F
4	Fourth	80^{0}F

2. Ventilation : Brooder house should be well ventilated so as to remove dust, moisture from environment to prevent respiratory diseases.

3. Sanitation and hygiene : Brooder house should be thoroughly cleaned, scrubbed and disinfected using half kg chlorinated lime (with 30% available chlorine) in 13-14 litre of water before housing the chicks.

4. Litter : Use 5 cm thick layer of suitable litter like saw dust, paddy husk, chaffed straw etc. and stir the litter at frequent interval to prevent formation of cake.

Remember...

- Never use mouldy material
- Wet litter be replaced by dry litter
- Moisture in litter should not exceed 25%
- Avoid reuse of old litter

5. Chick guard : They are placed at about 60 to 90 cm from the edge of the brooder. The distance is adjusted with the age of chicks and normally removed after 4-5 weeks of age.

6. Floor, feeder and waterer space : Floor space 0.5 sq.ft. should be provided per chick to start with and increased by 0.5 sq.ft.after 4 weeks until the pullets are about 7 weeks of age. Feeder space required during 0 to 4 weeks and 4 to 7 weeks is 1 and 2 inches, respectively. Whereas watering space required during first 8 weeks is 0.5 inches. Arrange sufficient number of feeder and waterers alternatively in the shed.

7. Feeding of chicks : After bringing the chicks, give them crushed maize on the paper for 24 hrs and then offer feed. Chicks should be fed chick crumb/mash up to age of 8 weeks.

8. Protection from diseases : Chicks are in stress due to transportation, so provide them water with electrolyte on 1st day and from second day onwards give antibiotics along with vitamin supplements (A, D_3, E and C) for 5 days.

Do you know ?

The golden rule that "prevention is better than cure" is appropriate to poultry than any other species of livestock.

i. Vaccination

Vaccinate chicks against Marek's, Ranikhet disease, Gumboro disease and fowl pox at appropriate age as per table 7.3.

Remember...

Quality of water and its cleanliness has an important bearing on the efficiency of the vaccine.

ii. Removal of sick chicks : Chicks looking dull, droopy, isolated or sick be removed.

iii. Disposal of dead chicks : Always dispose off dead chicks promptly either by burning or burying.

iv. Visitors : Prohibit the entrance of visitor to brooder and rearing house because visitors may carry germs along with clothes, feet, shoes, hands etc. Their feet / shoes must be disinfected by dipping in foot bath or spraying of disinfectant solution before they enter the farm.

Fig. 7.4 : Vaccination eye-drop method

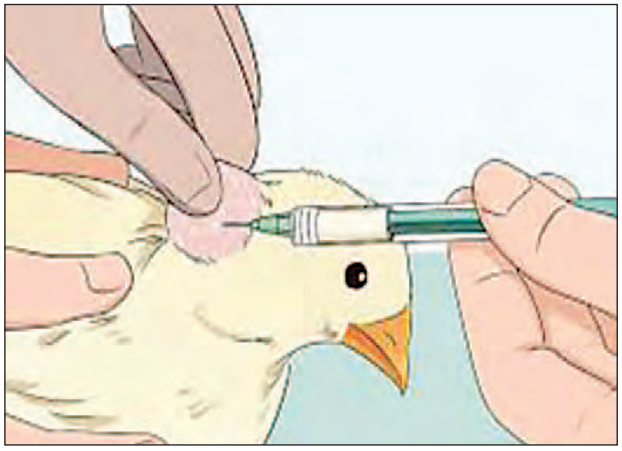


Fig. 7.5 : Vaccination by subcutaneous method

9. Debeaking : With the help of debeaker, upper beak is cut one half and lower beak is cut one third. First debeaking also known as touching is done in chicks at the age of 10-11 days and second debeaking at the age of 11 to 12 weeks.

Do you know ?

Debeaking is must to reduce cannibalism and feed wastage in layer bird.

Fig. 7.6 : Debeaking of chick

Fig. 7.7 : Debeaked bird

7.3 Grower/Pullet management

Grower management includes care of pullets from 8 to 20 weeks age.

The technical standards for pullets during growing stage are as below.

1. Average weight of pullet at 20 weeks should be 1.2 kg.
2. Maximum feed consumption per pullet should be 6.5 to 7 kg.
3. Maximum depletion during growing should be 5% including sexing error and culling.

Following care is essential in management of pullet

1. Judicious lighting programme to attain proper sexual maturity at proper age.
2. Separation of cockerels as soon as they are recognized.
3. Provide enough and clean space to avoid overcrowding in the house.
4. Provide fresh, clean, balanced ration and enough clean water.
5. Debeaking should be done at 11 weeks of age.
6. Deworm the pullets before transferring to layer house.
7. Follow proper vaccination programme.
8. **Culling :** Underdeveloped, weak, disabled and sick pullets must be removed during growing period.

Do you know ?

Testing of breeders for salmonellosis is carried out at 16 weeks of age.

9. Transfer pullets to laying house (housing) at 18 weeks of age at one time.

Remember...

Pullets must be given electrolytes and vitamins in water to overcome stress of handling during transfer to laying house.

Do you know ?

Management of breeder male is similar to layer management except that male breeders diet contains extra selenium and vitamin E to ensure proper fertility and hatchability.

7.4 Layer Management

The flock transferred from grower to layer house at 18 to 20 weeks of age. Layer is defined as egg laying female chicken up to one year. In breeding flocks male should be placed in the laying quarters 1 to 2 days prior to house the females if they were grown separately.

7.4.1 Housing : In India open sided poultry houses are very popular except in very cold areas. California cage system is comfortable and profitable for grower and layer birds.

Appropriate distance should be kept in between two houses to allow proper ventilation and prevent disease transmission. Floor space, feeder space and water space should be provided as per recommendation. One nest is enough for 20-25 layers.

7.4.2 Lighting : Lighting should be increased gradually till it reaches 16-17 hours per day and maintained at that level thereafter. One tube light with a reflector hung 2.1 m above the floor would provide the recommended intensity of light for every square meter of floor space. The duration of the light should not be decreased during the laying period. The artificial light hours should be provided both during morning and evening, particularly in summer.

Can you think ?

Why artificial light should be provided to layer ?

7.4.3 Culling of poultry

Removal of non producer and uneconomical birds from the flock is called culling. The culling of the birds is done with following objectives

1. To increase or maintain good efficiency of the flock.
2. To reduce cost on maintenance of flock.
3. To increase the profit from the flock.

Poultry farmer may start with a good stock but invariably there will be some birds, which do not grow well, or hens which do not lay well. Such birds reduce the efficiency of the flock and also increase the cost of maintenance of the flock. Therefore culling of poor layers or non

layers is very important and should be a regular process throughout the year.

The distinguishing features of layers and non layers, good layers and poor layers are given in the Table 7.1 and 7.2 respectively.

Fig. 7.8 : Good Layer

Fig. 7.9 : Poor Layer (Cull bird)

7.4.4 Stress: Factors such as vaccination, debeaking, improper and restricted feed, medication, climatic change and shifting induce stress on birds. This result in drop in egg production, poor growth and increased susceptibility to disease. Vitamins and

Table 7.1 : Characteristics for distinguishing layers from non-layers

Sr. no.	Character	Laying hen	Non laying hen
1	Comb	Large, bright, red, fully expanded	Small, pale with white scale
2	Wattles	Large, prominent	Small, contracted
3	Eyes	Bright, prominent	Dull
4	Vent	Large, oval, moist and bleached	Small, yellow, dry
5	Pubic bones spread	More than 2 fingers	Less than 2 fingers
6	Beak	Faded at the base	Yellow at the base
7	Pelvic bones	Flexible, wide open	Stiff, close together
8	Spread of body capacity	3 to 5 fingers	Less than 2 fingers

Table 7.2 : Differences between good layers and poor layer

Sr. no.	Character	Good layer	Poor layer
1	Eye	Bright, prominent	Dull
2	Ear lobes	Bleached	Yellow
3	Shank	Bleached, thin and flat	Yellowish, round, full
4	Beak	Bleached	Yellow
5	Plumage	Dry, old, brittle, soiled	New bright / clean
6	Time of moulting	Late	Early
7	Vent	Bleached, large oval and moist	Yellow, round, small

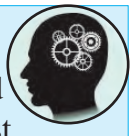
electrolytes should be given to prevent stress.

7.4.5 Medication and vaccination : The birds should be thoroughly checked daily for any abnormal behaviour and prompt attention should be given to diagnosis and control of the diseases. Routine prophylactic medication should be given in layer flock for control of salmonella and coccidiosis. Vaccination schedule should be followed as per Table No. 7.3

Table 7.3 : Vaccination schedule for layers

Sr. No.	Disease	Vaccine	Age (day)	Administration dose / route
1	Marek's disease	HVT vaccine	Day old	0.2 ml s/c (hatchery)
2	Ranikhet disease	F-1/ LaSota / B-1	5-7	1 drop in eye / nostril
3	Gumboro disease	Georgia / Intermediate (live)	14-15	1 drop in eye / nostril
4	Infectious Bronchitis (IB)	IB live massachusetts strain	20-21	1 drop in eye / nostril
5	Gumboro disease	Georgia / Intermediate (live) (booster)	24-25	1 drop in eye / nostril or drinking water
6	Ranikhet disease	LaSota booster	29-30	drinking water
7	Fowl pox	Fowl pox	6 weeks	wing web prick/ intramuscular
8	Ranikhet disease	R_2B (Mukteshwar)	8 weeks	0.5 ml S/C or I/M
9	Infectious Bronchitis (IB)	IB live Massachusetts	12 weeks	Drinking water
10	Gumboro disease	Gumboro (killed)	16 weeks	0.5 ml S/C
11	Ranikhet disease	Ranikhet (Killed)	18 weeks	1.5ml S/C

Remember...



Breeder stock should be routinely tested against salmonellosis and all the positive birds should be destroyed and not used for breeding.

Hen day production

$$= \frac{\text{Total no. of eggs laid on that day}}{\text{Actual no. of hen on that day}} \times 100$$

7.4.6 Hen day production : A hen day average is obtained by dividing the number of eggs laid during a given period by the average number of birds on hand during the same period. The hen day average is usually determined on monthly basis.

Hen house egg production

$$= \frac{\text{Total number of egg produced in a year}}{\text{No. of birds housed in the beginning of the year}}$$

7.4.7 Hen house egg production : It is obtained by dividing the total number of eggs produced during a given period by the number of birds housed at the beginning (housing) of the period. The hen-housed egg production is usually obtained on yearly basis. This method indicates income potential from a flock.

Internet my friend

Search Breeds/strains of broilers and layers

7.5 Broiler Management

Broiler is defined as young chicken aged about 6 weeks raised only for meat purpose from a hybrid strain.

Remember...

Broiler grows from a hatch weight of around 35-40 gm to a weight of about 2.0 to 2.2 kg in around six weeks.

Broiler production is rapidly increasing year after year as evidenced by increased production of broilers. Success of broiler production rests primarily on the efficient implementation of scientific management programme followed by sound marketing system.

7.5.1 Systems of broiler production

Do you know ?

All in all out system is profitable for broiler farming.

There are two systems of broiler production

1. **All in all out system :** This is most practical program for broiler rearing in which only one age group of broilers is on the farm at the same time. All the chicks are started on the same day and later sold on the same day, after which there is a period when no birds are in the premises. The lack of birds breaks any cycle of an infectious disease.
2. **Multiple brooding :** Although it has been more profitable to keep one age group of broilers on the farm, recent advances in isolation and disease control have made it possible to keep chicks of several ages on the same farm.

7.5.2 Contract broiler farming

The production of broiler on a contract basis has gained an important foothold in the industry during the past few years as the result of an increased amount of integration. Under such contracts , the producer furnishes the building, equipments, labour and litter material, while the integrator provides chicks, feed, medicine, vaccine along with the necessary supervision.

In this farming the integrator pays the producer a contracted price based on the live weight produced. A contract of this type offers the bonus to producer for decreasing the cost of production and fine for increasing cost of production.

7.5.3 Chick quality for broiler production

i. Chicks should be from healthy parents.

ii. Uniform size and weight : Average weight of 100 chicks should be between 3.8 to 4.0 kg.

iii. Chicks should be alert, active and free from deformities.

7.5.4 Housing for broilers

Deep litter system of housing is suitable for broilers. Artificial brooding, ventilation, litter management, sanitation and hygiene

Remember...

Ideal environmental conditions for rearing broilers

- Temperature - 22-30 ^{0}C (70-85 ^{0}F)
- Relative Humidity – 30-60%
- Ammonia level - less than 25 ppm
- Air flow - 10-30 meter/minute
- Litter moisture- 15-25 %

is discussed in detail in chick management. Management is almost same as chicks, except space, feed and water requirement due to faster growth rate. Floor, feeder and waterer space requirement are 0.5 to 1.2 sq.ft., 2-3.5" and 0.5-1" respectively depending upon the age.

7.5.5 General broiler management

1. Check electrical equipment and thermometer.
2. Day before chicks arrive, turn brooders to maintain 95^{0}F temperature.
3. Use chick guard of 18" height and place it 24" away from brooder.
4. Keep crush maize in trays.
5. Place waterer between feed trays.
6. Give electrolyte and vitamin A, D_3, E and K on first day along with crushed maize.

Remember...

The mortality should not exceed 5 % for profitable broiler production.

7. After 24 hours, provide vitamins through water and broiler pre starter up to 1st week followed by starter ration up to 21 days and finisher onward up to sale.

Do you know ?

Coccidiosis and chronic respiratory diseases are causing major economic loss in broiler farming.

8. Provide fresh, clean and cool drinking water.

7.5.6 Disease control and vaccination

1. Keep the litter dry to prevent coccidiosis.
2. Use coccidiostats in feed
3. Always use prophylactic medication against salmonellosis, colibacillosis and chronic respiratory disease.

Do you know ?

The recommended feed conversion ratio is 1.6 -1.7 to attain 2.0-2.2 Kg body weight.

4. Follow vaccination schedule strictly.

7.5.7 Weight and feed conversion ratio

Broilers are efficient converters of feed into meat. They convert maximum feed into meat within minimum period.

Important parameters to be considered in broiler business are

1. Weekly live weight
2. Weekly feed consumption
3. Cumulative feed consumption
4. Weekly feed conversion ration
5. Cumulative feed conversion ratio

The feed conversion ratio is calculated as follows

Feed conversion ratio is very important factor in cost of production. The data given in the Table 7.5 represent approximate average

Table 7.4 : Vaccination schedule for broilers

Sr. No.	Disease	Vaccine	Age (days)	Administration dose and route
1	Mareks disease	HVT vaccine	Day old	0.2 ml SC (at hatchery)
2	Rainkhet disease	LaSota/F-1/ B-1	5 - 7	1 drop in each eye/ nostril
3	Gumboro disease	Georgia/ intermediate (live)	14 -15	1 drop in each eye/ nostril
4	Gumboro disease	Georgia/ intermediate (live)	24 - 25	1 drop in each eye/ nostril or Drinking water
5	Ranikhet disease	LaSota / F-1 (Booster)	29 - 30	Drinking water

Table 7.5 : Live weight, feed consumption and FCR of broilers

Sr. No.	Age of broiler (days)	Live weight (g)	Cumulative feed consumption (g)	Cumulative FCR (pellet feed)
1	7	190	180	0.95
2	14	450	540	1.20
3	21	850	1115	1.31
4	28	1400	1975	1.41
5	35	1980	3050	1.54
6	42	2620	4407	1.68

$$\text{Feed conversion ratio (FCR)} = \frac{\text{Total feed consumption (kg)}}{\text{Gain in weight (kg)}}$$

performance for good flocks. There may be variation due to management, season, feed, strain etc.

7.6. Management of poultry according to season

7.6.1 Summer management : Intensive rearing of poultry requires immediate and special attention and care during heat stress in summer months. Heat stress can inflict heavy losses by causing almost a total reduction in egg production and weight gain. High yielding birds are highly susceptible to high temperature followed by high humidity.

Effect of high environment temperature

A. Rising temperature decreases

1. Feed intake
2. Egg production
3. Weight gain
4. Thyroid size and activity
5. Blood calcium level

B. Rising temperature increase

1. Panting
2. Mortality
3. Feed conversion ratio
4. Water consumption
5. Respiration rate
6. Body temperature
7. Stress

Following programme can be used at high temperature to make the birds more comfortable

1. Adequate floor space and no over- crowding
2. Give cool fresh water.
3. Increase the waterer space.
4. Give fresh food during the morning and evening cool hours.
5. Avoid feeding in between 12 AM to 4 PM
6. Insulate the ceiling.
7. Increase ventilation by providing fans.
8. Use foggers.
9. Sprinkle the roof -run sprinklers intermittently.
10. Wet the area outside and around the house.
11. Use vitamin supplement A D3 E K, Vit C and electrolyte powder.
12. Increase protein level and decrease energy content in the feed to maintain protein intake.

Fig. 7.10 : Panting of birds in heat stress

Fig. 7.11 : Fogger system

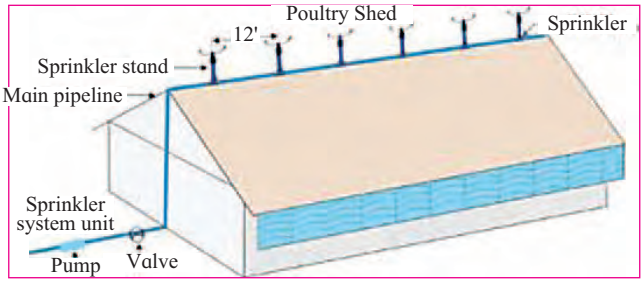


Fig. 7.12 : Sprinkler system (Sketch)

13. Painting the roof with white colour or thatching roof to reflect the heat to reduce the temperature.

7.6.2 Monsoon management

Management during rainy season is equally important as in summer season. Extreme humidity coupled with draft or rain predisposes to several diseases specially respiratory diseases causing severe stress on the bird leading to lowered egg production ,weight gain and mortality. Therefore, it is important that birds should be made comfortable by adopting following management practices.

1. Check up the leakages in the roofs and repair.
2. Depth of the litter be increased.
3. Litter should be stirred well thrice a week or alternate days.
4. In order to keep the litter dry, sprinkle 2-3 Kg of dry lime per 100Sq.ft. floor area.
5. Control flies by spraying dry lime, Sumithion or Malathion spray on the droppings once in a week.
6. Deworming should be done once in two months.
7. Avoid mould formation inside the feed bag during monsoon by keeping the feed neat, clean and feed bags on a dry high level platform.
8. It is better to get litter material and store it prior to monsoon.

Exercises

Q. 1. Fill in the blanks

1. Eggs should be turned at least ---- ---- times per day to get maximum hatchability
2. Fumigation is usually done with formaldehyde gas using ------ -----
3. Incubation period of chicken egg is ----- days
4. Candling is done on ------ day of incubation in commercial hatchery.
5. Optimum temperature and relative humidity in setter is ------and ------, respectively
6. In deep litter system moisture in litter should not exceed ------ %
7. Layer bird should be provided ---- --- hours light per day for better egg production.
8. Optimum temperature and relative humidity in hatcher is ----- and ------ , respectively.

9. Hatching egg should be stored at ---------- °F temperature and -------- % relative humidity for better results.
10. In first week optimum temperature in brooding should be ----- °F.

Q. 2. Answer the following questions in brief.

1. How to select hatching eggs?
2. Write short note on candling?
3. Enlist the technical standards for pullets during rearing stage.
4. Write types of brooding with advantages and disadvantages of natural brooding.
5. Write brief note on systems of broiler production.
6. Give vaccination schedule for broilers.
7. Give table showing age wise temperature requirement of chick during brooding.
8. How to calculate hen house egg production?
9. Why culling is necessary in layers management?
10. Write short note on contract broiler farming.

Q. 3. Answer the following questions in detail.

1. Write in detail the chick management.
2. Describe in detail broiler management.
3. Explain in detail layer management.
4. Write in detail the vaccination schedule for layers.
5. Discuss in detail about summer management of poultry.

8. LIVESTOCK DISEASES AND PUBLIC HEALTH

Livestock diseases cause heavy economic losses to farmers in terms of livestock deaths, loss of production, loss of body condition, poor growth rate and infertility. Thus for profitable dairy farming there is need to adopt proper health control measures for prevention of various livestock diseases and to upkeep the performance of animals.

8.1 Introduction to diseases

According to WHO, Health is defined as physical, mental and social wellbeing of an individual.

Disease means any deviation from normal state of health of an animal.

8.1.1 Classification of Diseases

The animal diseases are classified as follows -

1. On the basis of causes

i. **Infectious diseases :** These are caused by pathogenic organisms viz.Bacteria,Viruses, Fungi.

e.g. Foot and Mouth disease (FMD), Haemorrhagic septicemia (HS), Theileriosis.

ii. **Non-infectious diseases :** These are caused by physical, chemical or poisonous agents, nutritional deficiency or disturbed metabolism. e.g. Rickets, Milk fever, Pesticide poisoning

2. On the basis of mode of spread

i. Contagious diseases : They spread by means of direct or indirect contact with diseased animal e.g. FMD., HS.

Remember...

All infectious diseases may or may not be contagious but all contagious diseases are infectious

ii. Non-contagious diseases : They do not spread by means of direct or indirect contact with diseased animal e.g. Rickets.

3. On the basis of duration and severity

i. Per acute disease : It is characterized by very short course of time (few hours to 48 hours) and very severe symptoms. e.g. Anthrax.

ii. Acute disease : It is characterized by a sudden onset, short course of time (3-14 days) and severe symptoms. e.g. BQ, HS.

iii. Sub acute disease : It is characterized by longer course of time (2 - 4 weeks) and severity lesser than acute one. e.g. Sub acute mastitis.

iv. Chronic disease : It is characterized by very long course of time (more than 4 weeks) and milder signs. e.g. Tuberculosis.

8.1.2 Signs of Health and Disease

The signs of healthy and diseased animal are given in Table 8.1

8.1.3 General measures for prevention of contagious diseases

1. Identification, isolation and treatment of sick and in contact animals.
2. Slaughter the animals suffering from incurable disease by following prevailing laws in our country.
3. Disposal of dead animals either by burning or deep burial.
4. Proper disposal of contaminated feed and water.
5. Regular cleaning and disinfection of cattle shed and its premises with 1-2% phenyl.
6. Don't allow grazing in affected pasture land.
7. Close animal markets, cattle shows etc. during outbreak of disease
8. Restrict the movement of animals from affected to clean area.
9. Don't allow animals to drink water from ponds, rivers etc. during outbreak of disease.

Table 8.1 : Signs of Healthy and Diseased Animals

Sr.	Parameter	Healthy	Diseased
1.	Appetite	Normal	Reduced or absent
2.	Water intake	Normal	Usually reduced
3.	Milk yield	Normal	Decreased
4.	Rumination	More frequent	Less frequent or absent
5.	Body condition	Normal	Mostly weak
6.	Look of the animal	Active	Dull
7.	Gait	Move freely	Move slowly
8.	Head	Forward and raised	Downward
9.	Eyes	Bright	Dull
10.	Ears	Erect & move frequently	Drooping & move less frequently
11.	Mouth	Wet & without odour	Dry or profuse salivation & usually bad odour
12.	Nose	No discharge	May be some discharge
13.	Muzzle	Moist	Dry
14.	Skin / hair coat	Smooth & lustrous	Rough & dull
15.	Dung	Semisolid	Firm or loose
16.	Urine	Slightly yellowish	Dark yellow, coffee coloured or pinkish
17.	Tail movement	More frequent	Less frequent
18.	Temperature	Normal (101.6 ^{0}F)	Mostly increased
19.	Respiration	Normal	Mostly increased
20.	Pulse rate	Normal	Usually increased

10. Regular spraying of insecticides to control external parasites.
11. Regular deworming to control internal parasites.

8.2 Livestock diseases

8.2.1 Bacterial diseases

(1) Anthrax

Synonyms : Wool sorter's disease, *Fanshi*, *Kalpuli*

It is an acute widespread bacterial disease of all warm blooded animals especially cattle, buffalo, sheep and goat. It usually occurs after sudden climatic change

Do you know ?

Anthrax is communicable to human beings i.e. zoonotic disease.

Causative agent

- The disease is caused by spore forming bacteria called *Bacillus anthracis*.

Transmission

1. It is soil-borne infection.
2. It usually spreads through ingestion of contaminated feed and water.
3. Sometimes, it also occurs by inhalation and biting flies.

Symptoms

1. High fever (104-108 ^{0}F)
2. Loss of appetite
3. Severe depression
4. Suspended rumination
5. Increased heart rate
6. Bloat or tympany
7. Dyspnoea i.e. difficult breathing

8. Dysentery or diarrhoea
9. Blood in milk
10. Tarry black coloured bleeding from natural openings like anus, nostrils, vulva etc. (Fig: 8.1)
11. Sudden death in per-acute cases.

Fig: 8.1 Animal died of anthrax

Control

1. Identification and isolation of sick animal.
2. Plug the natural openings by cotton swab soaked in carbolic acid solution.
3. Movement of animals from infected area to clean area should be stopped.
4. Deep burial or burning of dead animals.
5. Destroy contaminated feed, fodder and bedding by burning.
6. Disinfection of cattle shed by using 10% caustic soda or formalin or 5% phenyl.

Never conduct post-mortem of the animal suspected to be died of anthrax.

6. Vaccination : Anthrax Spore Vaccine every year before onset of monsoon in areas where anthrax outbreaks are common. The immunity develops in 2 to 3 weeks and remains for 1 year.

2. Haemorrhagic Septicaemia (HS)

Synonyms : Pasteurellosis, *Ghatsurp*

It is an acute infectious disease of cattle, buffalo, sheep and goat. It is most common in buffaloes. It usually occurs during extreme environmental conditions, malnutrition and transportation for long distance.

Remember...

HS outbreaks generally occur during rainy season.

Causative agent

- It is caused by *Pasteurella multocida*

Transmission

The disease spreads through –

1. Contact with infected animal
2. Ingestion of contaminated feed and fodder
3. Inhalation

Symptoms

1. High fever (104 - 107 ^{0}F)
2. Loss of appetite
3. Suspended rumination
4. Dullness and depression
5. Increased heart rates
6. Salivation
7. Congestion of mucus membrane
8. Profuse nasal discharge
9. Rapid/difficult respiration
10. Swelling of throat region (Fig: 8.2)
11. Recumbency
12. Death within 12-24 hours

Fig: 8.2 : Haemorrhagic septicaemia in buffalo heifer

Control

1. Isolation and treatment of the sick animals.
2. Close animal markets, cattle shows etc.
3. Burning or burial of dead animals
4. Proper disposal of contaminated feed and water.
5. Disinfection of cattle shed where ailing animal is kept.
6. Protect animals from extreme weather.
7. Vaccination against HS should be carried out every year before monsoon. The immunity develops in 2 to 3 weeks and remains for 6 months (Alum ppt vaccine) to 1 year (oil adjuvant vaccine).

(3) Black-quarter (BQ)

Synonyms : Black -leg, *Farrya*

It is an acute infectious highly fatal, bacterial disease of cattle and buffaloes. Sheep and goats are also affected. It generally occurs following heavy rainfall.

Do you know ?

Young cattle between 6 to 24 months of age, in good body condition are mostly affected.

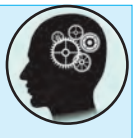
Causative agent

- It is caused by *Clostridium chauvoei*

Transmission

1. The disease spreads through contaminated soils.
2. The organisms gain entry through ingestion of contaminated feed and contamination of wounds.

Remember...



Black quarter is soil-borne infection.

Symptoms

1. High fever (104-107 ^{0}F)
2. Loss of appetite
3. Depression, dullness
4. Suspended rumination
5. Rapid heart rate
6. Difficult breathing
7. Lameness in affected leg
8. Crepitating swelling over hip, thigh and shoulder (Fig: 8.3)
9. Swelling is hot and painful in early stages becomes cold and painless later on
10. Recumbency
11. Death within 12-48 hrs

Fig. 8.3 : Black quarter in cattle

Control

1. Isolation of sick and in contact animals.
2. Disposal of dead animals either by deep burial or burning.
3. Disinfection of surgical instruments prior to operation.
4. Avoid grazing in affected area.
5. Vaccination against BQ should be carried out every year before rainy season. The immunity develops in 2 to 3 weeks and remains for 6 months.

4. Brucellosis

Synonyms : Contagious abortion, *Garbhpat*

It is an acute or chronic contagious bacterial disease of domestic animals. In India, disease causes heavy economic losses due to

abortion, infertility and reduced milk yield. It is common in sexually mature animals.

Do you know ?

Brucellosis is major zoonotic disease in India

Causative agent

- It is caused by *Brucella abortus*.

Transmission

1. The disease mainly spreads through ingestion of feed and water contaminated with discharges of aborted foetuses and vaginal discharge.
2. Sometimes the disease may spread through inhalation, vagina during coitus or abraded skin or conjunctiva.

Symptoms

1. Abortion usually during advance or late pregnancy.
2. Retention of placenta
3. Whitish vaginal discharge
4. Infertility i.e. low conception rate
5. Swelling of scrotum and joints in bull
6. Weak calves are born from affected cows

Control

1. Test entire herd for brucellosis at least once in a year.

Remember...

Plate and tube agglutination tests are used for screening and confirmation of brucellosis.

2. Culling of infected or carrier animal by following scientific method.
3. Adopt AI practice as far as possible to prevent spread of infection through natural service.
4. Proper disposal of aborted foetuses, placenta and uterine discharge.
5. Disinfection of infected premises.
6. Newly purchased animals should be tested for brucellosis twice at an interval of 30 days before introduction in a herd.
7. Pregnant animals should not be purchased without testing.
8. Vaccination : If incidence of disease in herd is more, then calves between 4-8 months of age should be vaccinated by using Brucella Cotton - 19 strain vaccine called as calf hood vaccination with due care to avoid zoonosis.

(5) Mastitis

Synonyms : Mammitis, *Dagadi kas*

Mastitis denotes an inflammation of the udder/ mammary gland. Mastitis is more common in high yielding cows and buffaloes.

This disease is responsible for heavy economic losses to dairyman due to discarding of abnormal milk, low milk production and milk fat, decreased market value of cow and cost of drugs and veterinary services.

Internet my friend

Find out causes of low milk fat.

In addition to this, the mastitic milk spreads diseases like tuberculosis, brucellosis, sore throat, food poisoning etc. in human beings.

Causative agents

1. **Bacteria :** *Streptococcus, Staphylococcus, E.coli*
2. Viral diseases : Pox, FMD
3. Fungus : Candida.
4. Mycoplasma
5. Trauma or injury to teat and udder
6. Incomplete or irregular milking
7. Improper milking techniques
8. Use of non disinfected milking machines
9. Pendulous udder and long cylindrical teats
10. Rough flooring
11. Unhygienic conditions of milkers and in milking parlour

Transmission

- It spreads through infected water, contaminated bedding, utensils, milkers hands and through wounds.

Symptoms

a. Acute form

1. Fever
2. Loss of appetite
3. Udder is swollen, hot and painful (Fig: 8.4)
4. Milk may be yellowish or reddish
5. Milk contains flakes or clots

b. Chronic form

1. No swelling of udder
2. Udder becomes hard due to fibrosis
3. Milk may show visible changes on careful examination
4. Reduced milk yield
5. Affected teat may become blind if not treated in time

Fig. 8.4 : Mastitis in cow

Control

1. Identification, isolation and treatment of affected dairy animals.
2. Regular testing of dairy cows for mastitis
3. Treatment of all teats of all cows/ buffaloes at drying.
4. The healthy non-infected cows should be milked first and known infected cows should be milked at last.
5. The udder of cow and hands of milker should be washed with antiseptic solution before and after milking.
6. Unsterile objects should not be passed in teat.
7. Teat sores/ wounds should not be neglected but treated at promptly.
8. Use of proper milking method i.e. full hand milking followed by stripping.
9. Maintain hygienic conditions in cattle shed /milking parlour .
10. The non-responsive quarter should be permanently dried up.
11. Culling of non-responsive cases.

8.2.2 Viral diseases

(1) Foot-and-Mouth Disease (FMD)

Synonyms: Apthous fever, *Khurkut*

It is highly contagious viral disease of cloven footed animals viz. cattle, buffalo, sheep, goat and pigs.

Do you know ?

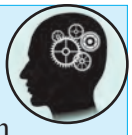
Crossbreds and young cattle are severely affected and are more susceptible for FMD.

In India, the disease is causing heavy economic loss due to reduction of milk, meat and working capability of draft animals. The disease outbreaks usually occurs at the end of winter i.e. in February and March.

Causative agent

1. It is caused by virus namely *Picorna virus* (Apthovirus)
2. There are 7 major strains of the virus namely O, A, C, Asia-1, SAT-1, SAT- 2 and SAT- 3.

Remember...



In India, O, A and Asia - 1 are responsible for foot and mouth disease.

Transmission

1. It usually spreads through ingestion of contaminated feed and water.
2. Air-borne infection can also occur.
3. Suckling calves may pick up infection from dam/mother.

Symptoms

1. Fever (104 - 106^{0}F) for 24 - 48 hours
2. Loss of appetite
3. Drop in milk yield
4. Vesicles and ulcers on tongue, dental pad and oral mucosa (Fig: 8.5)
5. Profuse salivation
6. Painful mastication
7. Vesicles and ulcers develop in inter-digital space and at coronet (Fig: 8.5)
8. Lameness
9. Stamping of feet
10. Recovery within 8 days, if complication doesn't occur

Fig. 8.5 : Foot-and-Mouth Disease in cattle

Control

1. Isolation of all affected animals immediately after detection.
2. Vaccination of all non-affected and in contact animals.
3. Restriction of animal movements by regulation.
4. Disposal of contaminated bedding and fodder by burning.
5. Disinfection of animal shed with 1-2% caustic soda or formalin.
6. Restrict human movement to and from infected premises.
7. Thorough disinfection of all the utensils, feeding pens in case of calves and cloths of the attendants.
8. Do not allow animals to graze on common grazing pasture or to drink water from ponds and rivers.
9. Do not allow calves to suckle affected mothers.
10. Vaccination : FMD vaccine should be given every six months i.e. in September/ October and March / April.

(2) Peste des petits ruminants (PPR)

Synonyms : Goat plague, PPR, *Bulkandi*

It is an acute highly contagious viral disease of sheep and goats. The disease most commonly occurs during rainy season. The morbidity rate is 100% while mortality rate is 25-90%.

Causative agent

- It is caused by *Morbillivirus*.

Transmission

1. It spreads primarily through inhalation and direct contact with infected animal.
2. It also spreads through ingestion of contaminated feed and water.

Symptoms

1. Fever
2. Loss of appetite
3. Dullness
4. Suspended rumination
5. Congested mucus membranes
6. Lacrimation
7. Nasal discharge
8. Coughing
9. Rapid/ difficult breathing
10. Erosions and bran like deposits on inner side of lips, on dental pad and tongue (Fig: 8.6)
11. Profuse diarrhoea-loose faeces (Fig: 8.6)
12. Dehydration
13. Death within 6-12 days


Diarrhoea


Mouth lesions in PPR

Fig. 8.6 : Peste des petits ruminants in goat

Control

1. Identification and isolation of sick animals.
2. Complete prohibition on import of small ruminants and animal products/ from affected area.
3. Restriction of animal movements.
4. Proper disposal of carcass.
5. Disinfection of contaminated shed and premises.
6. **Vaccination :** Give PPR vaccine at the age of 3 months and thereafter once in two years.

(3) Sheep and goat pox

Synonyms : *Devi*

It is most serious contagious viral disease of sheep and goats.

Lambs and kids are most susceptible.

Causative agent

- The disease is caused by *Capripox* virus.

Transmission

1. Disease mainly spreads through direct contact with infected animal.
2. It also spreads through inhalation.

Symptoms

1. High fever
2. Loss of appetite
3. Dullness and depression
4. Pock (papular, scabby) lesions on non-wooly / non-hairy parts of body like udder, scrotum, vulva, inside of thighs, under tail, axilla, face, eye lids and ears (Fig.8.7)
5. Nasal discharge, difficulty in breathing and coughing in some cases
6. Abortions in pregnant animals
7. Death or recovery within 3 to 6 weeks

Fig. 8.7 : Goat Pox : Teat lesions

Control

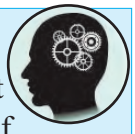
1. Movement of goat and sheep should be restricted.
2. Isolation of sick animals.
3. Strict hygienic measures should be adopted.
4. Vaccination against sheep and goat pox should be carried out annually, preferably in the month of December.

(4) Rabies

Synonyms : Hydrophobia, Madness, *Pisalne*

It is a highly fatal viral disease of all warm blooded animals. It is most common in dogs. It is **communicable** to man.

Remember...



Rabies is one of the most important zoonotic diseases of animals in India.

Causative agent

- It is caused by *Lyssavirus* virus.

Transmission :

1. It spreads almost always by the bite of rabid animal.
2. Through contamination of skin wounds by fresh saliva of infected animal.

Symptoms

a. Furious form

1. Change in behavior (Fig: 8.8 Buffalo)
2. Restlessness and excitement
3. Sexual excitement
4. Hypersensitive to sound and movement
5. Tendency to bite either animate or inanimate objects
6. Profuse salivation
7. Frequent and loud bellowing/barking with hoarse voice (Fig.8.9 cow)
8. Death within 2 - 4 days in cattle and 8-10 days in dog.

b. Paralytic/Dumb form

1. Decreased sensation
2. Hanging of lower jaw and protrusion of tongue
3. In-coordination in gait
4. Drooling of saliva
5. Voiceless attempts to bellow/bark (yawning movements) in late stage
6. Inability to swallow food and water
7. Progressive paralysis
8. Recumbency and death within 6-7 days

Fig. 8.8 : Rabies in buffalo

Fig. 8.9 : Rabies in cattle

Remember...

There is no specific curative treatment for clinical rabies, however after dog bite following treatment should be given-

- Thorough washing of the wound with soap water immediately after exposure.
- Treat wounds with antiseptics like tincture iodine.
- Post-bite vaccination with Antirabies vaccination on 0, 3, 7, 14, 28 and 90th day post bite in all animal species.

Control

1. Identification and euthansia of rabid animals.
2. Control of wild life vectors like foxes
3. Registration of dogs
4. Animal birth control programme in stray dogs
5. Compulsory prophylactic antirabies vaccination of dogs every year.

8.2.3 Protozoan Diseases

(1) Theileriosis

Synonym : Tick fever

It is an important protozoan disease of exotic and crossbred cattle. The disease is mostly observed during summer and rainy season. Young calves are more susceptible to this disease.

Causative agent

- It is caused by *Theileria annulata*

Transmission

- It is transmitted by ticks.

Symptoms

1. High fever for several days.
2. Loss of appetite
3. Increased heart and respiration rates
4. Dullness and weakness
5. Dyspnoea i.e. difficult respiration
6. Ocular and nasal discharge
7. Swelling of superficial lymph nodes (Fig: 8.10 Cow)
8. Anemia - pale mucous membranes (Fig: 8.11 Calf)
9. Jaundice - dark yellow coloured urine
10. Death within 7-10 days if not treated promptly

Fig. 8.10 : Enlargement lymphnode in theileriosis

Fig. 8.11 : Pale mucus membranes in theileriosis

Control

1. Control of ticks by spraying of insecticides on animal body and in animal shed.
2. Vaccination of cattle with Rakshavac - T vaccine @ 3ml SC every three year.

Keep in mind…..

- The vaccine should be stored in liquid nitrogen.
- Animals in advance pregnancy should not be vaccinated.

(2) Surra

Synonym : Trypanosomosis

It is an important protozoan disease found in cattle, buffalo, sheep, goat, horse and camel. It is more common in monsoon or rainy season.

Causative agent

- The disease is caused by a protozoa namely *Trypanosoma evansi*.

Transmission

- It is transmitted through the bites of flies mainly of *Tabanus* species.

Symptoms

(a) Acute form

1. Fever
2. Circling movements
3. In-coordination
4. Head pressing against hard objects
5. Blindness
6. Convulsions and death

(b) Chronic form

1. Intermittent fever
2. Poor appetite
3. Drop in milk production
4. Loss of body weight (Fig: 8.12)
5. Anaemia

Fig. 8.12 : Trypanosomosis in horse

Control

1. Control of vectors like flies.
2. Hygienic and sanitary measures
3. Detection, isolation and treatment of infected animals.
4. Prophylactic chemotherapy with quinapyramine in area where disease commonly occurs

8.2.4 Parasitic diseases

(1) Endoparasites

> **Do you know ?**
>
> Endoparasites are those parasites that live within animal body.

Endoparasites are divided into three groups as-

1. Round worms - They are elongated, cylindrical and tapered at both ends.

Fig. 8.13 : Roundworms

2. Tapeworms - They are flat, segmented or tape like worm.

Fig. 8.14 : Tapeworms

3. Flukes - They are flat, unsegmented leaf like worms.

Fig. 8.15 : Fluke

Transmission

1. Through ingestion of eggs or infective larvae (round worms).
2. Orbatid mites are the intermediate hosts of the tapeworms.
3. Fresh water snails are the intermediate hosts for flukes.

Symptoms

1. Loss of body weight.
2. Dry and rough hair coat
3. Poor growth rate
4. Pot-belly
5. Diarrhoea
6. Anaemia
7. Pica or depraved appetite - eating of soil and clothes, chewing of stones etc.

Fig. 8.16 : Poor body condition due to worm load in calf

Fig. 8.17 : Worm load in goat

Control

1. Isolation and treatment of affected animals.
2. Maintain cleanliness of animal shed.
3. Avoid contamination of feed and water with dung.
4. Keep young and old animals separately.
5. Avoid overcrowding.
6. Rotational grazing has to be encouraged
7. Carry out deworming twice a year i.e. before and after monsoon and once in a month up to 3 months in case of calves.
8. Provide balanced ration.
9. Screening of faecal samples of the animals at regular interval.
10. Spray intsecticide to control the orbatid mites.
11. Control of snails.
12. Avoid grazing in low lying or marshy areas like banks of river, ponds etc.

(2) Ectoparasites

Remember...

Ectoparasites are those parasites which live on the outside of animal body.

The ectoparasites found in animals are as follows.

1. Lice 2. Ticks 3. Fleas 4. Mites 5. Flies

Symptoms

1. Irritation/itching
2. Loss of hair i.e. alopecia
3. Restlessness
4. Anaemia
5. Loss of body weight
6. Decreased milk and meat production
7. Decreased growth rate
8. Some flies produce maggoted wound

Fig. 8.18 : Tick infestation in buffalo calf

Fig. 8.19 : Mange in goat

Do you know ?

Ectoparasites not only suck blood but also transmit various viral and protozoan diseases.

Control

1. Isolation and treatment of affected animals.
2. Spraying of insecticides in cattle shed at regular interval and on animal's body too.
3. Close cracks and crevices on the walls of animal shed.
4. Maintain sanitary conditions.
5. All vegetation surrounding the animal shed should be cleared.

8.3 Poultry diseases

Most of the poultry diseases are highly contagious in nature. Hence, they spread rapidly and cause heavy morbidity and mortality. Further there is no effective treatment for viral

diseases and most of the bacterial diseases are less responsive to treatment. Hence prevention is better and economical than controlling an actual outbreak of disease.

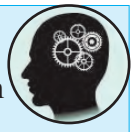
8.3.1 Bacterial diseases of poultry

1. Bacillary White Diarrhoea (BWD)

Synonyms : Pullorum Disease

It is an acute wide spread bacterial disease mostly of baby chicks, causing mortality up to 90 per cent.

Remember...



Bacillary white diarrhoea is an egg borne disease of poultry.

Cause

- It is caused by *Salmonella pullorum*.

Transmission

The disease spreads in two ways

1. Vertical transmission – It takes place through infected eggs.
2. Horizontal transmission – It usually takes place through contaminated feed and water.

Symptoms

1. Dead in shell chicks
2. Drowsiness
3. Weakness
4. Loss of appetite
5. Ruffled feathers
6. Gasping
7. Loose chalky white faeces
8. Soiling of vent

Keep in mind….

Adult birds do not show symptoms and remain as carrier.

Control

a. General measures

1. Periodical testing of breeding stock for Pullorum disease.
2. Culling of reactor / positive birds
3. Purchase of chicks from pullorum disease free flock
4. Infected eggs should not be used for hatching purpose
5. Adopt hygienic measures on farm.
6. Fumigation of incubators.

For fumigation, 355 ml of Formalin and 17.5 gm. of Potassium Permanganate per 100 cubic feet area is used.

b. Vaccination

- At present no commercial vaccine is available in India.

2. Chronic Respiratory Disease (CRD)

It is chronic slow spreading contagious bacterial disease of poultry. The disease is affecting birds of all age groups but more common and severe in young chicks. Mortality is up to 30-40 per cent in chicks.

The disease is causing heavy economic losses especially in broilers.

Cause

• It is caused by *Mycoplasma gallisepticum*.

Transmission

The disease spreads in two ways

1. Vertical transmission through infected eggs from chickens to chicks (egg borne).
2. Horizontal transmission takes place through inhalation (air borne).

Symptoms

1. Nasal discharge
2. Sneezing
3. Open beak breathing/ gasping
4. Loss of body weight
5. Reduced appetite
6. Drop in egg production up to 50%
7. Death in 3-8 weeks

Control

a. General measures

1. Periodical testing of breeding stock for chronic respiratory disease.
2. Culling of birds positive for chronic respiratory disease.

3. Purchase of birds from disease free farm
4. Dipping of eggs in tylosin solution before incubation.
5. Adopt hygienic measures on farm.
6. Prophylactic dose of tylosin to day old chicks

b. Vaccination

- At present no commercial vaccine is available in India.

8.3.2 Viral diseases of poultry

1. Ranikhet Disease (RD)

Synonyms : New Castle Disease, *Manmodi*

It is an acute highly contagious viral disease of poultry. The disease affects all age groups of birds. It causes heavy economic losses to poultry industry by way of high morbidity (100%) and mortality (50 – 90 %) and drop in egg production.

Do you know ?

First case of New Castle Disease was recorded in 1928 at Ranikhet near Almora (Uttarakhand) in India, hence it is named as Ranikhet disease.

Cause

- It is caused by *Paramyxovirus*.

Transmission

1. The disease spreads through infected feed, water or air.
2. Air borne transmission is the most important way of disease transmission.

Symptoms

1. Loss of appetite
2. Dullness and depression
3. Ruffled feathers
4. Respiratory rales
5. Gasping (difficult breathing)
6. Sneezing
7. Coughing
8. Nasal discharge
9. Greenish watery diarrhoea
10. Paralysis of one or both legs or wings
11. Tremors (twitching)
12. Torticollis i.e. twisting of neck (Fig.8.20)
13. Drop in egg production in layers
14. Finally death

Fig. 8.20 : Ranikhet disease

Control

a. General measures

1. Restrict the entry of visitors.
2. Depopulation of site.
3. Proper sterilization of poultry equipments.
4. Disinfection of poultry house.
5. Burial or burning of dead birds.
6. Control of rodents and free flying birds.
7. Isolation of affected birds.

b. Vaccination

1. LaSota vaccine @ 1 drop in each eye or nostril in first week of life.
2. R_2B Mukteshwar vaccine in 8^{th} and 18^{th} week.

2. Marek's Disease (MD)

Marek's disease is highly contagious viral disease, primarily of young chickens between 3-5 months of age.

Cause

- It is caused by *Herpesvirus*.

Transmission

- Infection is transmitted through inhalation of infective material from the environment.

Symptoms

1. Dullness
2. Inco-ordination.

3. Paralysis of one or both legs, neck and wings
4. Drooping or hanging of wings
5. One leg is extended forward and other backward (**Swimmer's posture**)

Fig. 8.21 : Marek's disease : One leg backward- one leg forward

6. Loss of body weight
7. Recumbency
8. Blindness in one or both eyes (ophthalmic form)
9. White nodules on skin (cutaneous form)
10. Sudden death in acute form

Control

a. General measures

1. Selection and breeding of genetically resistant stock.
2. Isolation of affected birds.
3. Disposal of dead birds by burning or deep burial.
4. Disinfection of poultry house.

b. Vaccination

- HVT (Herpes Virus of Turkey) vaccine is given to day old chicks.

3. Gumboro Disease

Synonym : Infectious Bursal Disease

It is an acute highly contagious viral disease of 3 to 6 week old chicks. It causes heavy economic losses to poultry industry by way of high morbidity (100%) and mortality (20 –30 %).

Do you know ?

Infectious bursal disease was reported for the first time from Gumboro in USA.

Cause

- It is caused by *Avian Reovirus* / IBD virus.
- Transmission
- The disease spreads through ingestion of contaminated feed and water.

Symptoms

1. Loss of appetite
2. Dullness and depression
3. Ruffled feathers
4. Diarrhea- loose faeces
5. Soiling of vent

Fig. 8.22 : Gumboro disease : Diarrhoea and soiling of vent

6. Pecking at vent
7. Tremors (twitching)
8. Inco-ordination
9. Death in 4 to 8 days

Control

a. General measures

1. Restrict the entry of visitors.
2. Depopulation of site.
3. Proper sterilization of poultry equipments.
4. Disinfection of poultry house.
5. Disposal of dead birds by burning or deep burial.
6. Isolation of sick birds.

b. Vaccination

- IBD vaccine should be given at the age of 2 to 3 weeks and repeated at 18*th* to 20*th* weeks of age.

4. Fowlpox

Synonym : Avian Pox

It is one of the most common slow spreading

viral diseases of poultry. The morbidity is high and mortality may be up to 50% in chicks.

Disease occurs in mild form in adults and in severe form in young chicks.

Cause

- It is caused by *Avipoxvirus*.

Transmission

- It spreads through direct contact, wounds or insect bites.

Symptoms

1. Scabs or wart like growths on featherless parts of the body such as comb and wattles (Fig. 8.23)
2. Yellowish cheese like deposits on tongue, in side of mouth and under eyelids
3. Lacrimation
4. Nasal discharge
5. Reduction in appetite
6. Loss of body weight
7. Decreased egg production
8. Death due to starvation as a result of blindness.

Fig. 8.23 : Fowl pox

Control

a. General measures

1. Isolation of sick birds.
2. Disinfection of poultry house.
3. Avoid overcrowding of birds.

b. Vaccination

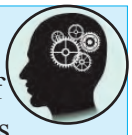
- Fowl Pox Vaccine in 6th and 16th week of life by cutaneous scarification/wing web method.

5. Bird flu

Synonyms : Fowl plague, Avian influenza.

Bird flu is very dangerous and highly contagious viral disease of poultry. The disease affects all age groups.

Remember...



Bird flu is a disease of great zoonotic importance as it is transmitted to human beings.

Cause

- It is caused by H1N1 *influenza virus*.

Transmission

- The disease spreads through contaminated air, water and feed.

Disease is usually transmitted to domestic poultry by wild birds.

Symptoms

1. Loss of appetite
2. Dullness and depression
3. Bluish colouration of comb and wattles (Fig: 8.24)
4. Gasping (difficult breathing)
5. Sneezing
6. Nasal discharge
7. Diarrhoea-loose faeces
8. Egg production stops
9. Finally death

Fig. 8.24 : Bird flu

Control

a. General measures

1. Restrict the entry of visitors.
2. Depopulation of site.
3. Proper sterilization of poultry equipments.
4. Disinfection of poultry house.
5. Disposal of dead birds by deep burial or burning.
6. Control of wild birds.
7. Slaughter of affected and in contact birds.

b. Vaccination

- Vaccination is not practiced in India due to virus mutation.

8.3.3 Parasitic diseases of poultry

1. Coccidiosis

It is serious protozoan disease of young stock up to 10 weeks of age. Disease outbreak occurs in warm and humid climate and damp litter condition.

Remember...

Coccidiosis is most common in birds reared in deep litter system.

Cause

- It is mainly caused by *Eimeria tenella* and *Eimeria necatrix*.

Transmission

- Disease spreads through contaminated feed, water or litter.

Symptoms

1. Depression, weakness
2. Ruffled feathers
3. Reduced appetite
4. Bloody diarrhoea (Fig.8.25)
5. Soiling of vent
6. Loss of body condition
7. Poor egg production
8. Pale comb and wattles due to anemia
9. Death

Fig. 8.25 : Coccidiosis in poultry

Control

1. Isolation and treatment of affected birds.
2. Use of proper waterers and feeders.
3. Use of dry litter or regular changing of litter.
4. Provide good ventilation and sunlight in poultry houses.
5. Use of anti-coccidial drugs as control measure.

2. Internal Parasites

There are 3 types of internal parasites (endoparasites) found in poultry.

1. Round worms (Nematodes) - eg. *Ascaridia galli, Hetrakis gallinarum*.
2. Tapeworms (Cestodes) - eg. *Davainea proglottina, Raillietina species*.
3. Flukes (Trematodes) are of little practical importance in India.

Symptoms

1. Decreased growth rate
2. Reduced appetite
3. Weakness
4. Anaemia
5. Diarrhoea
6. Loss of body weight
7. Drop in egg production

Control

1. Give diet rich in proteins, Vit. A and B-complex.
2. Avoid dampness in poultry house.

3. Provide sufficient space, ventilation and sunlight in poultry house.
4. Good sanitation.
5. Do not mix birds of different age groups.
6. Avoid contamination of feeders and waterers.
7. Control of flies, earthworms, fleas, snails and grass hoppers etc.
8. Deworming should be carried out at 4-6, 6-8 and 12 weeks of age.
9. Regular treatment of affected birds

3. External Parasites

The external parasites (ectoparasites) of poultry are ticks, lice, mites, fleas and biting flies.

Symptoms

1. Itching or irritation
2. Restlessness
3. Reduced feed consumption
4. Anaemia
5. Drop in egg production
6. Retarded growth
7. Decrease in body weight
8. Loss of feathers in mange

Control

1. Isolation and treatment of diseased birds.
2. Maintain sanitary conditions.
3. Close cracks and crevices in poultry house.
4. Regular spraying of insecticides in shed.
5. Spraying or dusting of insecticides on birds.

Rudolf Ludwig Carl Virchow (1821-1902) is a German physician and pathologist. He is known as "The Father of Modern Pathology" and as the founder of social medicine, and the "Pope of medicine". In 1855, first time he used the term “Zoonoses”

8.4 Zoonosis

Definition

- A zoonosis is any disease or infection that is naturally transmissible from vertebrate animals to humans.
- Zoonotic means infectious diseases that are spread between animals and humans.
- Zoonoses (Zoo – Animal, Nosos – disease).

Out of 1407, 816 (58%) human pathogens are zoonotic, i.e., capable of being transmitted naturally between animals and humans. Certain zoonoses are believed to be associated with the illegal slaughter and improper disposal of animals. Moreover, the large numbers of stray animals in India are also considered potential source for the spread of zoonotic infection.

Do you know ?

India is a hotbed of many zoonotic diseases that place a large burden on public health. About 40 zoonotic diseases are commonly reported from India

Fig. 8.26 : Zoonoses

Routes of transmission

1. Ingestion

a. Milk borne diseases: Through ingestion of milk. eg. TB, FMD, Brucellosis, Anthrax.
b. Meat borne diseases: Through ingestion

of meat. eg. TB, Brucellosis, Anthrax, Glanders.

c. Water borne diseases: Through ingestion of water. eg. Colibacillosis, Infectious Hepatitis, Leptospirosis.

2. Inhalation

- Air borne diseases eg. TB, FMD, Influenza.

3. Contact

- Through direct or indirect contact with diseased animal or its infectious materials. eg. Brucellosis, Anthrax, Leptospirosis, Plague, Pox, Glander.

4. Inoculation

a. Vector borne : Through bite of arthropode vectors

eg. Malaria, Dengue fever, Chikungunya etc. (Mosquito borne)

eg. Kaysnur forest disease etc. (Tick borne)

b. Dog Bite : eg. Rabies

Fig. 8.27 : Rabies in dog

Do you know ?

About 15 million people are bitten by dogs (mostly stray) in India every year and nearly 25,000-30,000 people are dying due to rabies annually.

Remember...

Some human infectious diseases that are transmissible from Human to animals and may again transferred to humans are termed as "Reverse Zoonosis or Retrograde Zoonoses". eg. Influenza, Ringworm, TB.

Zoonotic diseases of major public health importance in India

- **Endemic diseases :** Rabies, Anthrax, Brucellosis, Toxoplasmosis, Cysticercosis, Echinococcosis

Do you know ?

A disease that regularly found in a population and in a certain area is called as endemic disease.

- **Re-emerging diseases :** Japanese Encephalitis, Plague, Leptospirosis, Scrub Typhus, KFD (Kyasanur Forest disease)

Do you know ?

Diseases that once were major health problems globally or in a particular country, and then declined dramatically, but are again becoming health problems for a significant proportion of the population are known as re-emerging diseases.

- **Emerging diseases :** Avian Influenza, NiV (Nipah Virus), Trypanosomiasis, H1N1 (Swine flu), CCHF (Crimean-Congo haemorrhagic fever), Trichenellosis

Do you know ?

Infectious diseases or infections that have recently appeared within a population or those whose incidence or geographic range is rapidly increasing or threatens to increase in the near future are called as emerging diseases.

Do you know ?

Epidemic disease : A rapid spread of an infectious disease to a large number of population within a short period of time

Pandemic disease : An epidemic of a disease that spreads across a large region; continents to continents, or even worldwide

Internet my friend

Search for examples of epidemic and pandemic diseases.

Table 8.2: Important zoonotic diseases : their causes, mode of transmission and symptoms observed in human beings

Sr. No.	Name of the Disease	Cause	Mode of transmission	Common symptoms in humans
1	Bird flu	Avian Influenza virus H5N1, H7N9 and H9N2.	Direct or indirect contact with infected live or dead poultry	• Fever • Coughing • Difficult breathing • Death
2	Dengue fever	*Dengue virus*	Mosquito (*Aedes*) bite	• Fever • Headache • Severe joint/ muscle pain • Swollen lymph nodes • Skin rashes
3	Chikungunya	*Chikungunya virus – Alphavirus*	Mosquito (*Aedes*) bite	• Fever • Joints and muscle pains • Skin rashes
4	Kyasanur forest Disease (KFD)	*Kyasanur forest disease virus – Flavivirus*	Tick bite (*Haemaphysalis*)	• Biphasic fever • Haemorrhagic signs (GI bleeding, epistaxis) • In later stage neurological signs
5	Zika Virus Disease (ZVD)	*Zika virus*	Mosquito (*Aedes*) bite	• Mild fever • Skin rashes • Headache • Muscle and joint pain • Swollen eyelid.
6	Nipah Virus (NiV) infection	*Nipah virus*	Fruits contaminated by the saliva of fruit bats of the genus *Pteropus*.	• Fever • Muscle pain • Respiratory problems • Neurological signs in later stage.

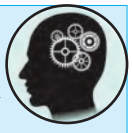
7	Ebola virus Disease (EVD)	*Ebola virus*	Contact with infected wild animals and humans	• Fever • Body aches • Diarrhoea • Sometimes bleeding inside and outside the body.
8	Swine flu	*H1N1, Swine influenza virus*	Contact with infected pigs	• Fever • Cough • Sore throat • Runny nose • Body aches • Headache and chills.
9	Scrub typhus	Rickettsial disease caused by *Orientiat sutsu gamushi*	Vector borne Larval mite (chiggers)	• Fever • Skin rashes • Lymphadenopathy • Pneumonia • Myocarditis • Meningio-encephalitis • Acute renal failure • Gastrointestinal bleeding
10	Glanders	Bacterial disease caused by *Burkholderia mallei*	Contact with tissues or body fluids of infected animals	• Fever with chills • Sweating • Chest pain • Muscle pain • Headache.
11	Leptospirosis	Disease caused by *Leptospira* spp.	Contact with water or soil contaminated by the urine of infected animals.	• High fever with chills • Headache • Muscle aches • Vomiting • Jaundice (yellow skin and eyes) • Red eyes • Abdominal pain • Diarrhoea • Skin rashes.

12	Brucellosis	Bacterial disease caused by *Brucella* spp.	• Contact with secretions • Ingestion of unpasteurized milk and undercooked meat of infected animals	• Fever with high "spikes" in the afternoon • Back pain and body aches • Headache • Poor appetite • Weight loss • Night sweats • Weakness and abdominal pain
13	Tuberculosis	Bacterial disease caused by *Mycobacterium* spp.	Contact with infected domestic and wild animals, inhaling infected droplets, ingesting raw milk or meat.	• Low-grade fever • Night sweats • Weakness or tiredness • Weight loss • Chest pain • Shortness of breath • Cough or coughing up blood
14	Anthrax	Bacterial disease caused by *Bacillus anthracis*	Soil-borne infection, ingestion of contaminated feed and water and sometimes by inhalation	• Sore throat • Mild fever • Fatigue • Muscle pain • Mild chest discomfort • Shortness of breath • Nausea • Coughing up blood • Painful swallowing.

Do you know ?

- KFD was first discovered in 1957 in and around the Sagar and Sorab talukas in the Shimoga district of Karnataka.
- Recently KFD was recorded in Dodamarg taluka in Sindhudurg district of Maharashtra in 2016.
- NiV was first recognized in India and Bangladesh in 2001; since then, nearly annual outbreaks have occurred in Bangladesh.
- In India, the first case of scrub typhus was reported in 2009 from Kerala.
- In recent years, outbreaks of scrub typhus have been reported from Maharashtra, Rajasthan, Punjab, Sub-Himalayan belt and southern Indian states of Tamil Nadu, Kerala and Karnataka.
- Glanders was used as a biological weapon against animals in Europe, Russia, and the United States during the First World War.

Remember...



- Swine flu was first isolated from pigs in the 1930s from USA.
- H1N1 caused the global pandemic in 2009
- More recently in 2015, swine flu spread across India with over 10,000 reported cases and 774 deaths
- Anthrax has been used in bioterrorism and warfare since World War First

- **Future Threat for India :** Yellow fever, Hanta Virus, Rift valley Fever, Ebola and Marburg virus, MERS CoV (Middle East Respiratory Syndrome Coronavirus), Zika virus disease

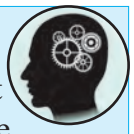
Prevention of zoonosis

Following measures be undertaken to prevent zoonotic diseases

A. Prevention of milk-borne infectious diseases

1. Don't drink raw milk. Drink only pasteurized milk and other dairy products.
2. Keep dairy products refrigerated within the expiration date marked on the package.
3. Do not leave dairy products outside of the refrigerator for more than two hours.

Remember...



Bacterial toxins may persist despite reheating of milk even if the bacteria themselves are killed.

B. Prevention of meat/food-borne infectious diseases

1. Wash your hands before handling food and often during food preparation
2. Wash and sanitize all surfaces and equipments used for food preparation
3. Protect kitchen areas and food from insects, pests and other animals
4. Wash fruits and vegetables, especially if eaten raw
5. Separate raw meat, poultry and seafood from other foods
6. Use separate equipment and utensils such as knives and cutting boards for handling of raw foods
7. Store food in separate containers to avoid contact between raw and prepared foods.
8. Cook food thoroughly, especially meat, poultry, eggs and seafood. Make sure that the food is washed and thoroughly cooked to get rid of harmful bacteria and other hazardous germs.
9. Do not leave cooked food at room temperature for more than 2 hours
10. Refrigerate promptly all cooked and perishable food (preferably below 5°C)
11. Keep cooked food piping hot (more than 60°C) prior to serving
12. Do not store food too long even in the refrigerator also
13. Do not use food beyond its expiry date

C. Prevention of water-borne infectious diseases

1. Make sure that the water is visibly clean and free from any sand and deposits etc.
2. Filter the water to get rid of any visible dirt.
3. Drink only clean and safe water which has been treated with water purifiers.
4. In bathing water, if it is not clear, put some antiseptic liquid to get rid of harmful bacteria.
5. As far as possible use disposable glass and plates while eating or drinking from outside.
6. Water treatment devices like filters, RO unit, etc. be serviced and maintained, regularly.

D. Prevention of vector-borne diseases

Mosquitoes/insects can spread serious diseases when they bite and currently there is NO VACCINE for vector-borne diseases. The only way to protect yourself and your family is to avoid being bitten by them

1. Use insect repellents or other methods to keep mosquitos, fleas, and ticks away.

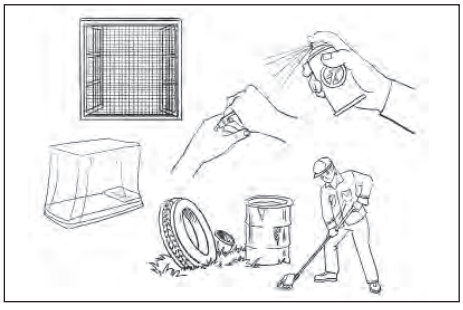


Fig. 8.28 : Measures to control vector borne diseases

(Cleaning, insect repellent, net for windows, bed etc)

2. Prevent bites from mosquitoes, ticks, and fleas by using bug sprays, wearing long trousers and sleeves.
3. Protect from mosquitoes, fleas etc by fitting mosquito nets to windows, beds.
4. Destroy mosquito breeding places by removing water from coolers, old tyres and other small containers, at least once in a week.
5. The surrounding area of house, colony and whole village/town should be kept clean
6. Regular spraying/fogging of gutters by using insect/mosquito repellents/killers (Permethrin, Pyrethroids cyfluthrin etc)

Fig. 8.29 : Mosquito fogging

E. Other general measures

1. Practice exceptional hand hygiene by washing hands meticulously with soap after using the toilet, before and after preparing food, before eating or drinking anything.
2. Children should always wash hands when they enter a home after playing games, and also everyone should wash hands while entering the home.

Fig. 8.30 : Hand washing

3. Cook food properly in clean areas and by washing dishes and pots before and after use.
4. Don't eat, drink, or touch your eyes or mouth while you're handling or in close contact with animals.
5. Use masks, spectacles, particularly during disease outbreak situation.
6. Avoid being bitten or scratched by an animal.
7. Vaccinate and deworm pets regularly.
8. Take appropriate measures for control of flea and ticks infestations to your pets.
9. Use gloves if you need to handle sick animal.
10. Keep area clean and sanitary, where animals are kept.
11. Above all, immunize yourself from vaccine-preventable diseases like Typhoid, Hepatitis A, Polio, etc.

Steps for proper hand wash

Steps to wash hands properly (National Health Portal))

- Wet hands with water
- Apply enough soap to cover all hand surfaces
- Rub hands with palm to palm
- Place right palm over left dorsum (back of hand) with interlaced fingers and vice versa
- Put palm to palm with fingers interlaced
- Backs of fingers to opposing palms with finger interlocked
- Rotational rubbing of left thumb clasped in right palm and vice versa
- Rotational rubbing, backwards and forwards with clasped fingers of right hand in left palm and vice versa
- Rinse hands with water
- Dry thoroughly with a single use towel or clean towel

Internet my friend

Search for CCHF, MERS, and Marburg viral infections in humans.

8.5 Contingency planning for Livestock

India has been traditionally vulnerable to natural disasters such as flood, drought, earthquakes and landslides. The floods are common in states of Assam, Bihar, Uttar Pradesh, West Bengal, Orissa and Andhra Pradesh, whereas droughts are more common in Karnataka, Rajasthan, Gujarat, Maharashtra, Madhya Pradesh and Tamil Nadu.

Disasters cause huge economic loss to animal husbandry segment. The economic losses result from death of livestock, management of livestock diseases, public health problems, production losses, habitat loss, nutritional insecurity and loss of bio-diversity.

Natural calamities like flood and drought can not be prevented, however losses can certainly be minimized by adopting following measures.

A. Management

This includes following aspects of planning and management required to be implemented prior to occurrence of flood or drought.

1. **Population data :** The data pertaining to livestock population and disease occurrence in the disaster prone districts should be collected and maintained. This will help in rescue operation, prevention of diseases and calculation of actual losses from such disasters.

2. **Human resource development :** The available technical man power and their competency to tackle disaster should be assessed from time to time. The veterinary doctors and supporting staff from disaster prone districts should be given training in disaster management of livestock
3. **Infrastructure development :** The hospitals from the areas should be well equipped with all necessary equipments, instruments, ambulance and animal transport facilities to combat emergencies
4. **Strengthening of extension institutes:** The technical staff of extension institutes should be trained in disaster management. The extension institutes i.e. NGOs , KVKs should be encouraged to provide information to farmers about dealing with situation of flood or drought
5. **Livestock Insurance :** It should be made mandatory in disaster prone areas.
6. **Animal incinerator :** The animal incinerator facilities should be developed in these areas for early disposal of animal carcass
7. **Temporary animal shed :** Arrangements for temporary shed at safe location be made.

B. Nutrition

During disaster majority of animals suffer from protein –energy malnutrition, dehydration and mineral deficiency diseases. Most of the forage crops stored straw and hay are washed away by the flash water. Even water becomes unsafe for drinking due to presence of animal/ human excreta, dead bodies and toxins. There is shortage of water as well as good quality fodder during draught.

To meet nutritional requirements of animals during disaster following measures should be adopted

1. **Fodder banks :** Establishments of fodder banks at each district in flood /drought prone districts during season when fodder is amply available.
2. **Relocation of stored fodder :** Farmers should be advised to relocate their fodder stores in view of situation arising due to flood.
3. **Unconventional feed stuffs :** Farmers from disaster prone area should be trained and encouraged for utilization of leaves, soft stems of locally available trees and plants as fodder after chaffing.
4. **Urea–molasses feeding :** Training and motivation of farmers to learn utilization of urea –straw –molasses feeding for nutritional support.
5. **Water :** Make necessary arrangements for whole some water supply. Stocking of water disinfectants such as chlorine tablets/bleaching powder be made.
6. **Mineral mixture :** Sufficient stock of mineral mixtures, vitamin supplements and salt blocks should be made at district level because deficiency diseases are very common during disasters
7. **Chaff cutter :** Supply of chaff cutter to each village to avoid feed and fodder losses.

C. Health control measures

During both drought and flood there are more chances of occurrence of various diseases, hence following measures should be adopted -

1. **Vaccination :** The cattle and buffaloes should be vaccinated against Black quarter, Haemorrhagic septicaemia, FMD and Theileriosis where as sheep and goats be vaccinated against PPR, Enterotoxaemia, Pox, FMD as per vaccination schedule in disaster prone districts. Sufficient stock of vaccines be made available during monsoon.
2. **Deworming :** During drought as well as flood, the animals are more prone to parasitic diseases. Therefore, deworming should be done at regular intervals

especially one month before monsoon in flood prone areas and before summer in draught prone areas. Sufficient stock of dewormers should be made available.

3. **Insecticidal spray :** In general during flood and drought the population of ectoparasites viz. ticks, lice, flies, mosquitoes increases. Therefore, it is essential to control these ectoparasites. Sufficient stock of pesticides /insecticides should be made available at district level.

Exercises

Q.1. Fill in the blanks

1. Vaccination against HS is carried out before the onset of…….....
2. Black quarter is caused by…….
3. Brucellosis is characterized by…….
4. Sudden death with bleeding from natural openings is a characteristic feature of……disease.
5. FMD is caused by .....
6. Goat plague is synonym of …….
7. Surra is caused by……
8. …….vaccine is used for prevention of Marek's disease.
9. Bird flu is synonym of ……
10. Scabs/ warts like growths are observed on comb and wattles in ……..disease.
11. Torticollis is typical sign of …….disease
12. Coccidiosis is ……disease.
13. Chronic respiratory disease is caused by……
14. Near about ….. number of diseases are zoonotic in India.
15. Influenza mainly transmit through…… route of transmission.

Q.2. Identify the odd one

1. HS, BQ, FMD, Anthrax
2. Mastitis, HS, FMD, RD
3. TB, Colibacillosis, Brucellosis, Anthrax
4. Ticks, Fleas, Fluke, Lice

Q.3. Answer the following in one sentence

1. What is contagious disease?
2. Name the causative agent of haemorrhagic septicaemia.
3. Give the appropriate time for vaccination against black quarter.
4. Mention any two zoonotic bacterial diseases of animals.
5. Enlist any two vector borne viral diseases of animals.
6. Write the typical symptoms of sheep pox.
7. Name the test used for detection of mastitis.
8. Give the use of LaSota vaccine.
9. Name the vaccine which is given to day old chicks.
10. Name the most important zoonotic viral disease of poultry.
11. Mention the synonym of infectious bursal disease.

12. Write the causative agent of chronic respiratory disease.
13. Give the cardinal symptom of coccidiosis.
14. Define zoonosis.
15. What do you mean by emerging diseases?

Q.4. Answer the following questions in brief

1. Differentiate between infectious and non-infectious diseases.
2. Enlist general measures for prevention of contagious diseases.
3. What are the symptoms of rabies?
4. Give the control measures for theileriosis.
5. Suggest measures for prevention of chronic respiratory disease in poultry.
6. Give vaccination schedule for Ranikhet disease.
7. Write a brief note on symptoms of fowl pox.
8. Write in brief about symptoms and prevention of Gumboro disease.
9. How bird flu is being transmitted? Give control measures.
10. Enlist the control measures to prevent water borne diseases.
11. List out the contingent strategies to be undertaken in view of drought/flood.

Q.5.Answer the following questions in detail

1. Describe in detail causative agent, transmission, symptoms and prevention of haemorrhagic septicaemia in buffaloes.
2. Explain in detail causes, transmission, symptoms and control measures of FMD in cross breed cattle.
3. What is mastitis? Enlist its causes, symptoms and control measures in dairy animals.
4. Write the cause, symptoms, control measures and vaccination of Ranikhet disease.
5. Discuss in details about the measures to be undertaken to prevent zoonotic diseases.

9. MILK, MEAT AND EGGS

Can you tell ?

- Different livestock products.
- What do you mean by milk?
- Why milk is called as complete food?
- How milk differs from colostrum?

Livestock plays an important role in Indian economy as it provides food items such as Milk, Meat and Eggs for human consumption. Milk, meat and eggs are important sources of animal protein. Livestock provides food safety to increasing global human population and helps in reducing the malnutrition, especially in developing countries.

9.1 Milk

Milk is a whole, fresh and clean normal lacteal secretion obtained by the complete milking of healthy milch animals excluding that obtained within 15 days before or 5 days after calving. Whereas, the first secretion of mammary gland following parturition is called as 'colostrum'.

Verghese Kurien (26 November, 1921 – 9 September, 2012) known as Milkman of India and the 'Father of the White Revolution'. He was a social entrepreneur whose "billion-litre idea" and Operation Flood programme made dairy farming India's largest self-sustaining industry and the largest rural employment provider. It made India the world's largest milk producer from a milk-deficient nation.

9.1.1Composition of milk

Milk contains major and minor constituents. The major constituents of milk are water, fat, protein, lactose and ash or mineral matter. The minor constituents are phospholipids, vitamins, enzymes, pigments, cholesterol etc.

Table 9.1 : Average chemical composition of milk in different species.

Sr.No.	Nameof Species	Milk Constituents (%)				
		Water	Fat	Protein	Lactose	Ash
1	Cow	86.8	4.6	3.2	4.7	0.7
2	Buffalo	84.2	6.6	3.9	5.2	0.8
3	Goat	86.5	4.5	3.5	4.7	0.8
4	Sheep	79.4	8.6	6.7	4.3	1.0
5	Human	87.7	3.6	1.8	6.8	0.1

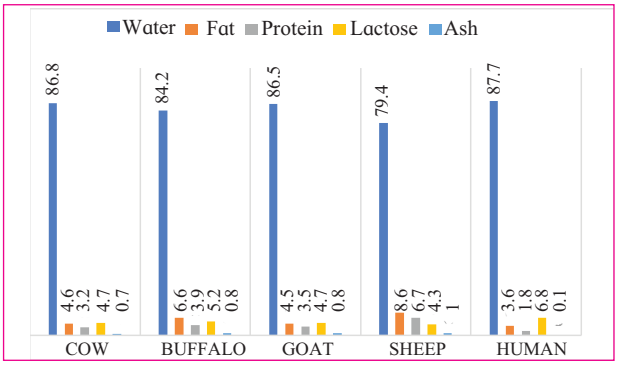


Fig. 9.1 : Composition of milk in different animal species

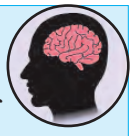
Constituents of milk

The details of major and minor milk constituents are as follows.

A. Major milk constituents

1. Water : It serves as a carrier for the other constituents of milk. A small amount of water in milk is hydrated to lactose and salts and bound to proteins. It ranges from 80 to 90% depending upon species and breed.

Use your brain power



Collect the information on current milk pricing on the basis of fat & SNF content of cow and buffalo milk

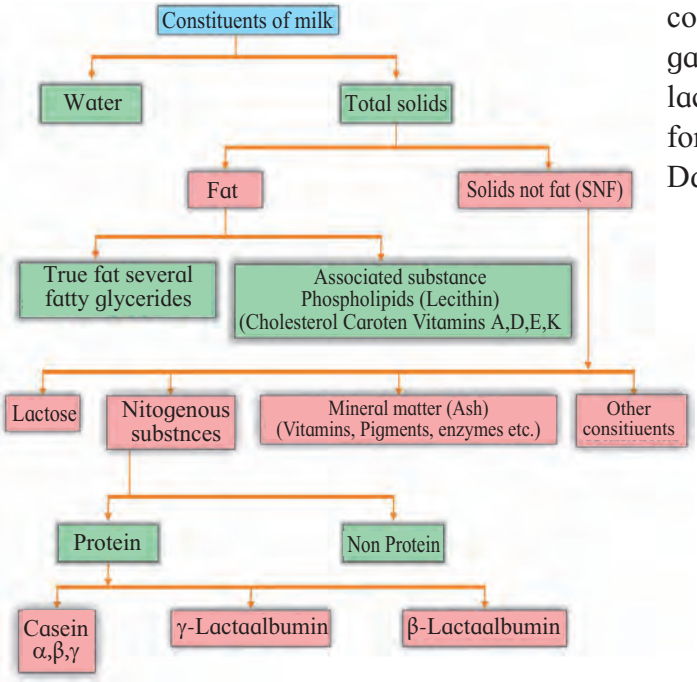


Fig. 9.2 : Milk constituents

2. Fat : It is an important constituent of milk. It is available in the form of small globules ranging from 2 to 5 micron insize. The surface of fat globule is coated with membrane called as fat globule membrane. Chemically fat is composed of number of glyceride esters of fatty acid.The fatty acids are saturated and unsaturated. Milk fat is sweet in taste and imparts smoothness and palatability to milk and milk products.The pricing of milk depends on the fat content of milk.

Try this...

Take water and milk in separate vessel, boil them and observe the changes.

3. Protein : It is the complex organic substance present in colloidal state.The proteins of milk consists of casein, α-lacto albumin and β - lacto globulin. Casein is composed of calcium-caseinate - phosphate complex. It is precipitated by acid, rennet, alcohol, heat etc. Casein itself is composed of, β, γ and k casein. Lacto-globulin and lacto-albumin are whey proteins or serum proteins.

4. Lactose : It is called as milk sugar. It is $1/6^{th}$ as sweet as sucrose. Chemically, lactose is composed of one molecule each of glucose and galactose. It is fermented by bacteria to yield lactic acid which is organic acid and important for production of cultured milk products e.g. Dahi, Shrikhand, Lassi etc.

Do you know ?

Milk is the only source of lactose

5. Ash or Mineral matter : It is available in trace amount. It influences physico-chemical properties and nutritive value of milk. The mineral constituents are potassium, sodium, magnesium, calcium, phosphorus, citrate, chlorides, sulphate and bicarbonates.

Internet my friend

Why children dislike milk ?

B. Minor milk constituents

1. Vitamins : Milk contains two types of vitamins -

a. Fat Soluble vitamins : e.g. A,D,E & K,

b. Water soluble vitamins : e.g. Thiamine (B_1), Riboflavin (B_2), Pantothenic acid, Niacin, Pyridoxine (B_6), Biotin, B_{12}, Folic acid etc.

Do you know ?

Milk is a poor source of vitamin C and iron (Fe) but a fair source of vitamin E.

2. Enzymes : The important milk enzymes are lipase-fat splitting, analase-starch splitting, phosphatase-splitting phospheric acid and esters, protease-protein splitting, peroxidase and catalase decomposes hydrogen peroxide .

3. Pigments : Milk contains two types of pigments

a. Fat soluble : e.g. carotene and xanthophylls

b. Water soluble : e.g. Riboflavin

Carotene, a precursor of vit. A impart yellow colour to cow milk, cream, butter and ghee. It also acts as an anti-oxidant.

4. Phospholipids : Phospholipids are of three types viz lecithin, cephalin and sphingomylin. They contribute to richness of flavour to milk and milk products. They are excellent emulsifying agents and thus stabilize milk fat emulsion.

Remember...

Phospholipids are responsible for rich flavour to milk.

9.1.2 Properties of milk

Can you tell ?

- Why cow milk is yellowish in colour ?
- Why fresh milk is amphoteric in nature?

Physical properties of milk

1. Flavour : It is composed of smell and taste. The sweet flavour of milk is due to lactose and salty taste is because of minerals.

2. Colour : The cow milk is yellowish in colour due to presence of carotene whereas, the buffalo milk is purely white due to complete conversion of beta-carotene into Vit. A. The colour of milk is due to reflection of light by colloidal casein and dispersed fat globules.

3. Specific gravity : Milk is heavier than water. The specific gravity of cow and buffalo milk expressed at 15.6^0c is 1.028 to 1.030 and 1.030 to 1.032, respectively. It is measured by lactometer.

Do you know ?

Milk is heavier than water.

Try this...

Different lactometers available in the market

4. Freezing point : This is the temperature at which the liquid phase may freeze or crystallize and the solid phase may melt or liquefy. The freezing point of Indian cow milk is 0.549°C where as buffalo milk is 0.547°C

5. Boiling point : The average boiling point of cow and buffalo milk is 100.5°C.

6. Viscosity : The viscosity of the whole milk at 25°C is about 2.0 centipoises. The casein micelle and fat globules are the important for the viscosity of milk.

Chemical properties of milk

1. Acidity : Freshly drawn milk is amphoteric in reaction i.e. red litmus turn blue and vice versa. The Titrable Acidity (T.A.) is expressed as percent of lactic acid. The T.A. of cow milk is 0.13 to 0.14 % Lactic Acid and buffalo milk is 0.14 to 0.15% Lactic Acid (L.A.)

Remember...

Titrable acidity is also known as Natural or apparent acidity and is caused by the presence of casein, acid phosphate, citrates etc. in milk and developed acidity is due to lactic acid produced by bacteria

2. p^H : The pH of normal, fresh, sweet milk usually varies from 6.4 to 6.6 for cow milk and 6.7 to 6.8 for buffalo milk. Higher pH values for fresh milk indicate udder infection (mastitis) and lower values suggest bacterial action. It is affected by contamination, ageing and temperature of stored milk.

9.1.3 Preservation of milk : The following are Three different methods of preservation of milk

1. Chemical preservation

Do you know ?

Preservatives are the chemical substances that are added to milk to check the growth of microorganisms and thus prevent spoilage of milk.

Preservatives are added to prolong the keeping quality of milk. They prevent spoilage of milk from bacterial action It is used only for testing of milk in laboratory and not useful for human consumption.

Remember...

The addition of preservatives in milk and milk products is not permitted in India. Hence, no preservative shall be added except in samples which are to be preserved for chemical analysis.

The various chemicals which are used as preservatives in milk are Boric acid and its salts (borates). Carbonates and bicarbonates, Formalin, Hydrogen peroxide, Benzoic acid, Salicylic acid and Niacin.

2. Pasteurization of milk

Pasteurization derives its name from French Scientist Louis Pasteur, who found that the heating of certain liquids especially wine at high temperature improved its keeping quality.

Louis Pasteur (1822 – 1895)

Louis Pasteur : Born on December 27, 1822, in Dole, France, Louis Pasteur discovered that microbes were responsible for souring alcohol and came up with the process of pasteurization, where bacteria are destroyed by heating beverages and then allowing them to cool.

Pasteurization is the process of heating a liquid to below the boiling point to destroy microorganisms. It was developed by **Louis Pasteur** in 1864 to improve the keeping qualities of wine. Commercial **pasteurization** of **milk** began in the late 1800s in Europe and in the early 1900s in the United States

Definition : The pasteurization, as applied to market milk, refers to the process of heating of every particle of milk to at least 63°C (145°F) and holding it at this temperature for at least 30 minutes or heating at 72°C (161°F) and holding it at this temperature for15 seconds followed by immediate cooling to 5°C(41°F) or below.

Objectives:

1. To destroy all pathogenic and non-pathogenic microorganisms in milk & make it safe for human consumption

2. To improve the keeping quality of milk by destroying most of the microorganism.

Methods of pasteurization of milk

1. Low temperature long time (LTLT) method: This is also called as batch or holding method. It is the process in which milk is heated at 63°C (145°F) and held for minimum of 30 minutes followed by cooling to 5°C(41°F). This process is carried out in a double jacketed vat fitted with a mechanical agitator and a thermometer. An outlet is provided in the bottom portion of the vat to drain out the pasteurized milk. Heating of milk is done by circulating hot water or steam and cooling by chilled water.

This method is used at small scale dairy plants.

2. High temperature short time (HTST) method: It is continuous process in which milk is heated to 72°C (161°F) for 15-16 seconds and cooled to 5°C.

The flow of milk in H.T.S.T. pasteurizer is as follows.

H.T.S.T. pasteurizer unit consists of following different sections. Pasteurizer comprises of stainless steel plates arranged in a series. The heating and cooling of milk takes place through these plates.

1. Float controlled balance tank : This regulates the supply of milk to the regeneration section of pasteurizer with the help of a centrifugal pump.

2. Regeneration section : The raw cold incoming milk is partially and indirectly heated to 51.6 to 54.4°C by the hot outgoing milk (milk to milk regeneration). This saves energy and adds to the economy of the HTST process, as the incoming milk requires less heating by hot water to raise its temperature for holding.

3. Filter : The units are connected directly to HTST system and which are placed after the pre-heater or regenerative (heating) section, these units, using 40-90 mesh cloth, are usually cylindrical in shape. Usually two filters are attached. Only one is used at a time. This permits continuous operation the flow being switched from one to the other while replacing of filter.

4. Heating section : Milk is heated to 72°C for 15-16 seconds with the help of a heating medium such as steam/hot water.

5. Holding section : Milk is held at 72°C for 15-16 seconds.

6. Cooling section : The pasteurized milk from the regeneration section is forced to the cooling section and cooled to 5°C, chilled water is used as cooling medium.

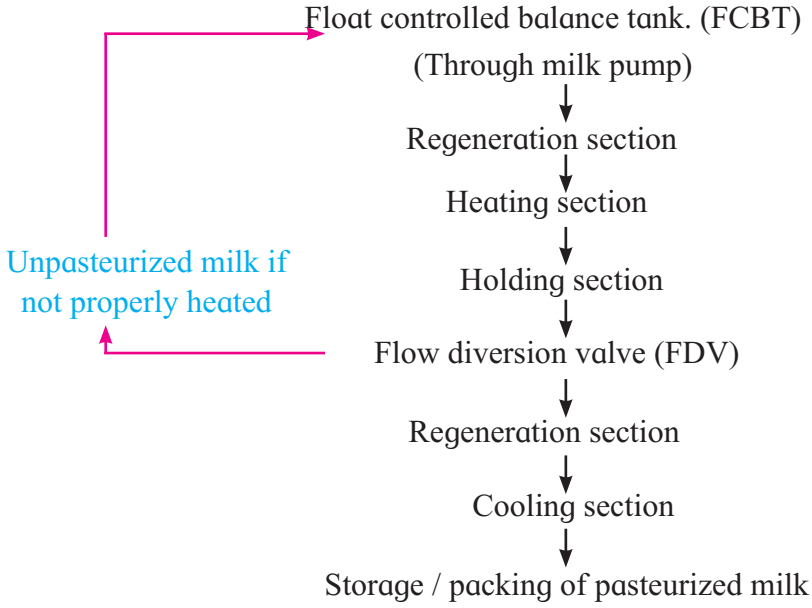


Fig. 9.3 : Flow diagram of HTST Pasteurization

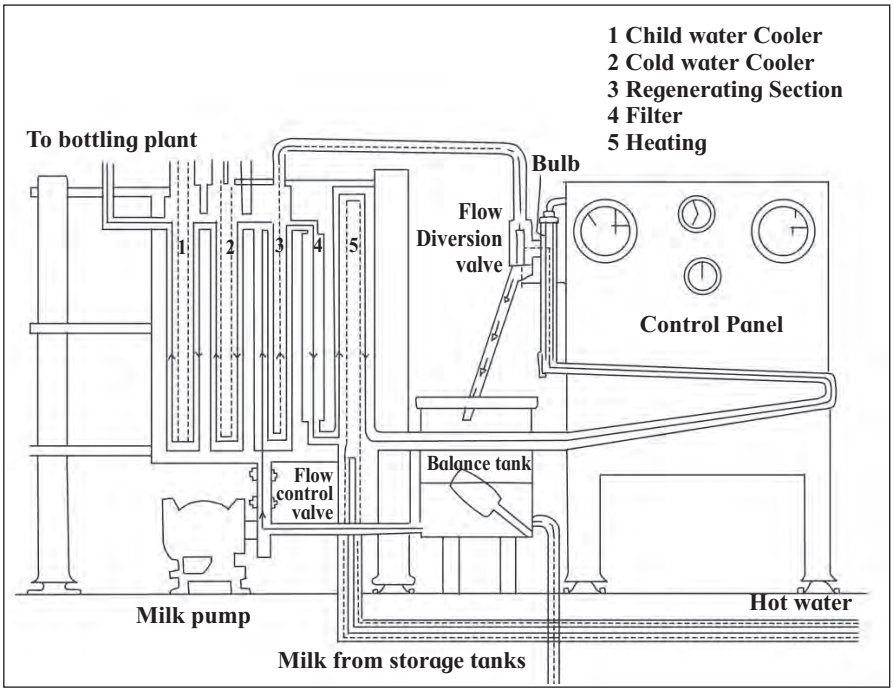


Fig. 9.4 : HTST pasteurizer

7. Flow diversion valve : The pasteurized milk is diverted to the regeneration section and improperly pasteurized milk (milk having temperature below 72°C is re-circulated to the balance tank for further pasteurization.

Try this...

Visit nearby dairy plant and observe the process of milk pasteurization.

Use your brain power

Differentiate LTLT and HTST method of milk pasteurization

Advantages

1. Capacity of heat treatment to milk is quick and adequate.
2. Less floor space is required.
3. It involves lower initial cost and operating cost.
4. Beneficial for large amount of milk.
5. Pasteurization capacity can be increased at nominal cost.
6. Reduced milk losses.
7. Development of thermophilic organisms is not a problem.
8. The process can be interrupted and quickly restarted.

Disadvantages

1. This is not beneficial for small amount of milk.
2. Gasket requires constant attention for possible damage.
3. Greater accumulation of milk stone in the heating section.
4. Complete drainage is not possible (without losses exceeding those from the holder system).

3. Chilling of milk

Try this...

- Visit nearest milk chilling center and study process of chilling.
- To know the importance of chilling.

The freshly drawn milk contains micro-organisms. Their number increases during subsequent handling especially under unsanitary conditions at village level. The common

milk micro-organisms grow best between 20-40 ^{0}C. Bacterial growth is invariably related by deterioration in market quality due to development of off flavours, acidity etc. Freshly drawn raw milk should therefore be promptly cooled to 5 ^{0}C or below and also held at that temperature till processed. Chilling is very effective in checking the growth of micro-organisms present in milk. Cooling delays milk spoilage. Immediately after reception, milk is chilled.

Try this...

Different methods of chilling of milk

9.1.4 Packaging of milk

Packaging means placing a commodity in a protective wrapper or container for storage and transport with the ultimate purpose of delivering it to the user safely without deterioration in shape, size and quality.

As a result of socioeconomic changes, packaging has become increasingly important for establishing a particular brand. The different types of packaging and milk distribution system for fluid milk are as follows

i. Returnable containers such as glass bottles.

ii. Single service containers in sachets or cartons.

iii. Dispensing through milk can or bulk vending machines directly into container.

Try this...

Observe the process of packaging of milk and milk products.

1. Packaging in bottles : Milk is packaged in plain glass bottles either manually or through mechanical bottle fillers. But packaging of milk in glass bottles requires extra expenditure on bringing the empty bottles back to the dairy plant for their re-use. This is the reason why bottle packaging is gradually being replaced by polythene packaging in the dairy industry.

Fig. 9.5 : Bottle packaging of milk

2. Packaging in single service containers : These containers have almost replaced bottle packaging because-

1. Empty containers need not to be returned, thus saving significant expenditure on transportation.
2. There is no need of cleaning of the empty containers.
3. Labour requirement is also less.

The containers are tamper proof. Single service containers are of two types.

a. Pre-fabricated packs : These are generally made up of cardboard coated with wax. The filler used for filling these cartons is similar to the gravity filler bottles.

b. Form and fill cartons / Pouches : The machines are fully automatic. The units form, fill and seal milk pouches in a continuous operation out of the rolls LDPE (Low density polyethylene) film. These machines are available in varying capacities and can pack milk in 200ml, 500 ml or 1 lit. pouches.

Fig. 9.6 : Milk pouch

Can you tell ?

Why packaging bottles are replaced by milk pouch for packaging of milk.

3. Packaging in cans : Stainless steel, aluminum or plastic cans of 20 or 40 liters capacity are cleaned and sanitized properly. Pasteurized milk of the desired standard is filled through a filling unit using appropriate lines and valves. The cans are sealed, marked and shifted to a cold room for storage till distribution.

Fig. 9.7 : Milk can (Aluminum and steel)

Milk packing machine : Now a day's fully automatic milk packaging machines are available in the market designed for packaging of milk in LDPE film, commonly known as "Milk pouch packing machine". The film roll is mounted on backside of milk packing machines, after unwinding mechanism film passes through series of free roller.

Fig. 9.8 : Milk pouch packing machine

9.1.5 Storage of milk

Modern milk plants hold both raw and pasteurized milk for a much longer period than earlier storage methods. Normally the milk storage capacity is equal to one day milk procurement.

Storage tanks are used in milk plants for the storage of raw, pasteurized or processed products. They must be designed for ease in sanitization, preferably by the circulation-cleaning method. In addition, the tanks should be insulated or refrigerated. So that they can maintain the required temperature throughout the holding period.

Try this...

Observe the storage rooms of modern dairy plant.

Can you tell ?

The importance of storage of milk and milk products

Objectives of storage

- To maintain milk at a low temperature so as to prevent any deterioration in quality prior to processing / product manufacture.
- To facilitate bulking of the raw milk supply, this will ensure uniform composition.
- To allow for uninterrupted operation during processing and bottling.
- To facilitate standardization of the milk.

Types of storage tank : Milk storage tanks are as follows.

1. Insulated and refrigerated tanks

The storage tanks are either insulated or refrigerated.

a. Insulated tanks : These tanks basically consist of stainless steel, a layer of insulating material viz thermocool /glasswool /cork /fiber glass and outer casing of stainless steel/ alloy aluminium or mild steel with necessary fittings for inspection, control and cleaning.

b. Refrigerated tanks : They have refrigerating facilities so that stored milk is chilled as and when required. In refrigerated tanks, the hollow space between the inner and outer shells is used for circulation of the cooling medium. Generally chilled water or brine solution is used as cooling medium.

2. Horizontal and vertical tanks

a. Horizontal tanks : They require more floor space than vertical ones but require less head space. The standard horizontal tanks are normally manufactured in 5000, 10,000 and 15,000 litre capacity.

b. Vertical tanks : They require less floor space but more head space. The standard vertical tanks are manufactured in 2000, 5000, 10,000 and 15,000 litre capacity. Silo tanks are used for bulk storage of milk having 1 lakh litre capacity.

3. Rectangular and cylindrical tanks

a. Rectangular tanks : They require more floor space than cylindrical. These tanks are difficult to clean because agitation effect does not reach the extreme corners of rectangular tanks.

b. Cylindrical tanks : They require less floor space than rectangular tanks. These tanks are easy to clean hence more preferred than rectangular tanks.

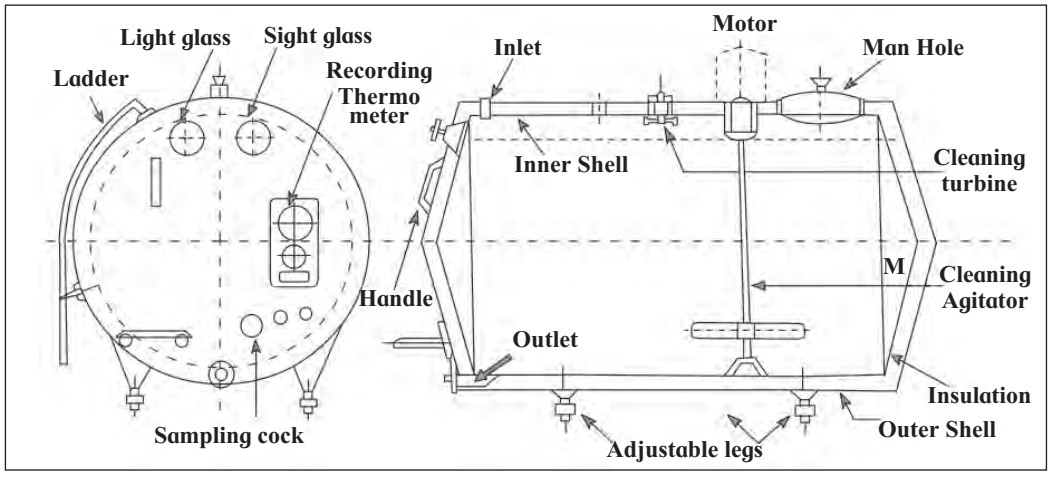


Fig. 9.9 : Horizontal type milk storage tank

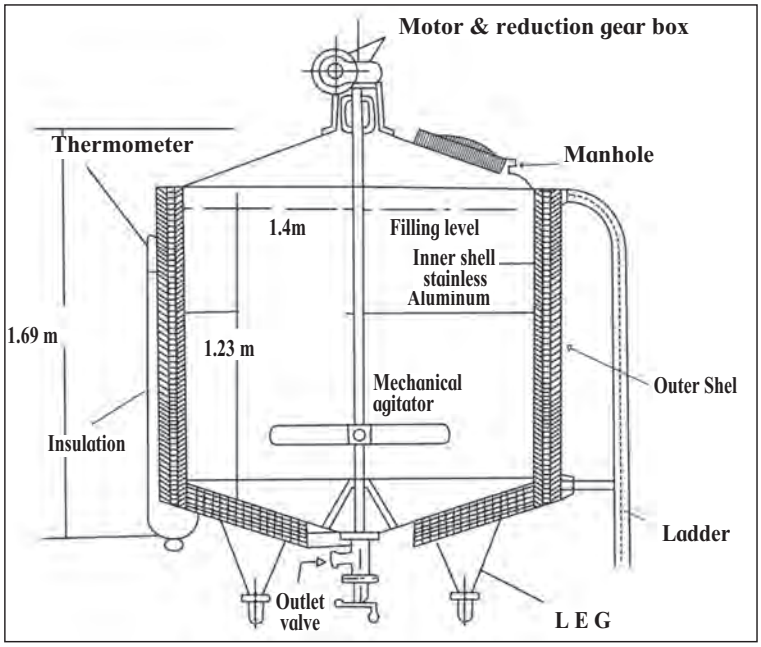


Fig. 9.10 : Vertical type milk storage tank

9.1.6 Transportation

Milk is a perishable commodity so it has to be regularly collected and transported twice a day (i.e. morning & evening). Hence transportation has a great importance.

The problems in relation to collection and transportation of milk are

1. Milk is liquid, perishable and bulky.
2. Small and scattered production of milk.
3. Tropical climate.
4. Lack of transport facilities.
5. Lack of country wide organizations for milk collection and transport.

Try this...

Observe and note how the milk is transported from rural to urban area.

9.1.7 Clean milk production

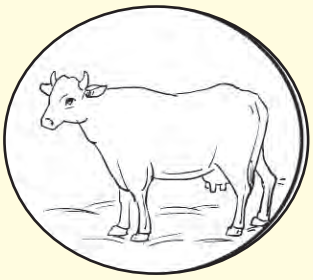
The concept of clean milk production is to develop sustainable, scientific and eco-friendly dairy animal management based on principles of clean, green and ethical practices. Clean milk is generally defined as "milk drawn from the udder of healthy animals, which is collected in clean dry milking pails and free from extraneous matters like dust, dirt, flies, manure etc". Clean milk has a normal composition, possesses a natural milk flavour with low bacterial count and is safe for human consumption.

Steps for clean milk production

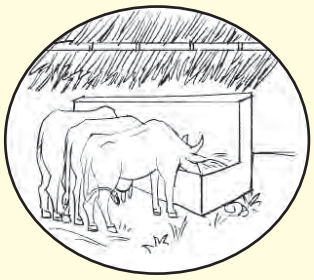
1. Milking shed should be cleaned with disinfectants before and after milking.
2. Wash the udder and teats with lukewarm potassium permanganate solution and wipe with clean towel.
3. Use strip cup method for screening the mastitis (udder infection), in this method milk of all four quarters will be stripped into a cup covered with black cloth.If the animal is suffering from mastitis, flakes of milk will be seen on black cloth.
4. If mastitis is detected, do not mix the milk of that animal in milk of healthy animals, the affected milk shall be totally discarded.
5. Drain the milk till the last strip as it contains more fat.
6. Immediately after milking, dip the teats in cup containing disinfectants to prevent infection.
7. Milker should be free from any infectious diseases. Should cut his nails regularly, wash his hands and legs before milking and should wear cap on the head.
8. He should not wet his hands with water or milk or saliva etc. during milking.
9. Practice "full hand" method of milking only. Avoid folding of thumb while milking. It may injure teats and cause wounds on teats.
10. Always use clean stainless steel or aluminum milk cans.
11. Milking cans should be thoroughly washed with detergent and should be sun dried every day.
12. Filter the fresh milk using clean dry muslin cloth.

Try this...

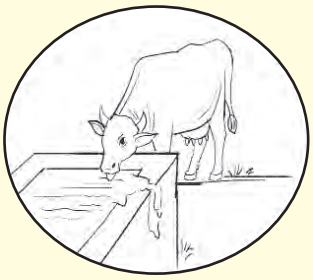
Visit to a organized dairy farm to observe machine milking and clean milk production



1.Clean and healthy cow



2. Clean byre for cows



3.Clean water for drinking

4. Clean stainless-steel utensils

5.Clean hand washing before milking

6. Wipe the udder with clean cloth before milking

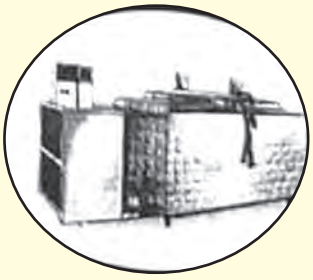
7.Remove the first one or two strips of milk

8.The milker is healthy and hygienic

9.At the time of milking give green forages to milch animal

10. Dipping of teat in germicides

11. Cover Milk cans and transport milkquickly to milk chilling centre



12. Store clean milk in refrigerator

Fig. 9.11 : Clean milk production steps

9.1.8 Organic milk

Fig. 9.12 : Organic milk

"Organic milk is milk produced from livestock raised according to organic farming methods and cows or buffaloes that are not treated with antibiotics".

Features of organic milk

- Free from growth hormones.
- Free from any antibiotics
- No de-wormer or other preventive medicines are used
- Feed should be free from animal by-products.
- Feed should be free from artificial "roughage".

Internet my friend

Search information on A1 and A2 type of milk

9.1.9 Adulteration of milk

Indians are habitual of drinking milk with water, which not only reduces its nutritive value of beverage but also possess risk to health.

A glass (250 ml) of unadulterated cow milk gives around 146 kcal, 11.5 gm of fat and 8.5 gm protein, 12.3 gm lactose with 257 mg of calcium and other vitamins and minerals, make it an important part of a balanced diet for people of all ages.

The addition of anything without clearly stating that addition on the label of the container is termed as adulterant.

Adulterants used in milk and milk products

Milk is adulterated with water, starch, gelatin, cane sugar, saccharin, glucose or monosaccharides, sodium chloride, urea, formalin, hydrogen peroxide etc. In ghee common adulterants used are vanaspati (dalda), refined vegetable oils e.g. Groundnut, coconut, cottonseed oil,animal fats etc..

In butter common adulterants used are animal fat and different oils, potato pulp starch, jaggary, soft paraffins vegetable oil, hydrogenated fat and margarine.

Hazards of Adulterants in Human Health

The Indian Council of Medical Research (ICMR) has reported that milk adulterants have hazardous effects on human health. The detergent in milk causes food poisoning and other gastrointestinal complications. Its high alkaline level can also damage body tissue and destroy proteins. Other adulterants like urea, caustic soda and formalin cause gastro enteritis and the long term effects are more serious.

Urea can lead to vomiting, nausea and gastritis. It is particularly harmful for the kidneys and caustic soda can be dangerous for people suffering from hypertension and heart problems. It harms the mucosa of the food pipe in kids. The chemical which contains sodium can act as slow poison for those suffering from hypertension and heart ailments.

9.2 Meat

Meat is defined as "All parts of animal that are intended for, or have been judged as safe and suitable for human consumption". The most common sources of meat are domesticated animal species such as cattle, buffalo, sheep, goat, pig and poultry. These species are main sources of animal protein for human. Pork is the most widely eaten meat in the world accounting for over 36 % world's meat intake followed by poultry 35 % and beef 22 %. Meat is composed of water, protein, fats, mineral, vitamins and other bioactive components, and small quantity of carbohydrates. From the nutritive point of view meat's importance is derived from its high

quality protein, containing all essential amino acids and its highly bioavailable minerals and vitamins. Meat is rich in vitamin $B_{12.}$

Terms used for Meat….

- **Beef :** The flesh of a cow, bull or ox used as food
- **Carabeef :** The flesh of buffalo
- **Mutton:** The flesh of fully grown sheep used as food
- **Chevon :** The meat of adult goat used as food.
- **Chicken :** The meat of poultry
- **Pork :** Flesh of a pig used as food

Meat is animal flesh and worldwide eaten as a food. Many types of meat are used for Indian cooking, but chicken and mutton tend to be the most commonly consumed meats. Fish and beef consumption are prevalent in some parts of India, but they are not widely consumed except for coastal areas, as well as the north east.

The area which deals with the processing, handling, marketing and preparation of egg and meat products and by products is called as meat and egg products technology.

Do you know ?

Meat of cattle and buffalo is called as "Beef", meat of goat is called as "Chevon" while meat of poultry is called as "Chicken"

9.2.1 Nutritive value of meat

Fig. 9.13 : Chicken

Fig. 9.14 : Mutton

Meat has high nutritive value having an excellent source of many nutrients, especially Protein, Iron, Vitamin B, Phosphorus and Zinc. Liver and other organs are also high in vitamin A, vitamin B_{12}, iron and selenium. Meat is also an excellent source of choline, an important nutrient for brain, muscle, and liver health. Meat contains all the essential amino acids.The composition of different type of meat, milk and eggs is as presented in table No.9.2

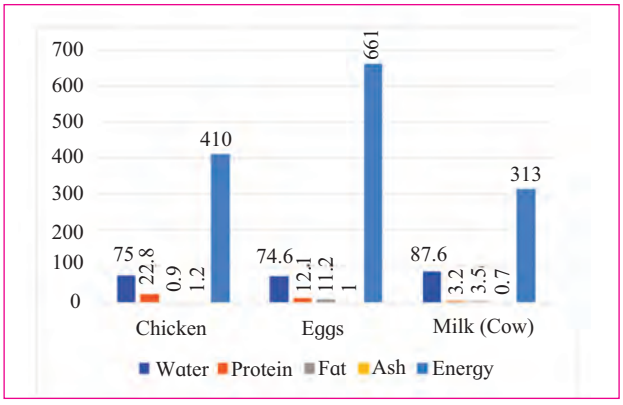


Fig. 9.15 : Composition of different meats

Table 9.2 : Composition of different types of meat, eggs and milk per 100g

Sr. No.	Species	Water	Protein	Fat	Ash	KJ (Energy)
1.	Beef (lean)	75.0	22.3	1.8	1.2	485
2.	Goat (chevon)	76.0	22.3	2.6	1.1	580
3.	Sheep (mutton)	75.0	19.0	2.5	0.65	258
4.	Pork (lean)	75.1	22.8	1.2	1.0	469
5.	Chicken	75.0	22.8	0.9	1.2	410
6.	Egg	74.6	12.1	11.2	1.0	661
7.	Milk (cow)	87.6	3.2	3.5	0.7	313

Source: FAO, 2007

9.2.2 Processing of Meat and Meat Products

Basic meat plant operation such as cutting, trimming, deboning and grinding do not constitute meat processing. In fact processing refers to any treatment including salting which brings about a substantial chemical and physical change in the natural state of meat. It imparts considerable shelf stability to meat.

Basic processing procedure

1. Comminution - All processed meat can be classified as either non- comminuted or comminuted products. Non comminuted products are generally processed from intact cuts. These products are usually cured, smoked and cooked e.g. ham and bacon. The term comminuted meat is used to describe meat, either raw or pre-cooked, which has been cut, shredded, ground or minced into small pieces,

Remember...

Comminution refers to subdivision or reduction of raw meat into meat pieces or particles. Meat particle size reduction helps in the uniform distribution of seasonings and eliminates the toughness associated with meat of old animals and lowers the fuel for cooking.

2. Emulsification – A mixture of two immiscible liquids where one liquid is dispersed as droplets in another liquid is called emulsion. An emulsion has two phases a continuous phase and a dispersed or discontinuous phase. For preparation of good meat emulsion lean meat is first chopped with salt to extract salt soluble protein and then fat and other ingredients are added. Once a good meat emulsion is formed it has to be protected during cooking or heat treatment.

Remember...

Meat emulsion comprises of a dispersed phase of solid or liquid fat droplets and continuous phase of water containing salt and protein for practical purposes Meat emulsion is an oil- in –water emulsion where solubilised meat protein act as emulsifier.

3. Meat extension : Soy products, potato starch and flour of wheat, rice, pea, corn, etc. are used as fillers to reduce cost of formulations. Several milk products such as skim milk powder, dried whey, sodium caseinate,etc. are frequently used as binders. Some gums like sodium alginate, carrageenan, gum Arabic,etc. may be used to stabilize fragile meat emulsion.

Remember...

Non meat food items which are incorporated in meat products are generally termed as extenders although these may be referred as fillers, binders, emulsifiers or stabilizers depending on the purpose and their incorporation in the basic meat formulation.

4. Preblending : It refers to the mixing of a part or all the curing ingredients (salt, nitrite, nitrate, etc.) with a ground meat in specified proportions. This process allows better extraction of protein which in turn helps in formation of stable emulsion. It permits control of product composition by adjusting the desired fat content.

5. Hot processing : It refers to the processing of carcass as soon as possible after slaughter (Certainly within 1-2 hours) without undergoing any chilling.

Advantages

i. Accelerate the processing step and entire processing time is reduced

ii. Improvement in the cooking yield and sensory quality of the product.

6. Cooking : Meat and meat products are cooked by one or a combination of three methods-dry heat, moist heat and micro wave cooking. Dry heat cooking is used for tender cuts of meat such as pork chops, legs and chops of lamb, ground and comminuted meats, etc. Dry heat cooking involves either broiling, roasting or frying in broiling. Meat held on a wire grill is exposed to heat from above as in electric and gas oven. Or below as in charcoal broiler. Meat is required to be turned for uniform and sufficient cooking of all sides. Roasting is also practiced on tender cuts of meat. Cooking temperature and time varies according to the cut. Roasting generally gives a good browning and improves the flavour of the product. Frying dep fat or shallow pan is also classified under dry heat cooking. This meat is suitable for thin cuts of meat such as sliced steaks, mutton chops, chicken meat pieces, etc.

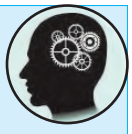
Moist heat cooking is recommended for relatively tough cuts of meat. In this method hot water or steam is continuously kept in contact with meat for cooking so that moisture loss does not take beyond a particular stage. Pressure cooking, stewing, simmering, etc. are popular moist cooking procedures.

Microwaves are high frequency non-ionizing electromagnetic waves which are generated by magnet on vacuum tube within the oven.

Microwave penetrates the food from all direction simultaneously upto a depth of 2-4 cm causing water, fat and sugar molecules to vibrate at a very high speed. The vibrations cause tremendous friction which produces heat for cooking the food.

7. Sausages : Presently sausage may be defined as meat product which is prepared from minced and seasoned meat and formed into cylindrical shape by natural or synthetic casings.

Remember...



Sausages term was derived from the latin word 'Salsus' meaning salt. It was coined to refer the ground meat which was salted and stuffed in animal casings

7.1 Classification

Sausages are a large number of varying kinds of products that it is not possible to cover them in any classification system. Some of the popular classification systems are

Sausages

1. Based on degree of chopping : Coarse ground sausages Emulsion type sausages

2. Based on moisture content :

Fresh sausage Smoked uncooked sausage
Cooked Sausage Dry and semi dry sausage

3. Based on fermentation : Fermented sausage Non fermented sausage

Processing steps

1. **Grinding or mincing :** Lean meat and fat are minced separately in a meat mincer. The choice of mincer plate or sieve depends on the type of meat.
2. **Mixing :** Meat and fat to be used for the preparation of coarse ground sausage are mixed uniformly in a mixer. Extender, condiments and spices should also be run in the mixer for even distribution.
3. **Chopping and emulsifying :** For emulsion preparation lean meat is first chopped for few minutes in a bowl chopper with salt to extract myofibrillar protein which is followed by addition of fat and running for a few minutes again to get desired emulsion consistency. Now all other ingredients are added and chopper is run for some time for uniform distribution. The entire operation is conducted at low temperature by addition of ice flakes in place of chilled water.
4. **Stuffing :** Sausage emulsion or batter is taken to stuffer for extrusion into casings. The casings are first collected on the stuffing horn or nozzle and released to coincide with the extrusion.
5. **Linking and tying :** In small sausages the encased mass is twisted to produce links either manually or mechanically. Whereas in large sausages the encased mass is tied with the thread at regular interval.
6. **Smoking and cooking :** Sausage links are hung on the smoke house and trolley and transferred to smoke house. The temperature of smoke house is usually maintain at 68-70^{0}C which is enough for coagulation of sausages emulsion, cooking and requisite drying of sausages.
7. **Chilling :** The cooked product is showered with chilled water to an internal temperature of about 4^{0}C.
8. **Peeling and packing :** While artificial or synthetic casings are peeled off before the product is packed. Small sized natural casings need to be removed. The product is generally unit packed for retail outlets.

9.2.3 Preservation of meat

The primary objective is to inhibit microbial spoilage and arrest physio-chemical process which brings about deterioration in quality. Methods used for preservation are as follows

1. Refrigeration : Meat can be stored at 1^0 to 4^{0}C with relative humidity of 80-85% for about a week. Crushed ice or mechanical refrigeration are generally used for chilling or cold storage.

2. Freezing : Meat can be frozen in air or liquid or refrigerated plates. Ideally, only chilled carcasses should be frozen.

a. Slow freezing : Still air, the method generally used in home freezer or small freezing operation.

b. Quick freezing : Air blast system used in commercial operation. Meat stored at -20^{0}C for 12, 15, 18 months with excellent, good and satisfactory quality, respectively.

3. Curing and smoking : These are closely interrelated and often practiced together. Curing is the process of salting meat along with one or more of the glutamates, ascorbic acid, acetic acid and phosphate. Cured chicken are smoked in a smoke chamber maintained at 40- 45^{0}C and 30-35% relative humidity for about 4 hours. The smoking process imparts a characteristic flavour and stable colour to the cured product and helps in preservation. Cured chicken could be stored for 4 and 14 days at ambient (26^{0}C) and refrigeration (4-5^{0}C) temperature, respectively while cured and smoked chicken for 14 and 30 days under the corresponding storage conditions.

4. Dehydration : Conventional hot air, drum, spray and freeze drying are the methods used to remove moisture from poultry meat. Generally, cooked meat is dehydrated. Dehydrated product is a porous mass with original shape and size which can remain stable up to 1 year under ambient condition when packed in tins under nitrogen.

5. Canning : It is heat processing of meat in airtight sealed containers.

6. Use of antibiotics : Antibiotics can be used for the preservation of raw meat but not in processed products.

7. Radiation preservation : It is also known as cold sterilization. The radiant energy is used to destroy the micro-organisms and inactivation of enzymes without any rise in the temperature of foods.

9.3 Eggs

The most commonly consumed eggs are chicken eggs. Other poultry eggs including those of duck and quail also are eaten. Fish eggs are called roe and caviar. Egg yolks and whole eggs content significant amounts of protein and choline, and are widely used in human diet.

Do you know ?

Fish eggs are called Roe and Caviar

Eggs are among the most nutritious foods.A whole egg contains all the nutrients required to turn a single cell into a baby chicken.Eggs also contain good amounts of vitamin D, vitamin E, vitamin K, vitamin B6 subscript 6, calcium and zinc

9.3.1 Nutritive value of poultry egg

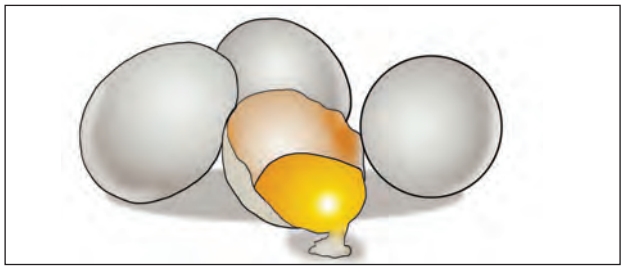
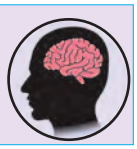


Fig. 9.16 : Poultry Eggs

Poultry eggs have very good nutritive value. The high nutrient content, low calorific value and easy digestibility make it a valuable protective food in human diet. The average chemical composition of edible part of hen's egg and role of eggs in daily diet are presented in Table 9.5 and 9.6.

Use your brain power

Is egg veg or non-veg ?



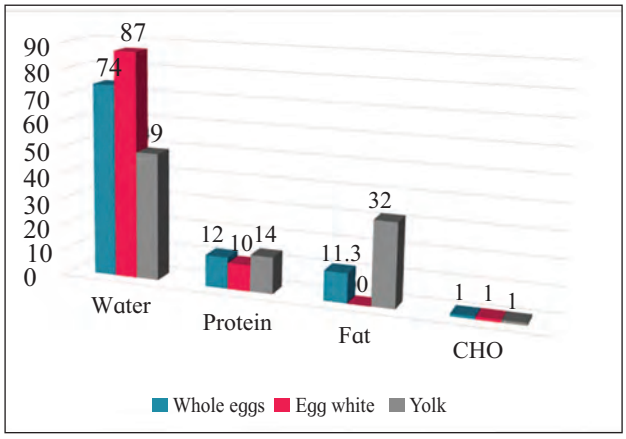


Fig. 9.17 : Composition of poultry eggs

Table 9.3 : Average chemical composition of edible part of poultry egg (%)

Sr. No.	Particular	Whole Eggs	Egg white	Yolk
1	Water	74.0	87.0	49.0
2	Proteins	12.0	10.0	14.0
3	Fat	11.3	Nil	32.0
4	Carbohydrates	1.0	1.0	1.0

Table 9.4 : Role of eggs in daily diet

Sr. No	Nutrients	Recommended daily allowance for a moderately active man	Quantity in eggs	Per cent daily requirement supplied by 1 egg
1	Energy (cal)	3000	90	03
2	Proteins (g)	70	6.6	10
3	Fat (g)	50	5.5	11
4	Calcium (g)	0.8	0.03	4
5	Phosphorus (g)	0.9	0.12	14
6	Iron (mg)	12	1.6	13
7	Iodine (mg)	0.1	0.005	05
8	Vitamin A (IU)	5000	500	10
9	Vitamin D (IU)	400	50	13
10	Vitamin B-^{1} (mg)	1.5	0.06	4
11	Vitamin B^{2} (mg)	2	0.16	8
12	Niacin (mg)	20	0.6	3

9.3.2 Designer eggs

Fig. 9.18 : Designer eggs

Fig. 9.19 : Normal eggs

In order to meet the growing demand of health conscious consumers, nutrient content of the normal eggs can be modified to provide nutrients above and beyond what normally found in the normal eggs are called as designer eggs.

"Designer eggs are those specially produced eggs which are rich in additional nutrients and health promoting components like carotenoids, trace minerals, EPA and DHA like omega 3 fatty acids".

Do you know ?

Designer eggs prevent cancer causing factors, cardiovascular diseases (CVD) and improve immunity and overall health status.

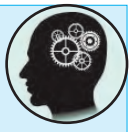
Production of Designer eggs

Designer eggs are produced by feeding special feed to chickens with sea kelp, flax seed and canola oil or other types of non-animal fats. Hens raised on this special diet will produce eggs with lower saturated fat that are fortified

with omega 3 fatty acids, iodine, selenium and vitamin E.

Remember...

Designer eggs are also known as "Supplemented eggs"



9.3.3 Grading of eggs

Try this...

Visit the local egg market and grade the eggs.

Grading is the classification of eggs into different categories. It helps in reducing wastage and facilitates uniform packaging, pricing and quality assurance to the consumers.

Egg grading involves inspection of

i. Egg weight

ii. Shell cleanliness and soundness

iii. Internal quality

a. Size of air cell

b. Firmness of albumen

c. Position of yolk

d. Blood and meat spots

Egg can individually flash candled to detect the above defects. The standards for table eggs are given in Table 9.8.

9.3.4 Preservation of eggs

Eggs are preserved as a shell eggs or liquid eggs.

A. Shell eggs

The methods for preservation of egg shell are based on simple principle of retarding the microbial growth and sealing the pores of the shell to minimize the evaporation of moisture and escape of gases.

Following methods are employed for effective preservation -

1. Thermal processing, 2. Immersion in liquids, 3. Oil coating and 4. Cold storage

1. Thermal processing

This includes heat treatment, thermo-stabilization and simultaneous coating and thermo-stabilization.

i. **Heat treatment :** Eggs are immersed for 2 to 3 seconds in water at 71^0C temperature. It destroys bacteria present on the surface of shell besides coagulating a thin film of albumen immediately beneath the shell membranes and thus seal the shell internally.

Table 9.5 : Grade designation and quality of table eggs produced in India

Sr. No	Grade	Weight per egg (g)	Shell	Air cell	White	Yolk
Grade "A"						
1	Extra large	60 & above	Clean unbroken & sound. Shape normal	Upto 4 mm in depth, particularly regular or better	Clear, reasonably firm	Fairly well centred practically free from defect. Outline indistinct
2	Large	53-59				
3	Medium	45-52				
4	Small	38-44				
Grade "B"						
1	Extra large	60 & above	Clean to moderately stained & sound. Shape slightly abnormal	8 mm in depth, may be free & slightly bubbly	Clear, may be slightly weak	May be slightly off centred out line slightly visible
2	Large	53-59				
3	Medium	45-52				
4	Small	38-44				

Source - Indian Poultry Industry, Year book 1990, 9th Edn.

ii. **Thermo-stabilization :** Eggs are immersed in water at various temperature.

49^0C for 35 minutes

OR

54^0C for 15 minutes

OR

56^0C for 10 minutes

OR

60^0C for 5 minutes

Heat stabilizes the thick albumen so that such egg remains fresh much longer than unheated eggs.

iii. **Simultaneous oil coating and thermo-stabilization :** These two processes complement each other in maintaining the internal quality of eggs.

2. Immersion in liquids

Under village conditions two liquids are used i. Lime water and ii. Water glass.

i. **Lime water :** The preservative effect of the lime water is partly due to its alkalinity. It deposits a thin film of calcium carbonate on the egg shell and thus partially seals the pores. The stepwise procedure is as follows.

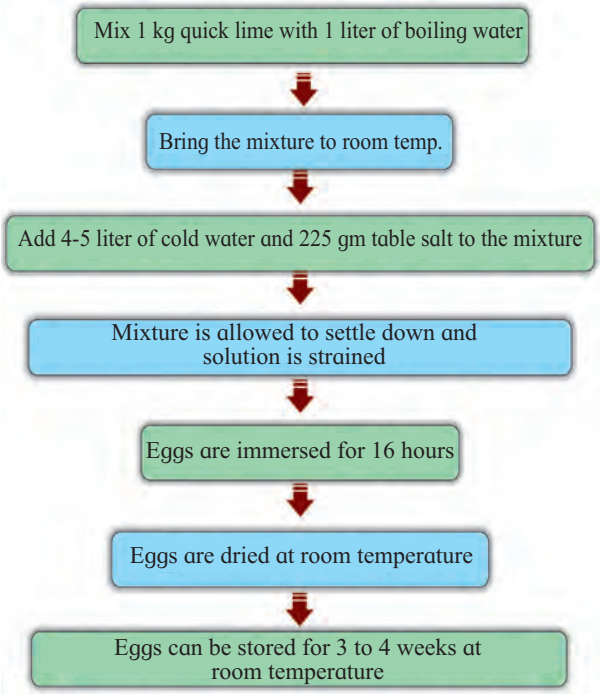


Fig. 9.20 : Preservation of egg

ii. **Water glass :** Dilute 1 part of sodium silicate with 10 parts of water, and the eggs are left immersed overnight in water glass. It deposits a thin precipitate of silica on the surface of egg shell.

3. Oil coating

Oil treatment preserves the eggs by forming a thin film on the surface of shell and thereby sealing the pores. The treatment should preferably be given within a few hours of lay to retain better internal quality. The vegetable oil used must be colourless, odourless, less viscous and free from fluorescent material.

4. Cold storage

For short period of storage, fresh eggs could be stored at 12.5 to 15.5^0C and 70-80% relative humidity. For long term storage, the storage temperature should be at 10^0C and 80-90% relative humidity. Eggs can be oil treated prior to cold storage to enhance their keeping quality. It can be done with eggs of small size like quail eggs.

Do you know ?

Egg can be stored at 12.5 to 15.5°C with 70 – 80 % relative humidity, 10°C with 80 – 90 % relative humidity for short and long period, respectively.

B. Liquid Eggs

Two methods are commonly used for the preservation of liquid whole egg. albumen and yolk separately, depending on their use.

i. Dehydration and ii. Freezing.

i. **Dehydration :** This method is used for preparation of whole egg powder. In this method moisture content of egg is reduced to 4-5%. Egg powder is packed in airtight sealed containers under nitrogen and it can be stored for more than 6 month at ambient temperature.

ii. **Freezing :** Rapid freezing is accomplished in an air blast at -1.1^0C, and the frozen whole egg, albumen and yolk should be stored at -32^0C or below.

9.3.5 Transportation of meat and eggs

Modes of transportation

Transportation of dressed carcasses for short distance, insulated containers of suitable thermal efficiency provided with adequate refrigeration can be used. For long distance transport specially built vehicle with refrigeration equipment is used. The temperature of ordinary vehicle can be controlled by solid carbon-dioxide containers attached to the roof of that vehicle.

Care during transportation

1. Care is to be taken to prevent surface contamination and the job to be done under hygienic conditions.

a. Placing the dressed carcass in a film envelope which is then sealed.

b. Wrapping the carcass in sheets of grease proof paper big enough to cover it completely.

2. As far as possible, temperature changes in the carcasses should be avoided during transport. The aim being to ensure that all carcasses travel at temperature below 50^0F.

3. Vehicle used for transport of dressed carcasses should be clean. Vehicle should be well equipped with hot, cold water, hose pipes, detergents, buckets, brass brooms etc.

A high degree of cleanliness should be maintained by all persons engaged in the handling and transport of poultry products.

Eggs transport

Fig. 9.21 : Transportation of eggs

Shell eggs packed for consumers be stored and transported under refrigeration at an air temperature not to be exceed 45^0F.

All packed shell eggs be labeled with a statement that refrigerations is required.

Exercises

Q. 1 Fill in the blanks

1. ---------- is the important constituent of milk for deciding the price of milk.
2. --------- is a whole, fresh clean and normal lacteal secretion of healthymich animal after 5 days and before 15 days of parturition.
3. --------- are the chemical substances that are added milk to check the growth of Micro-organisms and thus prevent spoilage of milk.
4. ---------- is the continuous method of pasteurization.
5. Titratable acidity of cow milk is ---------- % lactic acid

Q. 2 Make the pairs.

Group A	Group B
1. Lactose	a. Heat processing of meat.
2. Carotene	b. Batch pasteurization
3. L.T.L.T	c. Pigments.
4. Canning	d. Milk sugar
	e. Sucrose

Q. 3 Write true or false

1. Milk is sweet in taste, yellowish white in color and heavier than water.
2. Chilling is the important process to destroy all pathogenic organisms in milk.

3. Meat of goat is called as chevon.
4. Poultry eggs have very good nutritive value.
5. H.T.S.T. method of pasteurization in which milk is heated to 72°c(161°F) for 15-16 seconds and cooled to 50°c.

Q. 4 Identify odd one

1. Milk, Beef, Chevon, Chicken
2. Cow, Buffalo, Goat, Dog
3. Pasteurizer, Cooler, Homogenizer, stabilizer
4. Fat, Protein, vitamins, Lecithin

Q. 5 Answer in brief.

1. Give two objectives of pasteurization.
2. What are the preservatives?
3. What do you mean by fat soluble vitamins and give two examples.
4. Why the milk is called as complete food?
5. Give the importance of chilling.
6. Enlist the method of pasteurization of milk.
7. Write any two preservatives used for milk preservation.
8. Define organic milk and enlist any two features of it.
9. What do you mean by designer eggs?

Q. 6 Answer the following questions

1. Give nutritive value of poultry eggs.
2. Give chemical composition of poultry eggs.
3. Why kadaknath meat is so popular.
4. Write the objectives of storage of milk.
5. Give various methods of packaging of milk.
6. Give advantages of HTST pasteurization.
7. Write in short about horizontal type of milk silos.

Q. 7 Answer the following questions.

1. Write about grading of eggs.
2. Give the information about preservation of eggs.
3. Write in short about transportation of poultry products.
4. Write the steps for clean milk production.
5. Write in short about lime water treatment for preservation of milk.
6. Write about constituents of milks.

Q. 8 Answer the following questions in details.

1. Define pasteurization and explain HTST pasteurization in detail.
2. Write in detail about the preservation of meat.
3. Enumerate and explain the properties of milk.
4. Write about preservation of liquid eggs.

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

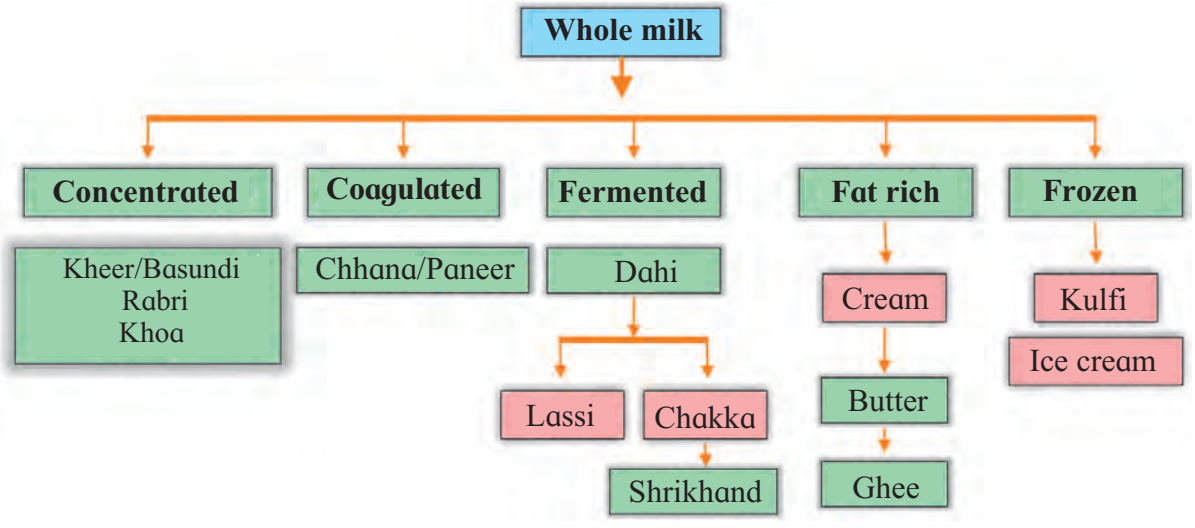


Fig. 10.1 : Indigenous milk products

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 table10.1

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?

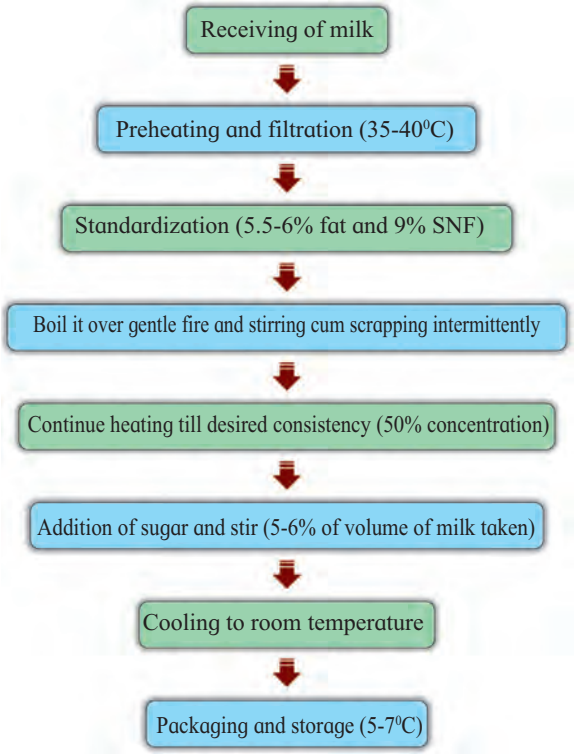


Fig. 10.2 : Method of preparation of Basundi/Kheer

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)

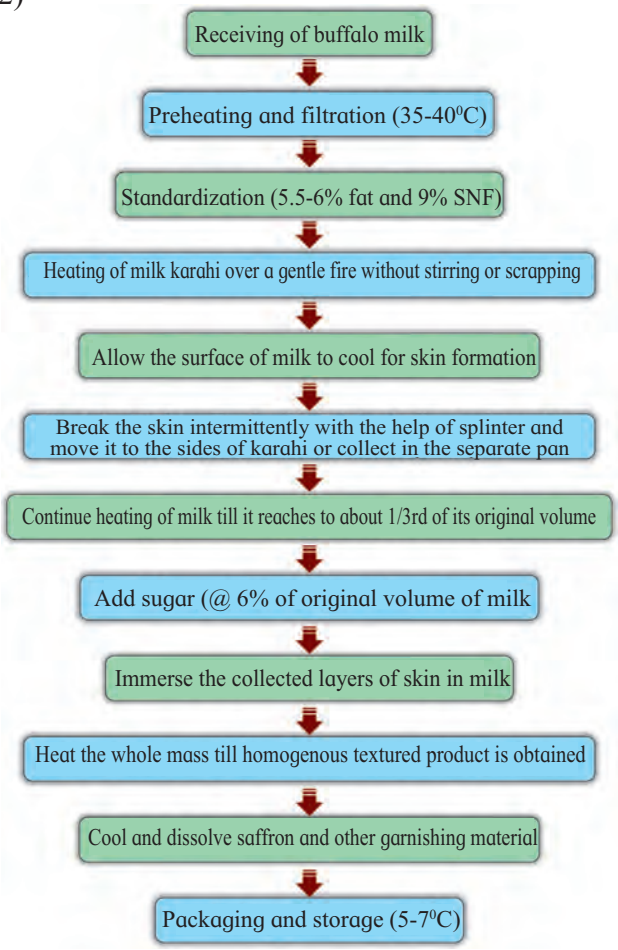


Fig. 10.4 : Method of preparation of Rabri

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

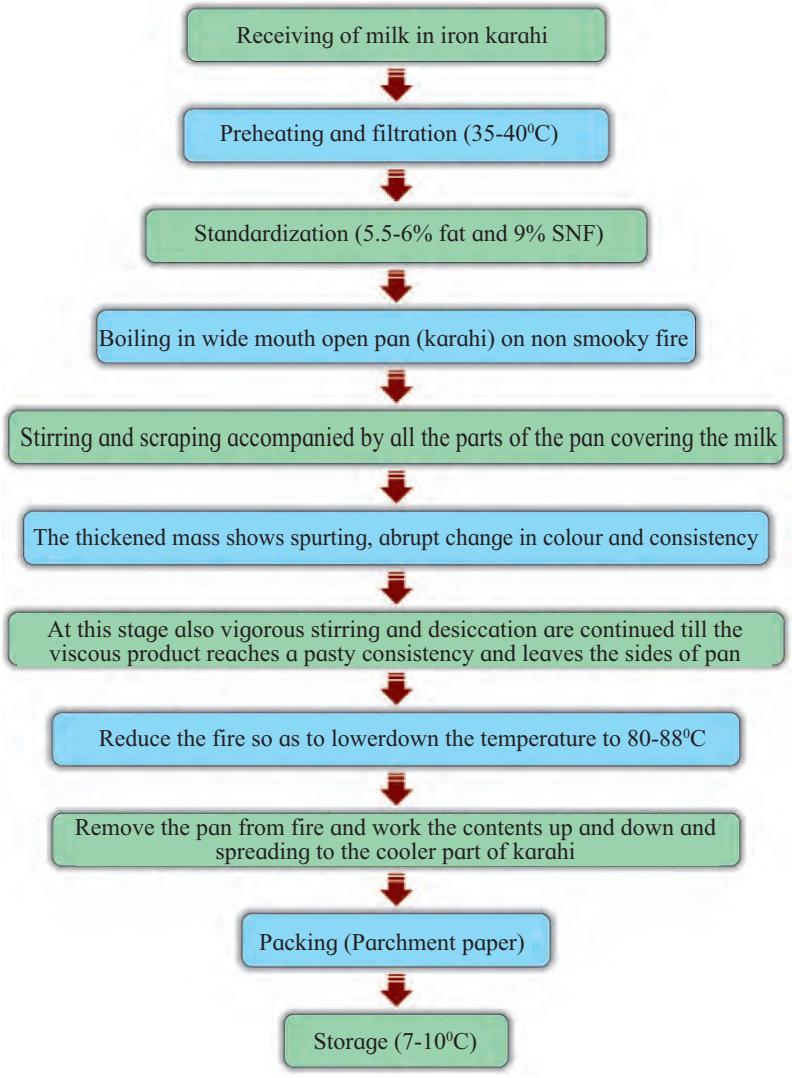


Fig. 10.6 : Preparation of Khoa by traditional method

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

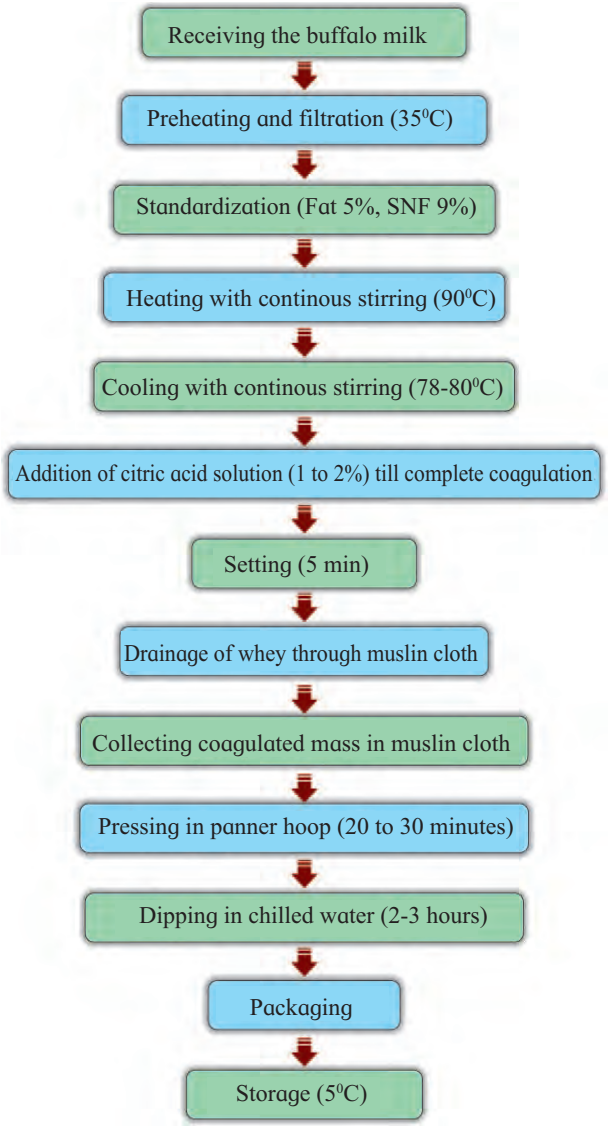


Fig. 10.9 : Method of preparation of Paneer

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%).

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-murkiand 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

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.

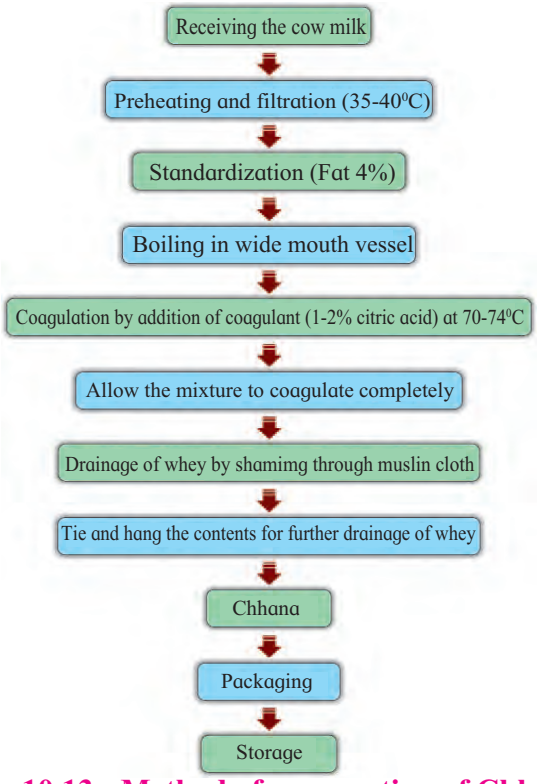


Fig. 10.13 : Method of preparation of Chhana

Remember...

Good quality chhana can be obtained from cow milk when it is coagulated at 82 ^{0}C temperature.

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.

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

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^{0}C). Incubation at same temperature for 16-18 hours to develop acidity. The product thus obtained is then transferred in refrigeration storage

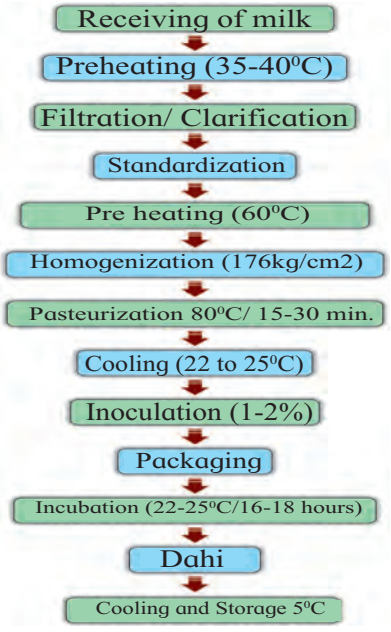


Fig. 10.15 : Method of preparation of Dahi

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 diactetylactics*, 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%

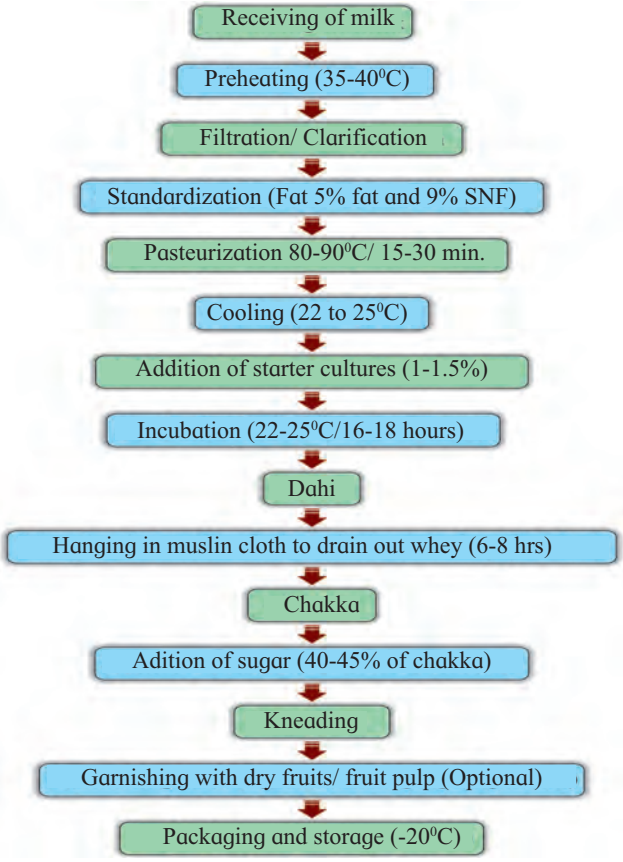


Fig. 10.17 : Method of preparation of Shrikhand

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.

Fig. 10.18 : Lassi

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

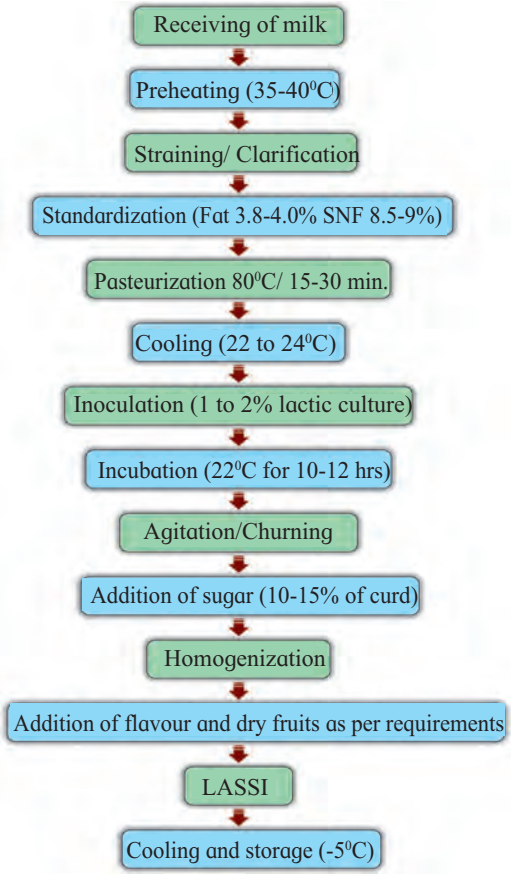


Fig. 10.19 : Method of preparation of Lassi

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 flavouredlassi)
- **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.
b. Light cream.
c. Coffee cream

} Contains 20 -25 % milk fat

d. Whipping cream
e. Heavy cream

} Contains 30-40% milk fat

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 ^{0}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 usedfor 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

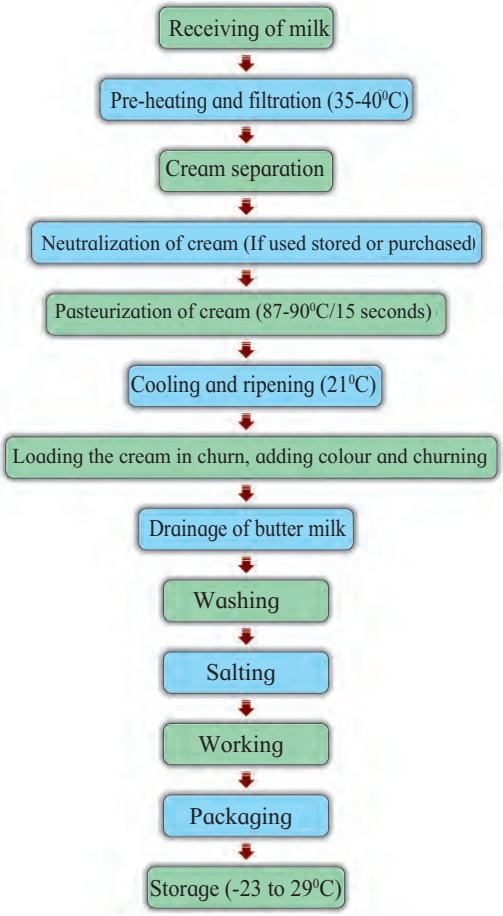


Fig. 10.21: Method of preparation of table butter

Some specific processing steps of butter

a. Preparing cream for churning : Adjust the temperature of cream between 9-11^{0}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 ^{0}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^{0}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^{0}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^{0}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:

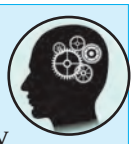
- For bulk packaging (25 to 50 kg) : paper board / corrugated board box, plastic tub or wooden boxes are used.
- For retail packing (25to 500g) : Parchment paper, grease proof paper, also in tin cans and aluminum foils, card board cartoons are commonly used in order to give added protection to the product.
- Normally shelf life of butter is 2 to 3 months under refrigeration while at -15 to -18^{0}C temperature butter will be stored for 9 months.

Fig. 10.22 : Wooden Butter churn

Fig. 10.23 : Wooden Butter worker

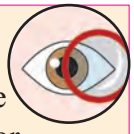
Yield : The yield of butter depends upon the percentage of fat present in milk and percentage of fat obtained in the butter.

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

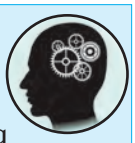
Ghee is clarified butter fat and occupies a very prestigious place in Indian dietary. Though cost wise ghee is quite expensive it is consumed extensively due to its characteristic flavour and aroma, unique taste and high nutritive value.

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	Unsaponiable matter		
	Carotene (µg/ g)	3.2 -7.4	-
	Vit A (I.U. /g)	19-34	17-38
	Tocopherol (µg/ g)	26-48	18-37
4	Free fatty acid (%)	Max 2.8 (Agmark)	
5	Charred casein, salts of copper and iron etc.	Traces	

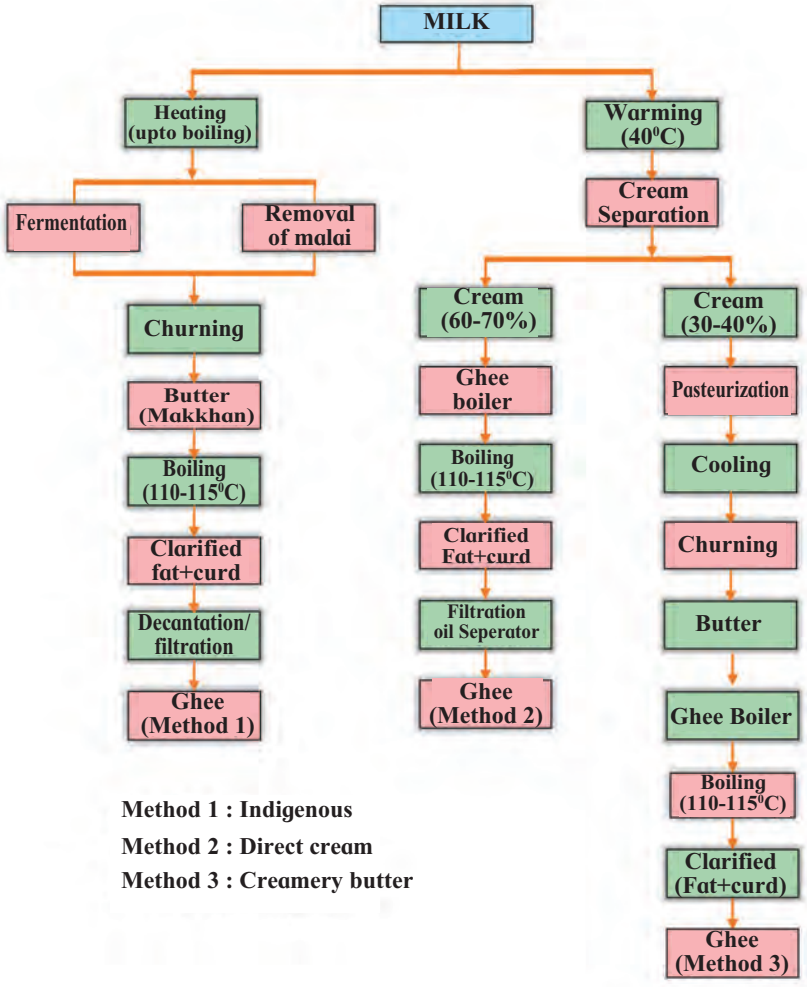


Fig. 10.24 : Different methods of preparation of ghee

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

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 - 29^0 C is about 6 months.

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

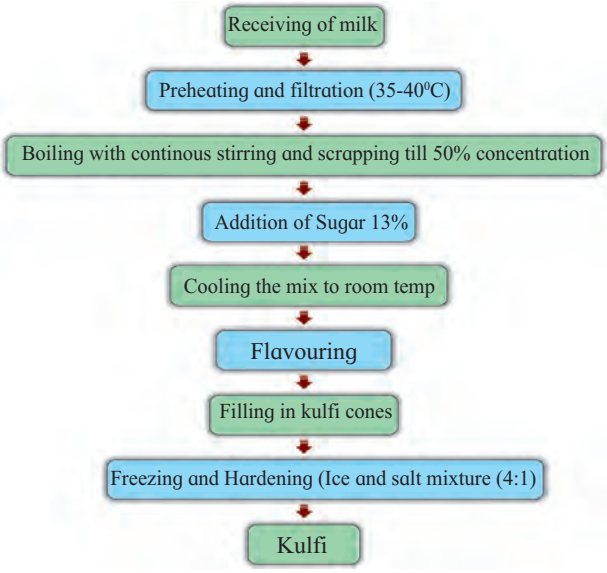


Fig.10.27: Method of preparation of Kulfi

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

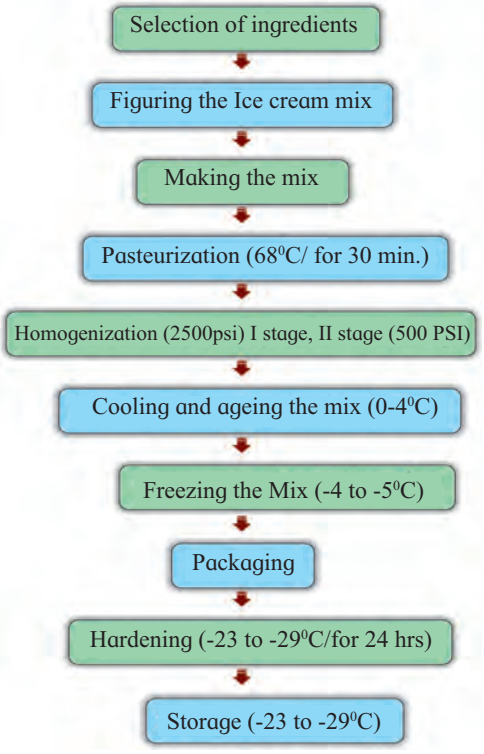


Fig. 10.31 : Method of preparation of Ice-cream

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 confirms 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.

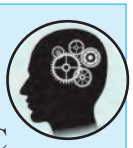
Remember...

In batch pasteurization system the product is heated in the vat to at least 68 ^{0}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 ^{0}C and then aged at this temp at least for 8 hrs.

Remember...



Ageing means holding the ice cream mix at temperature of 0 ^{0}C to 4 ^{0}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 %

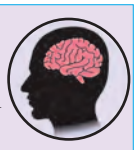
9. Hardening of ice cream : It refers to the second phase of freezing where freezing in packages is accomplished without agitation. Here the temperature is lowered to -23 to -29°C as quickly as possible. It is done in either hardening room or hardening tunnel or hardening cabinet.

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 150^0C for 20 minutes.
5. The internal temperature must reach 72^0C. 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^{0}C or steam without pressure or broiled in hot air oven at 165^{0}C for 2.5 to 3.0 hours.
3. The internal temperature of 70 ^{0}C must be achieved.
4. It is then given a cold shower and chilled at 4^{0}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 within 10 minutes.

Fig. 10.35 : Meat balls

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^{0}C for three minutes to get brown colour and fried flavour.
4. Alternately these are cooked in hot water maintained at 80^{0}C for 10 minutes to get an internal temperature of 65-70^{0}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^{0}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^{0}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, chikenshahi 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 sound 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 4^0C.

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 70^0C.
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 Hyderabadi Biryani

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

The ingredients used for preparation of Hyderabadi biryani are….

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

Fig. 10.43 : Hyderabadi 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	Group B
1. Chakka	a. Rossogolla
2. Ghee	b. Lassi
3. Chhana	c. Clarified milk product
4. Stabilizer	d. Shrikhand
5. Kulfi	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)**

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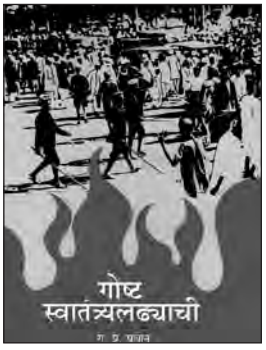

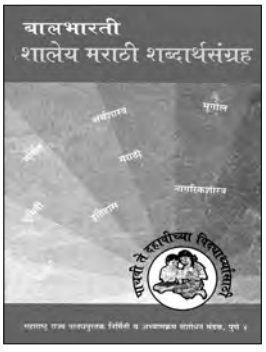

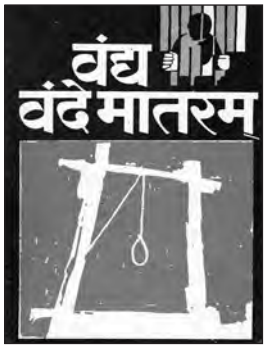

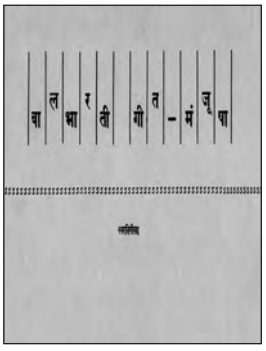

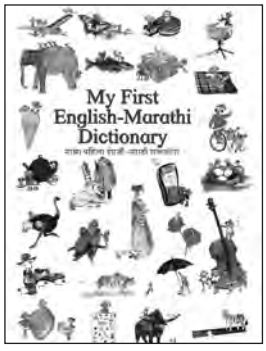

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Maharashtra State Bureau of Textbook Production and Curriculum Research, Pune- 411 004.

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