

Meat Preservation



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Chemical Changes in food during Preservation

The primary purpose of food preservation is to prevent food spoilage.



The primary cause of food spoilage

is the action of microorganisms; bacteria, moulds, or yeasts aided by enzymes.



Under unfavorable conditions the
microorganisms die or fail to
develop

As

physical means

Chemical means

Combination of physical and chemical
means

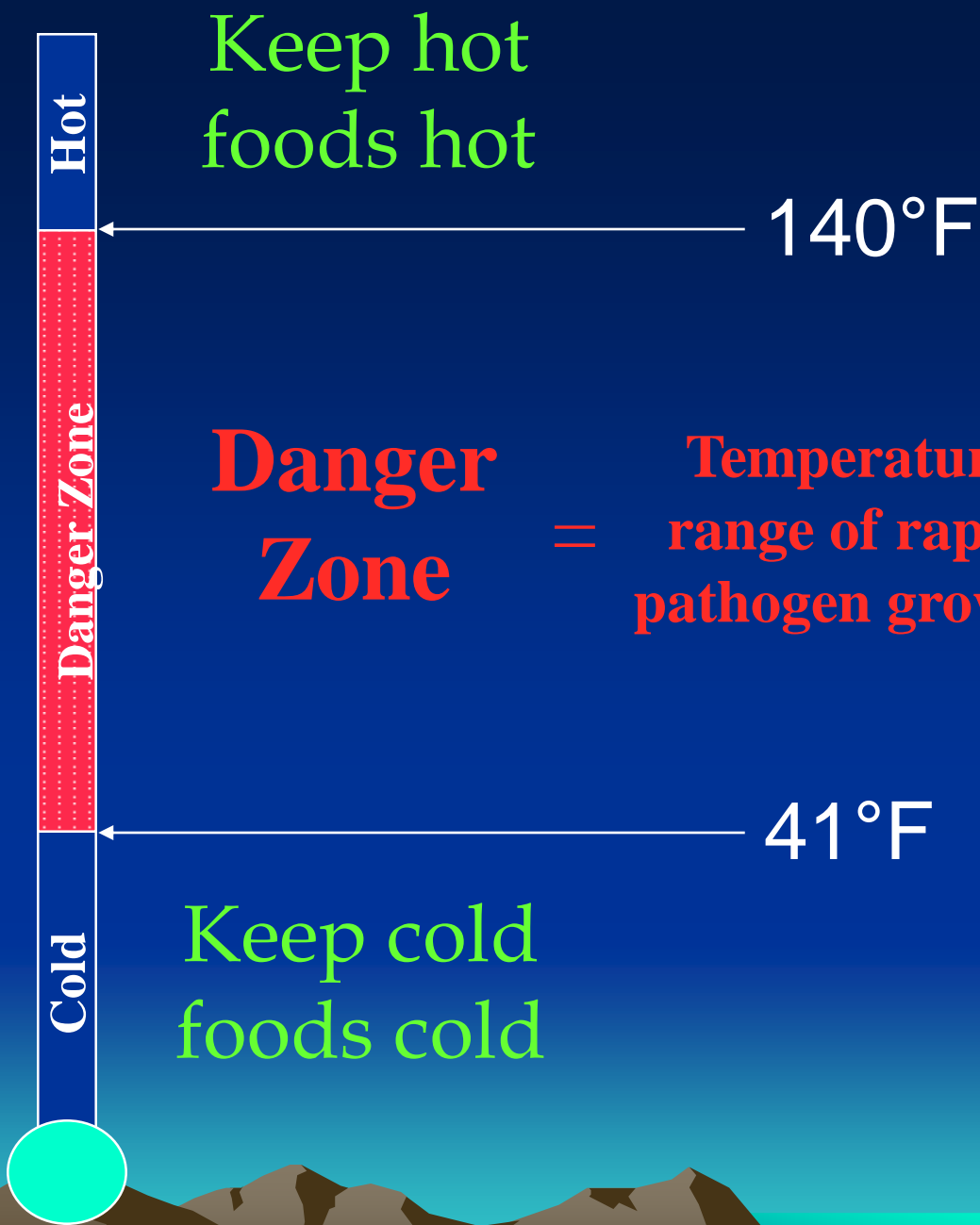


The principle of all food preserving methods

is the creation of conditions unfavorable to the growth or survival of spoilage microorganisms by for example extreme heat or cold, removal of water and some times oxygen , excess of saltiness or increased acidity .



“Food Safety
Thermometer”

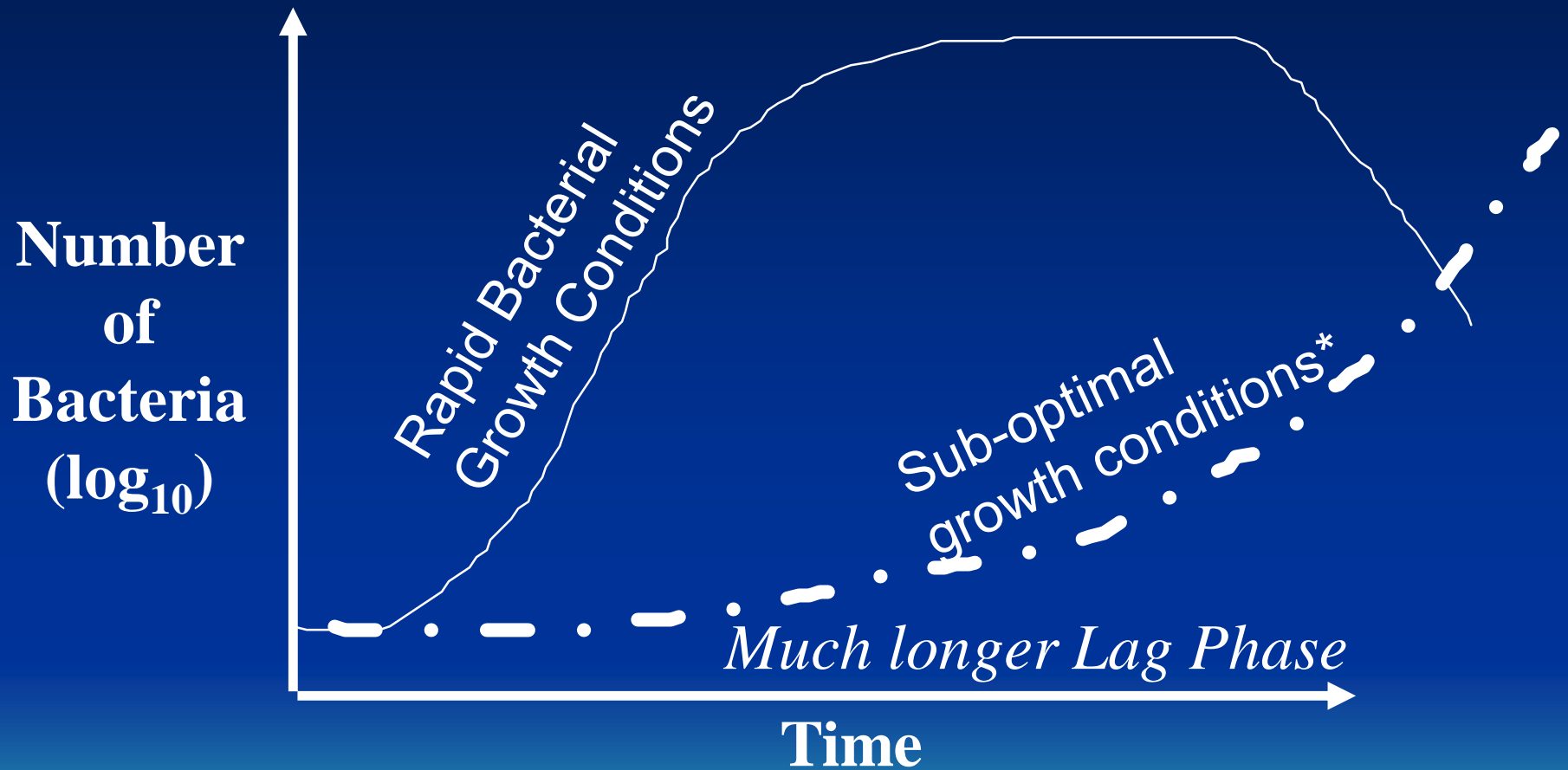


Methods of preservation

drying, curing, cold, heat, chemicals and irradiation

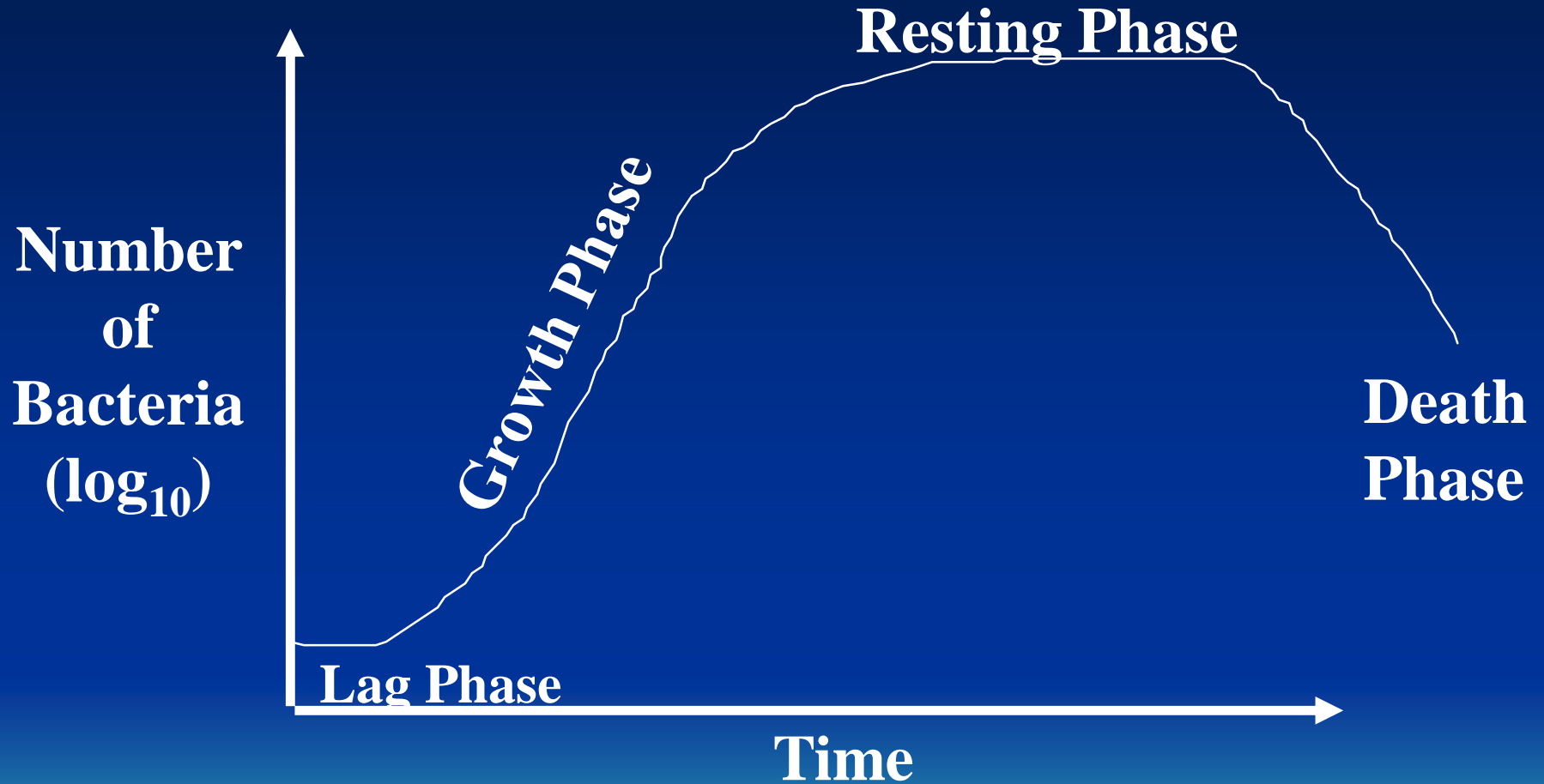


Changing the Bacterial Growth Curve



*Sub-optimal means lowered: pH, A_w , Temperature, etc.

Bacterial Growth Curve



Drying (Dehydration)

The meat should be cut into strips for easily removal of water.

Dried meat contains 10 % water.

Inactivation of bacteria till reach 12 % water in the product .



Drying methods

- 1-Sun drying:
- 2- Mechanical dryers
- 3- Sublimation (Freeze drying)
- 4- Smoking then drying
- 5- Cure drying
- 6- Electronic drying



Affections

1-Mould growth : R.H. of air over 75 %

2-Hardening of surface

3- Public health dangers :

a- Salmonella

b- contamination due to handling ,
preparation and storage



Refrigeration or Cold Storage

- 1-Natural type : put in or on ice
- 2- Mechanical type : by using ammonia , Freon , or methyl chloride



Chilled meat

At 0 to -1 C

Chilling methods

1-Traditional

2- Quick chilling

3-Ultra – rapid chilling



Changes in chilled meat or affections

- 1-Conditioning ,ripening or maturation
- 2-Shrinkage
- 3-Soiling
- 4- Absorption of foreign odor
- 5- Sweating
- 6- Loss of bloom
- 7-Chemical changes
- 8-Spoilage a-Mould formation b-bacterial decomposition



Effect of CO₂

CO₂ in less than 20 % to prevent formation
of metamyoglobin



Effect of exposure to air

Myohemoglobin may be converted to
Metahaemoglobin (brown color) due to
exposure to air



Frozen meat

Freezing rate

1-Slow Freezing

-15 to -29 C

36-72 hours

ice crystals 12mm x 3mm

2- Rapid freezing

-18 to -40 C

30 minutes

ultra microscopic ice crystals 0.001 – 0.002mm



Freezing methods

- 1-Still air freezing
- 2-Blast freezing
- 3-Direct immersion freezing
- 4-Cryogenic freezing
- 5-Plate freezing



1-Still air freezing

At -10 to -30 C

Placing packaged or loose foods in suitable freezing rooms till freezing



2-Blast freezing

As still air but using a compressor

Push cold air to pass over, under and through the food

Air temperature -10 to -40 C

Air velocity 15 m /s



3-Direct immersion freezing

Direct immersion of food in a liquid refrigerant as NaCl ,glycerol , and sugar solutions

Liquids must be:

Safe , non toxic , cheap , with low viscosity , good heat conductors



4-Cryogenic freezing

The best method of quick freezing use condensed gases such as

liquid nitrogen (-195C) or liquid nitric oxide (- 79 C) and Freon (- 30 C)

Advantage :

1- non toxic

2-minimize oxidative changes

3-less dehydration

4-less drip



5-Plate freezing

By indirect contact with refrigerants
food is placed on cold plates or walls.
Food may be packed in a can



Effect of freezing on m.o. and parasites

Anthrax bacilli can resist -130 C

Salmonella to -175 C for 3 days

T.b. 2 days at -10 C

FMD virus 76 days

Swine fever virus 73 days

Trichinella spiralis at -15 C for 20 days

C. bovis at -10 C for 10 days

C. cellulose at - 10 C for 4 days



Changes in frozen meat

- 1-Physical changes
 - A-muscle plasma b-Ice crystal formation
- 2-Fungal formation
 - A-Stickiness : Wiping
 - B- black spots: *Cladosporium herbarium*
 - C-White spot: *Sporotrichum carnis* Wiping
 - D-Whiskers: *thamnidium elegans*: Wiping
 - E-Green bluish patches: *Penicillium spp*
 - F-Yeast : causing sliminess, lipolysis, off-odor and discoloration : Wiping



Changes in frozen meat

- 3-Fat rancidity
- 4-Freezer burn
- 5-Brine staining : CaCl₂: dull or pale greenish color , bitter taste: trimming
- 6-bacterial slime
- 7-bone taint
- 8-Weeping or dripping



Canning

Preservation of food in a permanent sealed containers by the effect of heat ,causing destruction of microorganisms. permanent sealing is to prevent recontamination



Types of containers

- 1-Metal
- High conductivity of heat
- Opaque, to avoid bad effect of light
- Can not be easily broken
- 2-Glass



Canned food divided into

- 1-Acid food pH below 4.5 as fruits and some vegetables.
- 2-Low acid food pH above 4.5 as corned beef or corned pork or sheep, sea food.



Canning operation

- 1-Preparation and blanching of the food
- 2-Filling of the can
- 3-Exhosting
- 4-Processing
- 5-Cooling



Spoilage of canned food

- A- According to the cause
 - 1-Microbial
 - 2-Chemical
 - 3-Physical
 - 4-Rust or damage



Microbial spoilage

- A-Bacterial spoilage
- Factors influencing bacterial spoilage:
 - a-the types of microorganisms:
 - b-number of M.O.
 - c-Efficiency of processing
 - d-Access of air to the cans
- a-the types of microorganisms:
 - 1-Non spore forming bacteria
 - i-Proteolytic bacteria as pseudomonas, Achromobacter Flavobacterium
 - ii- Fermenting bacteria as Strept. thermophilus

2-Spore formers

- i-Aerobic bacteria
- Flat sour bacteria as *Bacillus subtilis*,
Bacillus mesentericus
- li-Anaerobic spore forming bacteria
- Putrefactive type produce gas as
- *Cl. botulinum*, *Cl. Sporogens*



B- Mould Spoilage



2-Chemical Spoilage

- A- Hydrogen swells
- B-Sulphiding
- 3-physical Spoilage
- 4-Rust & damage



B-According to the condition and content of the can (Appearance)

- 1-Flipper
- 2-Springer
- 3-Swelling
- 4-Leaker : Leaker test
- A-physical test
- B-hepp apparatus
- C-water bath
- D-Mohramann test E.coli broth
- E- silver nitrate grey blue clouds
- 5-Over filled cans 6-Flat souring



Electromagnetic radiation

- 1- Ionizing radiation (short wave radiation)
- (Cold sterilization)
- (X ray & Gamma rays)
- II-Non- ionizing radiation
- (Long wave radiation)
- (Heat sterilization)
- as Radio wave ,Infra red & UV rays



Preservation by Ionizing radiation

- Used for sterilization of canned , and refrigerated food even in combination with antibiotics
- Side effect:
- Change in colour, flavor , odour and texture of the treated food .

these reduced by irradiation at temperature below 20 C



Preservation by non- ionizing radiation

- Used to control surface spoilage of sausage, and meat kept at warm temperature or to sterilize air in cold stores
- Advantage of radiation:
 - 1-Extend the shelf life of food.
 - 2-Minimize high cost of refrigeration and canning
 - 3-used in defrosting frozen food and blanching of vegetables



Disadvantage

- 1-Induced radio activity.
- 2- Carcinogenic production.



Chemical means of preservation

- A- By antibiotics:
- 1-Taken as a part of normal feeding in small doses for long period.
- 2-in food in large doses for short period.
- 3-injection of antibiotic into living animal shortly before slaughtering.
- 4-injection into quarter by artery pump
- 5-applying either to surface or within the finished product.
- 6-aid in other processing of food treatment as canning, heat treatment or smoking.



B- By other chemicals

- To mask putrefaction
- Takes place by addition of
- 1- 2% sulfur dioxide
- 2- Borax dust
- 3-Burning sulfur and salt petre



Smoking

- Purpose of smoking
- 1-creation of new product
- 2- As a method of preservation
- 3- colour development
- 4- Flavor development
- 5- Antioxidant



Kind of smoking

- 1- Hot smoking at 35-60 C for 24-36 hours
- 2-Cold smoking at 22 C for 24 hours



Smoke mixture

- Phenol , cresol , formaldehyde , acetaldehyde, acids as propionic , lactic butyric, alcohols as methanol



The preservative action

- 1- Bactericidal
- 2- Surface dehydration
- 3- formation of crusts on surface by protein coagulation resist bacterial invasion
- 4- help in production of desirable flavor
- 5- help in production of desirable colour



Preservation by salting and pickling

- Salting use of dry salt
- Pickling use of salt solution



The value of curing agents

- A- common salt: sodium chloride
- 1- cause plasmolysis sharp cytoplasmic destruction

Gram negative plasmolysis easily

Gram positive very resistance

2- dehydration of food

3-ionized producing Cl^- ions harmful to bacteria

4- reduce solubility of oxygen

5-interfere with action of proteolytic enzymes



B- salt petre (Na nitrate or Na nitrite)

- 1- Act as colour stabilizer
- 2- reduced by air and light
- 3-in excess lead to hard meat
- 4-inhibit growth of Clostridium botulinum
- 5-retard development of rancidity.
- It is prohibited to use in canned baby food.
- Carcinogenic effect due to nitrosamine formation



nitrosamine

- Nitrite \rightarrow nitrous acid \rightarrow dimethylamine
- as secondary amino acid \rightarrow nitrosamine
- Formed during cooking
- This problem reduced by adding
- 550 ppm sod. Ascorbate + 120ppm sod nitrite or use K sorbate



C-sugar

- 1-counter act saltiness of salt and hardness of salt petre
- 2- sugar fermentation counteract putrefactive microorganisms growth
- 3-help in growth of certain bacteria help in flavor development
- 4-prevent nitrite oxidation



Storage stability of dressed poultry

Type	temperature	storage life	•
Chicken	-9 C	2m	•
	-12 C	4 m	•
	-18	10 m	•
	-22	18 m	•
Turkey	-12 C	3 m	
	-18 C	6 m	•
	-23	12 m	•
Duck and geese	-18 C	5-7 m	•



Thank you

