Contamination, preservation, spoilage of meat & meat products

Contamination

The healthy inner flesh of meats have been reported to contain few or no organisms,.

Staphylococci, streptococci, Clostridium, & Salmonella have been isolated from the lymph nodes of red meat animals.

Approved methods of slaughter- mechanical, chemical, electrical- have little effect of contamination..

But each method is followed by sticking & bleeding, which can introduce contamination.

Sources of contamination may be:-

Knives, cloths, air, & clothing of workers. During bleeding, skinning & cutting main source of micro-organisms are the exterior of the animal & intestinal tract. In the market, knives, saws, cleavers, slicers, grinders, chopping blocks, scales & containers.

Growth of organisms on surface, touching the meats & on the meat themselves increases their numbers.

IMPORTANT ISOLATED MICRO-ORGANISMS FROM MEAT	
PRODUCT	MICRO-ORGANISMS ISOLATED
FRESH & REFRIGERATED MEAT	BACTERIA:- *Pseudomonas, Aeromonas, Micrococcus, & Alcaligenes*
	MOLDS:- *Cladosporium , Geotrichum , & Mucor*
	YEASTS:- *Candida , Torulopsis , & Rhodotorula*
PRECESSED & CURED MEATS	BACTERIA:- *Lactobacillus & other lactic acid bacteria, Bacillus . Micrococcus, & Staphylococcus*
	MOLDS:- *Pencillium , Aspergillus , Rhizpus*
	YEASTS:- *Candida , Torula , Torulopsis*

Preservation

Meat is the most perishable food. Preservation of meats are more difficult than other foods.

So the preservation of meats is done by combination of preservative methods.

1. **Use of heat**

The canning of meat is very specialized technique – in that the procedure varies with the meat product to be preserved.

Chemical added to meats, such as, spices, salts, or nitrates in curing processes, also affect the heat processing, & make it more effective. Nitrates in meat helps to kill spores of anaerobic bacteria by heat & inhibit germination of surviving spores.

2. low temperatures

A. Chilling

Modern packing house methods involve chilling meat immedieately & rapidly to temperature near freezing. Chilling storage at only slightly above the freezing point.

The more prompt & rapid this cooling, cause less growth of mesophillic organisms.

The low temperature bacteria that grow on meat during chilling :- That is from species of Pseudomonas, Alcaligenes, Micrococcus, Lactobacillus, Flavobaterium.

B. Freezing

Freezing often is used to preserve meats during shipment over long distances,

for holding until times of shortage, quantities of meat now are frozen in home freezers.

The preservation of frozen meats is increasingly effective as the storage temperature drops from -12.2 to -28.9 C.

The freezing process kills about half the bacteria, and numbers decrease slowly during storage.

3. Use of irradiation

Irradiation with UV rays has been in conjunction with chilling storage to lengthen the keeping time.

The rays serve:- to reduce numbers of organisms in the air & to inhibit or kill them on the surface of the meat.

Gamma irradiation of meats still is limited because it cause undesirable changes in flavor & color.

4. Preservation by drying

Meat for drying should be of good bacteriological quality to avoid undesirable flavor.

Meat products, such as dry sausages preserved by their low moisture content & dryness.

Drying pork involves a short nitrate-nitrite cure before drying & addition of lecithin as an oxidant & stabilizer.

5. Use of prservatives

Sodium chloride & nitrate are commonly used.

Functions of the agents are:-

Sodium chloride- used as a preservative & flavoring agent. Its main purpose is to lower aw.

Nitrate used as a color fixative & has some bacteriostatic effect in acid solution.

6. Smoking:-

Smoking has two main purposes:-

To add desired flavors.

To aid in preservation.

7. Spices:-

Spices added to meat products to add their effect to other preservative factors.

8. Antibiotics

Antibiotics can be used successfully in meats to prolong storage life

The most often recommended antibiotics are:- chlortetracycline & chloramphenicol.

The antibiotics may be applied to meats in various methods-

1. It may be fed to more intensively for a short period before slaughter,
2. It may be applied to the surface of pieces of meat or mixed with continued meat.
3. Antibiotic injection before slaughter might be employed to prolong the keeping time of carcasses at atmospheric temperature before they reach the refrigerator.

Spoilage

Raw meat is subjected to change by its own enzymes & by microbial action & its fat may be oxidized chemically.

All kind of microorganisms which cause spoilage can grow under favourable conditions.

Invasion of tissues by microorganisms upon the death, invasion of the tissues by contaminating micro-organisms takes place.

Factors that influence the invasion include:-

a. The load of gut of the animal- more the load, greater the invasion of tissues.

b. The physiological condition of the animal immediately before slaughter- if the animal is excited, feverish bacteria is more likely to be enter the tissues.

c. The method of killing & bleeding- the better sanitary the bleeding, better would be the keeping quality of meat.

d. The rate of cooling- rapid cooling will reduce the rate of invasion of tissues

Factors that influence the growth of microorganisms to cause spoilage are:

1.The kind and amount of contamination with microorganisms & the spread of these organisms in the meat.

2.The physical properties of meat- The amount of exposed surface of the flesh influence on the rate of spoilage.

3. The chemical properties of meat- The moisture content of the meat determine organisms to grow.

4. Availability of oxygen- Aerobic conditions at the surface of meat are favorable to yeasts, molds & aerobic bacteria.

5. Temperature- Low-temperature organisms can grow on stored temperature of meat i.e. not far above freezing.

General types of spoilage of meat

Spoilage under aerobic conditions

1. Surface slime-

which may be caused by species Pseudomonas, Leuconostoc, Bacillus etc. Temperature & availability of moisture, influence the kind of organisms causing surface slime.

2. Changes in color of meat pigments- The production of oxidizing agents causes change in red color of meat to shades of green, brown & gray, by bacteria species of Lactobacillus.

3. Changes in fats- The oxidation of unsaturated fats in meats takes place chemically in air & may be catalyzed by light & copper. Lipolytic bacteria may cause lipolysis.

4. **Various surface color due to pigmented bacteria-**

Yellow discoloration may be cause by bacteria with yellow pigment i.e. species of Micrococcus.

5. **Off odors and off tastes-**

undesirable tastes & odors, appear in meat due to growth of bacteria on the surface often are evident before other signs of spoilage. Souring is term applied to almost any defect, hat gives a sour odor may be due to volatile acid.

*Under Aerobic conditions, yeast grow on the surface of meats, causing.. Sliminess, lipolysis, off odors, & tastes, and discolorations.

*Aerobic growth of molds may cause., stickiness, whiskers (white fuzzy growth), black spot, Green patches, decomposition of fats, off odors & tastes.

Spoilage under anaerobic conditions

Facultative and anaerobic bacteria are able to grow within the meat under anaerobic conditions to cause spoilage.

1. **Souring:-**

This could be caused by formic, acetic, byutric, propionic and higher fatty acids or other organic acid like lactic.

Souring can result from-

1. Action of meat own enzymes during ripening
2. Anaerobic production of fatty acids or lactic acid during ripening.
3. Proteolysis without putrefacation, caused by anaerobes.

2. Putrefaction:-

True putrefaction is the anaerobic decomposition of protein with the production of foul smelling compounds. It usually is caused by species of Clostridium.

But facultative bacteria may cause putrefaction by *Pseudomonas putrfaciens* and *Alcaligenes putrificum*

Gas formation accompanies putrefaction by clostridia, the gases being hydrogen & Co2.

3. Taint:-

This word is implied to any off-taste, off-odor.

Spoilage of eggs

1. Contamination of eggs:

Freshly laid egg is sterile but the egg shell soon becomes contaminated by fecal matter of hen by nest, by washing water, by handling and by other material in which it is stored.

If a total number of micro-organisms per shell of hen's egg has been reported to range from 10^2-10^7 with average of 10^5.

Salmonella spp. may be found on shell or inside egg.

Non-microbial spoilage of eggs

These include loss of moisture and hence loss of weight during long term storage.

Change in physical state of egg contents also occur during long term storage, they include thinning of egg white and breaking of yolk membrane. As the yolk membrane weaken and break, yolk becomes flat and homogenously mixed in egg white.

Microbial spoilage of eggs

In order to cause spoilage of shell of egg, microorganisms must contaminate the shell, penetrate through the pores in shell and inner membrane, reach the eggwhite and yolk and grow there.

Some microorganisms cannot grow in egg white but can grow rapidly in egg yolk.

Change in storage temperature facilitates penetration of organism through shell and hence facilitates microbial spoilage.

Bacterial spoilage of egg

Bacteria are more common spoilage organism than mold. Bacteria cause rots in egg.

When bacteria grow within the egg, they decompose the content and form byproduct. This result in characteristic odor, appearance or color from which various microorganisms acquire their name:

Green rot:

It is caused by Pseudomonas fluorescence. Green egg white shows fluorescence when exposed to UV light. In later stage of spoilage, egg yolk disintegrates and mask green color of egg white. Odor is lacking or fruity.

Black rot:

It is caused by Proteus and sometimes Pseudomonas and aeromonas. Egg yolk blackens and then breakdown to give whole egg content muddy brown color. Odor is putrified due to H2S.

Pink rot:

It is caused by Pseudomonas usually at the later stage of green rot. They are similar to colorless rot except that pink coloration occurs in yolk and white.

Prevention

Waxing and oiling of shell keep the shell dry, reduce penetration of oxygen into the egg and reduce passage of carbon dioxide and moisture out.

Immersion of whole egg in solution of sodium silicate is also a good preservative.

Use of CO2 in ozone in storage atmosphere improves quality of egg.

Canned food spoilage

• Canned food spoilage is both due to non microbial (chemical and enzymatic reactions) and microbial reasons. • Production of hydrogen (hydrogen swell), CO_2, browning, corrosion of cans due to chemical reactions • Liquefaction, gelation, and discoloration due to enzymatic reactions are some examples of non microbial spoilage

Microbial spoilage is due to 3 main factors:

(1) Inadequate cooling after heating or high-temperature storage, allowing germination and growth of thermophilic sporeformers.

(2) Inadequate heating, resulting in survival and growth of mesophilic microorganisms (vegetative cells and spores)

(3) Leakage (can be microscopic) in the cans, allowing microbial contamination from outside following heat treatment and their growth.

Thermophilic sporeformers can cause three types of spoilage

1. Flat sour spoilage

In this spoilage the cans do not swell but the products become acidic because of germination and growth of facultative anaerobic *Bacillus stearothermophilus*. •Germination occurs at high temperature (43 °C and above), but growth can take place at lower temperature (30 °C and above) •The organism ferments carbohydrates to produce acids without gas but with some off-flavor and cloudiness.

2. Thermophilic anaerobe spoilage

Several Clostridium spp., *Clostridium butyricum* and *Clostridium pasteurianum,* ferment carbohydrates to produce volatile acids and H_2 and CO_2 gas, causing swelling of cans.

Proteolytic species, *Clostridium sporogenes* and *Clostridium putrefacience*

3. Sulphide stinker spoilage

Proteolytic *Clostridium botulinum*, metabolize proteins and produce foul- smelling H_2S

*spores of some facultative anaerobic Bacillus spp., such as Bacillus subtilis and Bacillus coagulans, grow, with the production of acid and gas (CO_2).

*Damaged and leaky containers allow different types of microorganisms to get inside from the environment after heating. •They can grow in the food and cause different types of spoilage, depending on the microbial types.

*YEASTS: Yeasts are not thermo tolerant, thus they are not found in suitably heat treated cans. Their presence indicates under processing or post pasteurization contamination through leakage.

Fermentative yeasts are more prominent and they produce carbon dioxide, thus causing swelling of cans. Film yeasts too can grow on the surface of the food products.

* MOLDS: Among molds, Aspergilus and Penicillium are most spoiling organisms. These can grow at high sugar concentration.

Acidification is considered method of preventing growth of molds. Some of the molds are resistant to heat.

•Molds are more common in home canned foods where heating as well as sealing is not under total aseptic conditions.