



# Methods of preservation of meat

**Module-21: Methods of preservation of poultry meat**



# INTRODUCTION

- Meat is a highly perishable food.
- Susceptible to deterioration by microbial growth, chemical change and breakdown by endogenous enzymes.
- Destroying microbial growth and enzymes using heating procedures (cooking and canning), or removal of water by drying or osmotic control.
- Use of chemicals to inhibit growth and, very recently, ionising radiation.
- Traditionally drying in wind and sun, salting and smoking to preserve it.



# *How to preserve meat*

## **Deep freeze**

- easiest way to preserve meat for the short term is freezing.
- meat wrapped tightly in foil or in plastic package.

## **Salt**

- used as a means of preserving meat.
- either rubbed on meat or meat is dipped in brine.



### ***Pickle the meat***

- using vinegar and spices
- vinegar keeps parasites and bacteria away for up to six months
- spices add taste to meat.

### ***Jerky***

- popular method of preserving meat
- drying out the meat



# *Meat preservation:*

- highly perishable due to nearly neutral pH (low acid food)
- high moisture and rich nutrients.
- good source for microbial growth
- various undesirable biochemical reactions leading to its deterioration.
- different procedures employed to stop the undesirable conditions



# *Various preservation methods:*

1. Chilling /Refrigeration
2. Freezing
3. Curing
4. Smoking
5. Canning
6. Dehydration
7. Irradiation



# *Chilling/Refrigeration*

- widely used method for short term storage
- slows down the microbial growth and enzymatic as well as chemical reactions.
- technique of preservation applied from ancient times
- meat was stored in natural caves where temperatures were relatively low throughout the year.



- Chilling reduces surface temperature
- enhance carcass drying resulting in reduction of microbial growth.
- Critical process in terms of meat hygiene, safety, shelf life, appearance and eating quality.
- temperature for chilling process ranges from  $1^{\circ}\text{C}$  to  $4^{\circ}\text{C}$ .
- slaughtering and meat cutting carried out under strict hygienic conditions.





- refrigeration begins with chilling of animal carcasses
- continues through the entire process of holding, cutting, transit, retail display and even in the consumer household before ultimate use.
- relative humidity generally kept 90%
- carcasses first held in chill coolers ( $15^{\circ}\text{C}$ ) to remove their body heat
- passed on to holding coolers ( $5^{\circ}\text{C}$ ).



- Poultry with high microbial load.
- Care taken during handling to check further microbial contamination.
- Refrigerated temperatures favor the growth of psychrophilic organisms
- Causing spoilage of meat occurs in due course of time.



- fresh meat maintains good condition for a period of 5-7 days at a refrigerated temperature of  $4 \pm 1^\circ\text{C}$ .
- Processed meat products are stored under refrigeration have long shelf life as compared to their raw ones.
- Processed products less perishable and life of poultry meat is 3-6 months under refrigerated conditions.



# Freezing

- best and most simple option for preserving poultry.
- process for long term preservation of meat.
- stops the microbial growth and retards the action of enzymes
- retains most of the nutritive value of meat during storage
- little loss of nutrients occur in the drip during thawing process
- Meat wrapped in suitable packaging films before freezing to prevent it from under going freeze burn.



- slow freezing freezes the outer water more quickly as compared to inner water
- resulting in formation of larger ice crystals damaging the muscle tissue.
- fast freezing, forms various small ice crystals uniformly throughout the tissue.
- drip loss during thawing is low in fast freezing
- small ice crystals also impart it a desired lighter colour as compared to slow frozen meat.



## *Types of freezers:*

Different freezers are used such as;

- Plate type freezers with temperature  $-10^{\circ}\text{C}$ .
- Blast type freezers with temperature from  $-10$  to  $-30^{\circ}\text{C}$ .



# ***Curing:***

- It is a heavy salting age old practice.
- widely used method of preserving meat before the days of refrigeration.
- done for imparting specific flavor and colour development, in addition to preservative effect.
- main ingredients include sodium chloride, sodium nitrite, sodium nitrate and sugar.



# ***Properties of ingredients:***

## **Sodium chloride /common salt;**

- inhibits the growth of spoilage bacteria by dehydration and alteration of osmotic pressure
- slows down the action of enzymes.
- reacts with fatty acids to enhance the flavor of the cured products.
- contributes to the tenderness of the product.





## **Sodium nitrates and nitrite;**

- responsible for imparting the attractive cured meat colour and
- characteristic cured meat flavor.
- Nitrates and nitrites permitted levels ;500 ppm and 200 ppm respectively
- inhibit the growth of a number of bacteria especially Clostridium botulinum.
- also retard the development of rancidity.



## **Sugar;**

- suppresses the harsh hardening effect of salt
- adds to the flavour development
- also serves as an energy source for nitrate reducing bacteria in the curing solution.
- Mainly sucrose or dextrose used for this purpose



# ***Smoking:***

- known to man as a preservation for a long time.
- meat is subjected to smoke house, where saw dust or hardwood are subjected to combustion at a temperature of about 300°C.
- High temperature desirable to minimize the production of carcinogenic compounds.
- Smoke generation accompanied by formation of numerous organic compounds (aldehydes, ketones, organic acids, phenols etc) and their condensation products.



- Aldehydes and phenols condense to form resins
- contribute most of the colour of smoked meat products.
- Phenols act as bacteriostatic
- formal- dehyde as bactericidal compound besides imparting characteristic smoky flavor.
- Preservation also due to surface dehydration,
- lowering of surface pH and antioxidant property of smoke constituents.
- Curing and smoking of meat are interrelated



# ***Canning:***

- applying heat to sealed food container in order to destroy microorganisms
- thermal sterilization of a product held in hermetically sealed containers is achieved.
- preserves the sensory attributes such as appearance, flavor and texture to a large extent.
- have a shelf life of atleast 2 years at ambient temperature.



## **Canning process is performed as;**

- Lean and clean meat taken and mixed with gravy
- prepared using condiments, tomatoes, dry spices, and salt in water
- cooked for some time so that all the ingredients get properly mixed in the water.
- mixture then precooked at 70°C for 15 minutes.



- filled in cans by leaving proper headspace.
- exhausted to remove the air from the container.
- seaming is done and then retorting or thermal processing to achieve sterility.
- At last cooling performed followed by storage at cool and dry place.



# ***Dehydration:***

- oldest known method of preserving
- food dried and exposed to a temperature high enough to remove the moisture.
- process of removal of water from meat nutrients making them unavailable to the microorganisms.
- lowers the water activity considerably
- prevent the growth of spoilage organisms.





- Different drying procedures are employed such as mechanical drying, freeze drying, etc.
- Mechanical involves the passage of hot air with controlled humidity.
- Freeze drying satisfactory process, due to better reconstitution properties, nutritive quality and acceptability.



- Freeze drying involves removal of water from a food by sublimation
- keeping it under vacuum and giving a low heat treatment.
- Meat is first frozen at  $-40\text{ }^{\circ}\text{C}$ .
- Then dried under vacuum for 9-12 hours at low temperature in plate heat exchangers at 1 to 1.5 mm pressure of mercury.
- Ice crystals get sublimated to water vapour
- no rise of temperature.



# ***Irradiation:***

- Radiation is the emission and propagation of energy in the material medium.
- works by exposing meat to radiant energy
- destroys most but not all microorganisms.
- can destroy the microorganisms by fragmenting their DNA molecules
- causing ionization of inherent water within microorganisms.



- microbial destruction takes place without significantly raising the temperature of food.
- Irradiation referred as cold sterilization.
- Among radiations, alpha and beta-rays are used
- Gamma radiations produce desired effect only during food irradiation.
- dose of 50-100K rad enhance the shelf-life of fresh meat cuts and poultry products by 19 days



- dose of 4-5 Mrad can sterilize pork, poultry and fish.
- ultraviolet radiations of  $2650\text{\AA}$  are most bactericidal in nature,
- dose of 2 - 5 kGy extend the shelf life of poultry stored at  $1-3^{\circ}\text{C}$  by 8-14 days.

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