

# Guidelines for Microbiology of meat and meat products

## **Acknowledgement:**

We would like to acknowledge the committee of National Egyptian Guidelines for Veterinary Medical Interventions, Egyptian Health Council for adapting this guideline.

Executive Chief of the Egyptian Health Council: Prof. Dr Mohamed Mustafa Lotief.

Head of the Committee: Prof. Dr Ahmed M Byomi

The Decision of the Committee: Prof. Dr Mohamed Mohamedy Ghanem.

Scientific Group Members: Prof. Dr Nabil Yassien, Prof. Dr Ashraf Aldesoky Shamaa, Prof. Dr Amany Abbass, Prof. Dr Dalia Mansour, Dr Essam Sobhy

Editor: Prof. Dr Nabil Yassien, Dr. Marwa Abdallah

## **Abbreviations**

m.os: microorganisms

GIT: gastrointestinal tract

## **Glossary:**

**Food poisoning** It may be defined as, any acute illness associated with the recent consumption of food, characterized by sudden onset, short incubation period, gastrointestinal disorders (abdominal pain, diarrhea and with or without vomiting and with or without fever) and it may be accompanied with neurological signs.

**Meat spoilage:** Means break down of complex compound → simple one → change in the characteristic of meat such as odor, taste and color.

- Raw meat starts deteriorating by its own enzymes and microorganism and chemically oxidize the fat.

**Food infection:** Infection with living m.o.s which multiply in the food and may produce endo-toxin inside the body

**Food intoxication:** Ingestion of preformed bacterial or mold toxin in the food.

## **Scope:**

Meat microbiology as a part of the food microbiology science, deal with organisms that are present, contaminate, or grow in and on red meat, poultry, fish and their product. This field is of great importance as it helps ensure the safety and quality of meat products. By studying the behavior of microorganisms in food, researchers and meat industry professionals can develop strategies to prevent foodborne illnesses, extend shelf life, and maintain nutritional quality. Additionally, meat microbiology plays a crucial role in the development of meat preservation methods, such as pasteurization and sterilization, as well as in the monitoring and regulation of food safety standards.

## Objectives

1. Minimize the risk of meat contamination so, prevent outbreaks.
2. Protection of consumer against meat borne disease
3. To prevent meat spoilage
4. Increase meat quality
5. Preservation
6. ensuring the overall quality of the meat supply

## Sources of meat contamination

### Endogenous ways

1. Diseased Animal (when the animal is affected by some infections disease as T.B, Anthrax ... etc.
2. Lowered natural resistance due to stress → microorganisms (m.os) invade the intestinal mucosa and distribution by blood and lymph to different organs and tissues as *E. coli* and as well as anaerobic m.os → bone taint deep muscular putrefaction and ham taint in pig.

### Exogenous ways

1. From exterior (soil and hide)  
The skin is the main sources of the contamination of meat
2. During carcasses preparation & evisceration  
Should close the rectum and esophagus  
Fasting of the animals help in decreasing contaminations
3. Equipment and tools  
Tools, knives and other equipment used during skinning, preparation and processing of meat (must be dipped for 5 sec in a bucket with boiling water and water is thoroughly changed and boiled).
4. Hands and cloths
5. Flies, rodents and stray dogs
6. Transport and storage

## I)Meat spoilage

### Types of meat Spoilage

#### 1. Meat sliming:

- It is an indication of spoilage, often observed before expiry date.
- It is caused by psychotropic m.os (*Pseudomonas*, *Acinetobacter*, *Moraxella*, *Alcaligenes*, *streptococcus*, *Leuconostoc*, *Bacillus*, and *Micrococcus*) when the meat is kept in refrigerator at R.H more than 90%
- At first, it appears as drop colonies which coalesce with each other to form yellowish brown slime all over the surface of meat.

Accordingly, the meat should be kept at 0-2°C and 88% - 90% RH to avoid this type of spoilage.

#### 2. Meat putrefaction:

It means hydrolytic cleavage of meat protein by m.o.s to form free amino acids (e.g. tyrosin +tryptophan) which result in typical putrefaction (odor + flavor).

### **Types of meat putrefaction:**

#### **a. Aerobic putrefaction:**

\* **Cause:** →aerobic spore former.

\* **Source:** →skin, surface of carcass, Air.

Aerobic spore former (*B.anthraxis*, *B. subtilis*, *B.mycoides*) they liquefy gelatin, peptonize meat and blood hemolysis.

\* **Sit of Beginning:** at surface appearance

Meat characters: → Soft in consistency, alkaline pH, change color, smell

#### **b. Anaerobic putrefaction:**

• **Cause:** anaerobic Spore formers e.g. *Cl. sporogenes*, *Cl. putreficum* , *Cl. perfringenes*.

• **Sources:** Soil, manure, small intestine.

• **Site of Beginning:** deep seated parts later after aerobic spoilage after consuming of O<sub>2</sub>.

• **Meat characters:** →greenish yellow color, more bad odor.  
→Some produce toxin (*Cl. Perfringens*)

#### **C. Chromogenic Gram – ve rods:**

• **Causes:** Pigment producing m.o.s. e.g. pseudomonas + flavobacterium

• **Sources:** water, soil

• **Site of beginning:** surface of meat.

• **Meat characters:** unpleasant odor

✓ *Ps. flourescens* →green

✓ *Ps. prodigiosum* →bloody = red

✓ *Ps. cyanogenus* →bluish green

✓ *Serratia* → red spot

#### **Control of meat spoilage**

1. surface drying of carcasses
2. Reducing of surface pH (to 4 – 4.5) which inhibit the growth of both spoilage and pathogenic m.o.
3. Using chlorinated & hot wash water
4. Cooling or refrigeration (chilling and freezing)
5. Salting and curing
6. Enzyme inhibitors:
7. Irradiation
8. Packaging
9. Reduce the stress as possible before slaughtering
- 10.Using of antioxidants

11. Balanced relation in cold store between R.H, temp., air velocity

## II) Food poisoning

**Microbial food poisoning:** Food poisoning produced due to consumption of food contaminated with food poisoning organism itself and / or their toxin. It may be classified on the basis of mode of illness into:

A) Food infection	B) Food intoxication
E.X: <b><u>bacteria</u></b> <ul style="list-style-type: none"> <li>• <i>Salmonella</i></li> <li>• <i>Campylobacter</i></li> <li>• <i>Vibrioparahemolytica</i></li> <li>• <i>Yersinia enterocolitica</i></li> <li>• <i>Listeria monocytogenes</i></li> <li>• <i>Escherichia coli O157:H7</i></li> </ul>	E.X: <ul style="list-style-type: none"> <li>• <i>Clostridium botulinum</i></li> <li>• <i>Clostridium perfringens</i></li> <li>• <i>Staphylococcus aureus</i></li> <li>• <i>Bacillus cereus</i></li> </ul>

\* The difference between the two types clinically is the incubation period interval elapse between eating and symptoms developed.

### Bacterial food poisoning

Agent	Normal incubation period	Normal duration	Main clinical symptoms	Commonly associated foods
<i>B. cereus</i> emetic toxin	1-5 hours	< 24 hours	Vomiting	Cereals, rice
<i>B. cereus</i> enterotoxin	8-16 hours	< 24 hours	Abdominal pain, diarrhea	Cereals, rice
<i>Campylobacter</i> spp.	3-5 days	2-7 days	Abdominal pain, diarrhea (sometimes bloody), headache, fever	Poultry, cooked meats, milk
<i>Cl. Botulinum</i>	12-36 hours	Extended	Swallowing difficulties, perhaps as respiratory failure	Preserved foods, e.g. canned, bottled
<i>Cl. Perfringens</i>	10-12 hours	24 hours	Abdominal pain, diarrhea	Stews, roasts
<i>E. coli</i> 0157	12 hours-10 days	Possibly extended	Abdominal pain, diarrhea	Beefburgers, meat, dairy products

			(may be bloody). May lead to renal failure	
<i>Listeria monocytogenes</i>	3-21+ days	Varies	Fever, headache, spontaneous abortion, meningitis	Soft cheeses, pates, poultry meat
<i>Salmonella</i> spp.	12-36 hours	2-20 days	Abdominal pain, diarrhea, fever, nausea	Meat, poultry, eggs, dairy products Cooked meat
<i>Staph. Aureus</i>	2-6 hours	12-24 hours	Vomiting, abdominal pain, diarrhea	Cooked meat, human source
<i>Vibrio parahaemolyticus</i>	12-24 hours	1-7 days	Abdominal pain, watery diarrhea, headache, vomiting fever	Shellfish
<i>Yersinia enterocolitica</i>	3-7 days	1-3 weeks	Acute diarrhea, abdominal pain, fever and vomiting	Pig meat products

## **FOOD POISONING PREVENTION**

- Hygienic measures at abattoir.
- Education programs for food handler.
- Cold storage.
- Perishable food must not be stored in refrigerator (1-4°C) for more than 3 days.
- Cooking efficiently.
- Avoid spread of contamination in kitchen.
- Bacterial examination especially to ensure Salmonella free carcass.
- Decrease food handling especially for minced meat and sausage (made up food).

### **References:**

- Foodborne Illness. Simcoe Muskoka District Health Unit (2017).** Available at: <https://www.simcoemuskokahealth.org/Topics/FoodSafety/Foodborne-Illness>. Accessed January 21, 2024.
- Franzevich Zabrodskii, P. (2020).** Food Poisoning. Bacteria Associated with Food. *Acta Scientific Microbiology*, 3(3), 01–01. <https://doi.org/10.31080/asmi.2020.03.0503>
- Pellissery, A. J., Vinayamohan, P. G., Amalaradjou, M. A. R., & Venkitanarayanan, K. (2020).** Spoilage bacteria and meat quality. *Meat Quality Analysis*, 307–334. <https://doi.org/10.1016/b978-0-12-819233-7.00017-3>
- Zagorec, M., & Champomier-Vergès, M. C. (2017).** Meat Microbiology and Spoilage. *Lawrie 'S Meat Science*, 187–203. <https://doi.org/10.1016/b978-0-08-100694-8.00006-6>