UNIT 3 EGG HANDLING, GRADING, PRESERVATION, PACKAGING AND STORAGE

Structure

3.0 OBJECTIVES

After reading this unit, you will be able to:

- state how to handle the eggs during collection, transportation, packaging and storage etc;
- narrate the process of candling of eggs;
- grade the eggs according to Indian standards and U.S. standards;
- pack the eggs properly;
- state the requirements for transport of eggs safely;
- store the eggs properly;
- describe the changes occurring during egg spoilage; and
- describe the techniques to preserve the egg.

3.1 INTRODUCTION

The quality of an egg is governed by both external and internal factors. The external factors include size, shape and conditions of the shell whereas internal factors include air cell size, conditions of albumen and yolk. All these factors are important for consumer acceptability. The quality of egg can be evaluated by candling procedures.

It helps in detecting cracked and abnormal eggs such as egg with blood spot. The eggs are graded for marketing purposes. They can be graded according to size, weight and other quality factors. Freshly laid eggs are of good quality but as aging proceeds, various physical and chemical changes sets in resulting in deterioration of egg. To enhance the shelf life of an egg various preservation methods can be used. Proper packaging and storage system are also required for maintaining the quality of egg.

3.2 EGG HANDLING

One must know how to handle the egg at different stages - from the production to consumption. It is not possible to maintain high quality of egg without proper handling. After collection of eggs from layer house following steps should be followed:

- Eggs should be collected in coated wire baskets or plastic container to facilitate cleaning and disinfection. Metal containers are not generally used to avoid rust.
- Eggs should not be stacked too high to avoid breakage. These should be washed properly as soon as possible after collection. This reduces the chances of contamination and loss of interior qualities.
- For cleaning of dirty eggs, mild detergent can be used.
- Eggs should be washed with little warmer water so that egg contents swell and push the dirt away from the pores.
- Eggs should not be cooled before cleaning because egg shell may contract and pull any contaminant from the surface to pores during cooling.
- After washing, eggs are cooled and dried.
- Eggs should be stored as large end up. At least 75% relative humidity and temperature below the ambient temperature should be maintained in the storage for highest quality eggs.
- Eggs should not be kept in a place close to onions, potatoes, apples, kerosene or strong odour of any kind because eggs absorb odour during storage.

Proper handling during transport and storage is very important which will be discussed later in this unit.

3.3 EGG GRADING

Quality is the sum of the characteristics of given food item which influences the acceptability or preference by the consumer. Grades are used to classify a commodity into different levels or ranges of quality such as good, better, best or C, B and A grades. Standard is the description of one or more characteristics of food which divide those in the market into two or more groups called grade. Grades are based on standards. Eggs are usually graded according to established standard. In U.S.A, these are graded according to U.S.D.A standard which have been developed based on their exterior and interior quality parameters. In India, eggs are being graded as per egg grading and marketing rules, 1968. Following grading, egg and containers are marked by the grade designation and the word "Agmark". Recently, the Bureau of Indian Standard (BIS) has also come up with standard for grading eggs, taking into consideration both exterior and interior quality of eggs.

3.3.1 Candling of Egg

The commercial method of determining the interior and exterior quality of a shell egg

is by candling. This method involves: (i) holding the egg before a suitable light at about elbow level with the air cell upward as shown in Fig 3.1, (ii) giving a quick twist in order to start the contents whirling. This makes the interior of the egg visible and the exterior of the egg more visible. This helps to see the condition of the shell, the size of the air cell and whether the yolk is well centered (a sign that the white is thick, as it holds the yolk in position). Thus it makes air cell, egg white, yolk, blood spots and other contents easier to distinguish.

During candling, the shell is examined for porosity, cracks and cleanliness. If there is any white line on the shell, then there is a cracked egg. Cracked eggs should not be stored but consumed as soon as possible or discarded. The size of air cell should be checked. The distance between top and bottom of the air cell, when the egg is held with air cell up, is measured as depth of the air cell. In a fresh egg, air cell is small and not more than $1/8^{th}$ inch deep. With the aging of the egg, air cell becomes larger due to evaporation and the egg is considered as low grade. The condition of albumen, its viscosity, presence of meat and blood spot is also visualized. Commercially, candling by flush candling and grading according to size/weight are done together followed by oil spraying on shell eggs.

Grading generally involves the sorting of products to quality, size, weight and other factor that determine the relative value of the product.

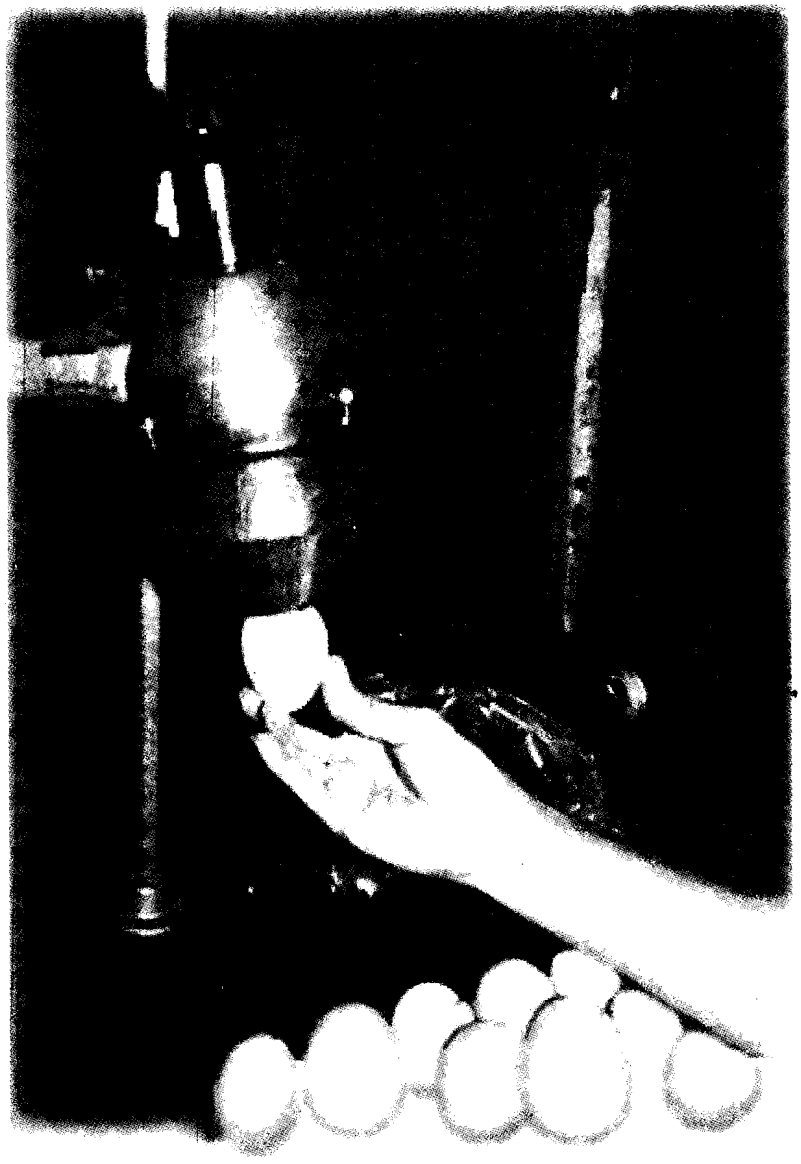

Fig 3.1: Candling of eggs

Advantages of grading and standardization:

- Provide uniform categories - is of economic importance to interstate and foreign trade.
- Give assurance of quality.
- Personal inspection is not necessary.
- A basis for settling disputes involving quality.

3.3.2 Quality Factors in Grading of Egg

The various interior and exterior quality factors used in grading eggs are as follows:

1. **Interior quality**

   (a) **Condition of the yolk**: Visibility of yolk, ease of its movement and shape are examined. In fresh egg, yolk is in the centre of the egg compared to old eggs. Presence of any blood spot or meat spot is also examined.

   (b) **Condition of the albumen**: Albumen should be thick and firm in fresh eggs.

   (c) **Condition of the air cell**: Air cell size is small in fresh egg and it increases with time of storage.

2. **Exterior quality**

   (a) **Soundness of the shell**: Shell may be broken, dented or may have cracks.

   (b) **Cleanliness of the shell**: It has consumer appeal. Shell should be free from any visible dirt.

   (c) **Size**: Eggs may be of jumbo size, extra large, large, medium, small, peewee size.

   (d) **Shape and texture of the shell**: Visual inspection reveals mis-shaped, rough or thin- shelled eggs.

   (e) **Colour of the shell**: It has consumer's preference. Brown shell are preferred than white shell but it has no significance in quality. Shell colour may vary from white to brown, depending upon the breed of the hen.

On the basis of above factors, Indian and USDA standards for quality of eggs are given in Table 3.1 and 3.2 respectively. Popular grading system in India is as per the Table Egg Grading and Marking Rules, 1968. Grades according to this rule are given in table 3.1.

Generally egg from pullet flock is of better grade compared to that of aged birds.

Table 3.1: Indian Standards for Table Eggs

Grade	Weight of Individual Egg (gm)	Weight per dozen (gm)	Weight per unit of ten (gm)	Shell	Air cell	White	Yolk
A. Extra large	60 and above	715 and above	596 and above	Clean, unbroken and sound shape normal	Upto 4 mm in depth, practically regular or better	Clear reasonably firm	Fairly well centred, practically free from defect, outline in distinct
A. Large	53-59	631-714	526-595				
A. Medium	45-52	535-630	446-525				
A. Small	38-44	456-534	380-445				
B. Extra large	60 and above	715 and above	596 and above	Clean upto moderately stained, sound and slightly abnormal	8 mm in depth. May be free and slight bubbly	Clear, may be slightly weak	May be slightly off centered, outline slightly visible
B. Large	53-59	631-714	526-595				
B. Medium	45-52	535-630	446-525				
B. Small	38-44	456-534	380-445				
Eggs which do not qualify under the above two grades, may be debarred for entering Trade Channels as fresh shell eggs.							

Table 3.2: Summary of U.S. Standards for Quality of Individual Shell Eggs

Quality Factor	AA Quality	A Quality	B Quality
Shell	Clean Unbroken Practically normal	Clean Unbroken Practically normal	Clean to slightly stained[a] Unbroken Abnormal
Air cell	⅛ in. or less in depth Unlimited movement and free or bubbly	3/16 in. or less in depth Unlimited movement and free or bubbly	Over 3/16 in. or depth Unlimited movement and free or bubbly
White	Clear Firm	Clear Reasonably firm	Weak and watery Small blood and meat spots present[b]
Yolk	Outline-slightly defined Practically free from defects	Outline – fairly well defined Practically free from defects	Outline – plainly visible Enlarged and flattened Clearly visible germ development but no blood Other serious defects
For eggs with dirty or broken shells, the standards of quality provide two additional qualities. They are:			
Dirty		**Check**	
Unbroken: adhering dirt or foreign material, prominent stains, moderate stained areas in excess of B quality		Broken or cracked shell but membranes intact, not leaking[c]	

Source: *USDA (1983A)*

[a] Moderately stained areas permitted (1/32 of surface if localized, or 1/16 of scattered).

[b] If they are small (aggregating not more than 1/8 in. in diameter).

[c] Leaker has broken or cracked shell and membranes, and contents leaking or free to leak.

Check Your Progress 1

1) Write the grade designation of table eggs according to Table Egg Grading and Marking Rules, 1968.

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2) What characters of the egg are used in measuring the quality of egg on the basis of candling?

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3) What is the specification for air cell of A and B grade eggs according to Table Egg Grading and Marking Rules?

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3.4 DETERIORATION OF EGG

3.4.1 Physico-chemical Changes

Egg starts to deteriorate in interior quality as soon as it is laid. The quality of eggs and their stability during storage are largely determined by their physical structure and chemical compositions. The fresh eggs have following characteristics:

Shell Colour: It may be white or brown.

Shell texture: Generally fresh egg shell is uniform and 0.35 mm thick. Eggs with dirty and poor shells should be avoided.

Shape: Usually egg shape is spherical with one broader and one comparatively narrower end. 'Shape index' is an indicator of egg shape. A fresh normal egg has a shape index of 72. Higher value indicates broader egg and lower value means longer egg.

Albumen quality: Fresh egg has thick, slightly cloudy and slightly greenish yellow colour albumen. Greenish yellow colour of albumen may be due to the presence of riboflavin (Vitamin B_2)

Yolk quality: Yolk of fresh egg is round, firm, yellow in colour and stands up well.

During storage, various physical and chemical changes result in deterioration of the egg. (Fig 3.2)

- There is loss of interior quality due to escape of CO_2 through pores of the shell.
- Loss of weight results from evaporation of moisture through egg shell pores. Therefore, it is better to store at 30°F and relative humidity (R.H.) 80-85%. The number and size of pores, temperature, R.H., length of storage time etc., affect the loss of moisture.
- The thick white flattens and decreases in amount. Yolk flattens; membrane weakens and breaks when egg is opened. Finally staleness occurs. Yolk gets stuck to inner membranes and rapid mold growth occurs.
- Tainting by odours of kerosene, gasoline, paint, varnish, onions etc. So, store away from such products.

Storage changes are mainly regulated by time, temperature and humidity of storage room. The first effect of storage change noticed in eggs in the enlargement of air cell due to evaporation of water from its contents. Transfer of water from white to yolk also occurs across the vitelline membrane due to difference in osmotic pressure. Thus vitelline membrane is distended. Other change noticed is liquefaction of white. Interaction of lysozyme and ovomucin in egg white is reduced with increase in pH, leading to liquefaction, since the maintenance of thick gel state of egg albumin is mainly due to the lysozyme and ovomucin complex.

Changes during storage can be summarized as:

- Increase in size of air cell.
- Loss of weight due to escape of moisture.
- Increase in pH of albumen and yolk due to escape of CO_2.
- Changes in egg contents as revealed by candling.
- Changes in thick and thin albumin.
- Yolk tends to migrate nearer to the shell.

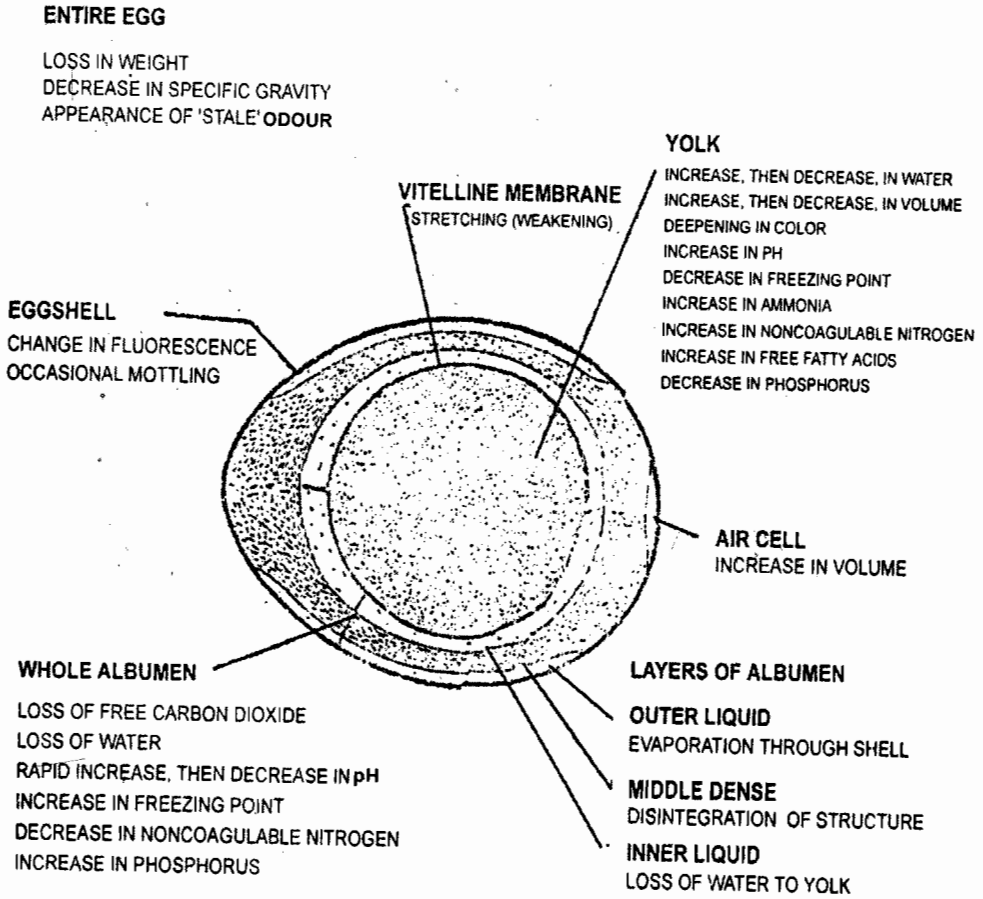

Fig. 3.2: Important changes that time produces in the intact avian egg

3.4.2 Microbial Changes

Organisms associated with egg spoilage are given below:

Bacteria

- *Proteus vulgaris*
- *Pseudomonas fluroscence*, P.ovalis
- Achromobacter
- *E. coli*
- Aerobacter
- *Staphylococcus aureus*
- *Clostridium sporogenus*

Moulds

- Penicillium
- Cladosporium
- Torula

Moulds create problems only when there are:

1. High temp
2. High humidity
3. Long time storage

Moulds may not grow well on albumen. If it wants to grow, it has to get contact with yolk as in the case of an addled egg.

The growth of microorganisms results in defects such as mustiness, sourness, green, black and red rots.

i) Mixed rots – H_2S is involved.

ii) Green rot – *Pseudomonas fluroscence* causes this condition. Under UV light, a bright green colour of the albumen is seen.

iii) Black rot – It is caused by *Proteus, Aeromonus, Pseudomonas*. On candling, egg appears opaque with blackened yolk.

iv) Red rot – It is caused by *Serratia spp.* H_2S is involved.

v) White rot or sour or addled egg indicates early stage of bacterial decomposition.

'Black light' is used to determine florescence in spoilage of egg.

3.5 PRESERVATION OF EGG

Following methods employed to maintain the quality of egg:

1. **Washing of eggs**
   i. Only dirty eggs are washed with water.

ii. Sanitizer is used as recommended by manufacturer.

iii. Water temperature should be 110° to 120° F for 3 minutes.

iv. Water should be changed after each batch washing.

v. Eggs are collected from different sources to one plant which takes care of bulk washing of eggs.

vi. Ultrasonic are also used for egg as cleaning agents.

2. **Thermostabilization:** This involves immersing the eggs in hot water. Different time-temperature combinations can be used. Three such combinations are given below:

Temperature	Time
130° F	15 minutes
142° F	2 minutes
212° F	5 seconds

Immersing the eggs in hot water (212° F or 100° C) for 5 seconds is known as flash heat treatment. Thermostabilization helps in stabilizing the albumen quality. Albumen immediately next to the shell gets coagulated by heat treatment and forms a fine peripheral film of albumen. This treatment also destroys the viable germ of fertile eggs and thereby defertilizes eggs. Thermostabilized eggs can be stored at room temperature for 3-4 weeks. But this method is time consuming, expensive and requires instrument to control heat. If temperature is not controlled properly it may result in cooked eggs. This method is not in practice.

3. **Cold Storage**: For short term storage (upto 2-3 weeks), eggs are stored at 4°C with relative humidity of 60-70%. Even the eggs can be stored at 15°C and relative humidity of 70-80% for short term storage. Dirty, cracked or low quality eggs should not be kept in the cold storage. To facilitate heat loss from the eggs proper air circulation is important in the storage room. The storage room should be attached with an anteroom to avoid entry of air. For long term storage, a temperature of -1.1°C with relative humidity of 85-90% is sufficient but eggs in shell should not be kept in the freezer.

Table 3.3: Storage Life of Egg and Egg Products in Refrigerator and Freezer

Product	Refrigerator (4°C)	Freezer (-18°C)
Raw eggs in shell	3 to 5 weeks	Do not freeze
Raw egg whites	2 to 4 days	12 months
Raw egg yolks	2 to 4 days	Yolks do not freeze well
Hard-cooked eggs	1 week	Do not freeze

4. **Lime water**: Slaked lime is mixed with cold water to make saturated lime water solution. Eggs are submerged in this solution for 14-16 hours. Lime water treated eggs can be stored for 3-4 weeks at room temperature.

5. **Oil coating**: It involves use of oil which seals the pores of the shell and thus prevents escape of moisture and CO_2 from egg content. Generally, light weight,

colourless, odourless mineral oil is used for this purpose. Eggs are either dipped or sprayed. Oil temperature should be 15-30^0 C. Oil should be food grade and egg surface should be dried completely before oiling. Oil treated eggs can be stored upto 3 weeks at room temperature. But this treatment may result in oil shine of the egg and cloudy albumen as CO_2 cannot escape from the egg.

6. **Water glass treatment**: Water glass refers to a solution of 10% sodium silicate. It seals the shell pores of the eggs without hampering egg quality. Cold solution is used for dipping the eggs. Water glass treated eggs can be stored at room temperature.

7. **Pasteurization of eggs**: Generally pasteurization is done for preservation of yolk or whole egg content. Shell eggs are also pasteurized by immersing in hot water for a specific time (62^0 C for 3 minutes or 64^0 C for 2 minutes). Main objective of this treatment is to destroy the egg-spoiling microorganisms. Temperature and time should be maintained very carefully; otherwise it may result into cloudy albumen. You will study more about pasteurization in the next unit under the heading of 'egg products.'

8. **Gaseous packaging**: Eggs can be over wrapped with cellophane or packed in plastic bag or retail cartoons with inert gas like CO_2. Higher CO_2 pressure in the package reduces CO_2 loss from the eggs thus preserves the egg quality. It is costly and not convenient method.

9. **Irradiation**: It preserves the egg quality but it is expensive and not practicable.

3.6 PACKAGING OF EGGS

Eggs are fragile products. The egg should be packed in such a way that they are exposed to a minimum of shaking, jerks and pressure during the journey. Transport damage is 2 to 5%, which can be reduced to 1% by using appropriate packaging material.

Rice husk, wheat chaff, chopped straw are used for packaging egg. It should be clean and odourless when used for local transport.

Different Containers used for packaging of eggs are:

1) Firm-walled baskets and boxes.

   (a) Wooden boxes. Top protected and securely sealed.

   (b) Plastic coated wire baskets.

2) Barrels.

3) Flat boxes.

4) Paper-board case with fillers and cup flats.

   Fillers: These consist of strips of paperboard which can be fastened with each other to form cuboidal cells for accommodating individual egg.

   Flats: These consist of pieces of moulded pulp and are used for being kept below and the top of a filler which nicely fits between them. On the upper surface, these have cups for the small ends of egg.

5) Wooden case with tray and paper board fitting--hold eggs securely in individual compartments.

6) Fiber egg cases.

7) Trays (aluminum frame): Trays can also be made up of washable plastics. These may be of wood pulp moulded to accommodate 30 eggs in six rows of round hollow. Stack one on top of another. Make firm pack without case.

Inner packing materials

For packing, you can use saw-dust, rice husk, straw, wood shaving etc., but, eggs packed in this manner cannot be transported in refrigerated vans. In this, packing materials may get moistened, and the putrefaction may set in after the consignment is removed from the van. In the modern system, fabricated materials called 'filler and flats' and 'egg cartons' are used.

In retail marketing eggs are packed in:

a) Paper board,

b) Moulded pulp cartons for 6 to 12 eggs, or

c) Paperboard with open sides.

Grade and size should be indicated on each package over wrappings.

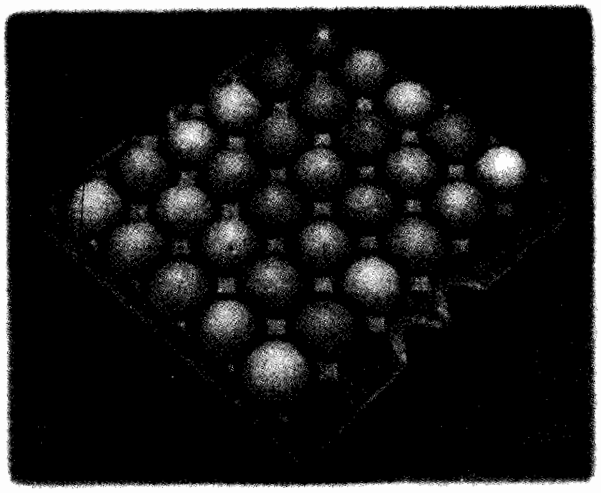

Fig. 3.3: Eggs in Tray

3.7 TRANSPORT OF EGG

The requirements for transport of eggs are:

- Good packaging material.
- Careful handling.
- Protection against temperature (30-46°F suitable) when transport needs more time (5-6 days).

Precautions

- Avoid condensation of moisture on eggs.
- Avoid excessive shaking.
- Stack tightly and tied down securely to minimize movements.
- Cover to protect from sun, heat, rain and extreme climate.
- *Preferably use refrigerated vans.*

3.8 STORAGE OF EGG

The eggs can be stored for 1 – 2 weeks at refrigeration temperature. The room temperature storage can leads to deterioration in quality within a week. They must be hold at constant low temperature for maintaining its quality. The production of egg is not uniform throughout the year. Therefore, it is important to preserve surplus eggs during peak season for distribution in the lean period of egg production.

For storage of eggs, following points should be considered:

- Eggs should be stored small end down in egg carton to keep the air cell stable.
- Temperature and relative humidity of the storage room should be maintained carefully. Eggs should not be stored at or above room temperature or at low humidity (lower than 70-75%). In warm dry environment, interior qualities of egg drop quickly.
- Eggs should not be stored in a close vicinity of any odourous material like onion, fish etc.
- Date should be mentioned in egg carton so that oldest eggs be sold first.

The various methods such as storage under CO_2, spraying mineral oil and thermostabilization employed to extend storage life of eggs have already been discussed.

3.9 FACTORS INFLUENCING A QUALITY EGG PROGRAMME

i) **Breeding**: High egg quality starts with good breeding. Important egg quality factors such as egg weight, shell texture, shell thickness, shell colour and albumen height may be inherited.

ii) **Rearing**: Any hen that is expected to lay high quality eggs over an extended period of time must have been properly grown as a pullet. Only strong, healthy pullets can be expected to give maximum results in the laying house. Confinement rearing of pullets may be practiced where adequate housing is available. Eggs of the highest interior quality are usually laid by pullets. Confinement rearing results in clean egg as birds are reared in clean environment.

iii) **Nutrition**: A balanced diet is essential for high production of eggs of good quality. Special attention must be given to supply adequate amounts of vitamins A and D, and calcium, if good shell quality is to be maintained. The misuse of certain feed additives may adversely affect egg quality. Layers must be confined at all times if eggs of uniform yolk colour are to be produced. Xanthophyll, Nicarbazine (drug), Gossypol, (of the cotton seed cake) in the feed produce olive yolk and pink albumen. A deficiency of Vitamin K may cause an increase in the number of blood spots. Flocks of good breeding on a good ration should not have a blood spot incidence much over 1 per cent.

iv) **Disease**: Most outbreaks of disease or major flock disturbance will influence egg quality. The most common diseases severely affecting egg quality are Newcastle disease and bronchitis. These diseases are minimized by proper vaccination of the pullets.

v) **Laying stock**: Eggs from birds of different laying stock vary in the incidence of blood spot, meat spot, shell quality, egg size and albumen quality. Age of bird

also influences the quality of the egg. Initial egg quality declines with increase in age of birds.

Age of bird	Haugh unit	Egg quality
26 weeks	87.8	good
39 weeks	75.2	decline
76 weeks	73.0	further decline

The higher number (Haugh unit), the better the quality of the egg (fresher, higher quality eggs have thicker whites).

vi) **Management**

Litter: Dry litter (bedding material) is essential. The use of built-up litter and adequate ventilation help to keep litter dry.

Nests: Clean eggs can be produced only when nests are filled with clean nesting material and are adequate as to number and size. Hens prefer darkened nests. All nests should have a minimum of light and equal light if hens use them uniformly.

Waterers: Automatic waterers with a wire platform underneath are recommended. An abundant supply of water is essential for high egg production. There should be approximately one pound of water for each dozen of eggs.

vii) **Collection of eggs**: Eggs should be gathered at least three times per day. The exact time will vary according to the rate of lay and season of the year. A suggested schedule for gathering is 9:30 a.m., noon and 4:30 p.m. Heat is the worse enemy of quality. Always eggs should be gathered in a wire basket.

viii) **Cooling of eggs**: A fresh laid egg has a temperature of approximately 107°F and will deteriorate rapidly unless cooled at once. Eggs should be cooled as soon as they are laid and kept cool until ready for use by the consumer. The best temperature for holding market eggs on the farm is from 50 to 60°F with a holding room humidity of approximately 75%. Any poultry man making egg production a major farm enterprise is usually justified in installing mechanical refrigeration equipment for cooling eggs. Eggs should not be packed until they have thoroughly cooled.

ix) **Cleaning of eggs**: Dirty eggs should not be a serious problem if proper housing and management practices are followed. However, dirty eggs and those with heavy stains cannot go into Grades A or B. Therefore, dry cleaning or mechanical washing of dirty eggs is recommended. In an immersion type washer, the water should be thermostatically held at 120°F and eggs should not be washed longer than 3 to 5 minutes. The detergent should contain a sanitizer to reduce microbial growth. Certain egg laying farms are installing in-plant egg washers to eliminate the need of washing on the farm.

x) **Shell Treatment**: The purpose of shell treatment is to partially seal the pores of the shell thus reducing the escape of H_2O and CO_2 from the egg. Farm shell treatment normally consists of spraying a light weight mineral oil on the upper portion of the eggs as they are being cased after being cooled.

Following table summarizes the various quality defects encountered in egg, their cause and remedy to prevent those problems.

Table 3.4: Egg Quality Trouble Shooting Chart

Problem	Cause	Remedy
Large air cells	1. Holding too long. 2. Too high temperature and low humidity in holding room.	1. Market more frequently. 2. Provide 50-60°F temperature and 70-80% humidity in egg room. 3. Supply adequate oyster shell and grit to hen.
Blood or meat spots or bloody eggs production	1. Ruptures of blood vessels during egg formation.	1. Avoid excitement or injury of birds. 2. Good diet
Blood rings	1. Partial germ development in fertile eggs.	1. Remove males from flock. 2. Cool eggs to below 60°F promptly
Heavy yolk shadows (when Candling)	1. Weak, watery whites. 2. Holding two long.	1. Keep eggs at 50-60°C. 2. Market 2-3 times a week.
Dark Yolks	1. Feeding pigmented feeds or too much green.	1. Confine birds to house, reduce pigmented. 2. Keep eggs at 50-60°F.
Weak, watery whites	1. Too high temperatures for holding eggs. 2. Holding too long. 3. Disease, especially Newcastle. 4. Breeding characteristic of birds.	1. Keep eggs 50-60°F and 70-80% °F humidity. 2. Market more frequently 3. Prevent respiratory disease. 4. Change strain of birds if other measure do not give results.
Heat spots	1. High holding temperature. 2. Time held. 3. pH of egg.	1. Hold eggs at 50-60°F.

Check Your Progress 2

1) How are the blood or meat spots produced in the egg? What remedies would you suggest to reduce their occurrence?

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2) What do you mean by thermostabilization?

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3) Minute cracks on the shell can cause bacterial spoilage of eggs. Justify.

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4) Highlight the important changes that could occur during deterioration of the egg.

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3.10 LET US SUM UP

Quality of a food item is the ultimate criteria for its acceptance by the consumers. To produce high quality eggs, it is important to adopt good management practices right from the breeding and rearing of birds to the candling of eggs in the retail chain until it reaches the consumer. In this unit, you have learnt various quality factors used for grading the eggs. The deterioration in the quality during storage is due to the manifestation of various physical, chemical changes and microbial invasion in the eggs. To preserve market eggs, different methods such as low temperature storage, washing, oil treatment can be employed.

3.11 KEY WORDS

Air Cell : Space containing air in between the shell membranes of egg at broader end.

Albumen : White portion of egg content.

Albumin Index : It is the ratio between albumen height and albumen width and expressed as percentage of albumen width.

Blood Spot : Is a defect found normally on yolk surface. The egg is not passed for food.

Candling : Commercial method of determining exterior and interior quality of shell eggs in dark room by passing light to the surface of egg.

Fertile Egg : The egg contain embryo which is present in hatching eggs.

Grading : Sorting out market eggs according to weight/ quality.

Haugh Unit : A measurement used in determining albumen quality by the breakout method. When the height of the thick albumen (that immediately

surrounds the yolk) is correlated with the weight, it is expressed as Haugh unit.

Meat Spot : Is a defect found on albumen or chalaza. The egg is not passed for food.

Pullet Flock : Birds between 20 weeks to 50 weeks age (young chicken) for laying.

Shell : Outer covering of egg which protects/enclose egg contents.

Table Egg : Edible eggs derived as a product of poultry husbandry.

USDA : United States Department of Agriculture.

Yolk : Yellow portion of egg content.

Yolk Index : It is the ratio between height and diameter of yolk.

3.12 SOME USEFUL BOOKS/REFERENCES

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3.13 ANSWERS TO CHECK YOUR PROGRESS

Check Your Progress 1

1) According to Table Egg Grading and Marking Rules, 1968, Grade designations of table eggs are:

(i) A. Extra large, (ii) A. Large, (iii) A. Medium, (iv) A. Small,
(v) B. Extra large, (vi) B. Large, (vii) B. Medium and (viii) B. Small

2) Following characters are used in measuring the quality of egg on the basis of candling.

- Condition of Shell
- Condition of Air cell
- Condition of Yolk
- Condition of Albumen (white)
- Condition of Germ cell

3) According to Table Egg Grading and Marking Rules, air cell of A grade eggs should be upto 4 mm in depth and practically regular. According to this rule, air cell of B grade eggs may be upto 8 mm in depth, free and slight bubbly.

Check Your Progress 2

1) Blood or meat spots may be produced in the egg due to following reasons:

   - Ruptures of blood vessels during egg formation
   - Heredity
   - Deficiency of vitamin K

   Remedies to reduce the occurrence of blood or meat spots in the eggs include:

   - Good breeds
   - Good diet
   - Avoid excitement

2) Thermostabilization is a process of preservation of egg quality by the application of heat. This involves immersing the eggs in hot water of certain temperature for certain time. Eggs may be immersed for 15 minutes in the water heated to 130^0 F or for 2 minutes at 142^0 F water or for 5 seconds at 212^0 F water. Heat coagulates the albumen adjacent to the shell, thus stabilizes the albumen quality. It also defertilizes the egg.

3) Minute cracks on the shell can cause bacterial spoilage of eggs because of the following reasons:

   - Egg content has ideal nutrients for growth of micro-organisms.
   - Micro-organisms can gain entry to egg contents through minute cracks.
   - A chance of contamination is greater due to faecal matter adhering to egg shell.

4) Important changes that could occur during deterioration of the egg are listed below:

   - Loss of CO_2
   - Loss of weight due to escape of moisture from the interior contents.
   - Change in pH of albumen and yolk.
   - Increase in aircell size.
   - Intermixing of yolk and albumen in egg content.
   - Tainting due to storage along with odourous material like onion, garlic, paints, kerosene.