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Lecture title: **Meat Hygiene: Meat microbiology part I**

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Summary:

Meat microbiology

Meat microbial contamination is the exposure of meat and meat products to harmful microorganisms, as consumption will lead to severe illnesses, which is a widespread international problem according to the World Health Organization (WHO), for example, Salmonellosis,Cholera and Enterohemorrhagic *E.coli* (EHEC) in developing countries. Therefore, Meat must be of a high quality in order to ensure that the consumer receives a product that is not spoilt or doesn't carry food born disease. Abattoir assumes more responsibility for the microbiological conditions of the product. Microbial quality on carcasses can be influenced by:

- Environmental contaminants which introduce bacteria to the skin of the animal
- Cross contamination from the hide to the carcasses can results in both pathogenic and spoilage bacteria in meat.
- Personal and equipment used during handling and processing can aid further contamination of carcasses.

It may be necessary to carry out a microbiological examination of meat in order to:

- Determine the microbiological quality of meat in order to estimate its shelf-life.
- Determine that the meat meets established microbiological criteria.
- Identify the cause of spoilage or the presence of a pathogens.

A general bacteriological examination of a carcass may be considered when suspicion of systemic infection or presence of zoonotic agents in the carcass arises. If the carcasses or organs show marked pathological changes or severe systemic infection, bacteriological examination is not needed, and the meat inspection decision can be made based on post-mortem findings. However, in these cases, bacteriological examination can be used to identify the infective organism, if needed. The routine microbiological tests of meat can be essential in determining:

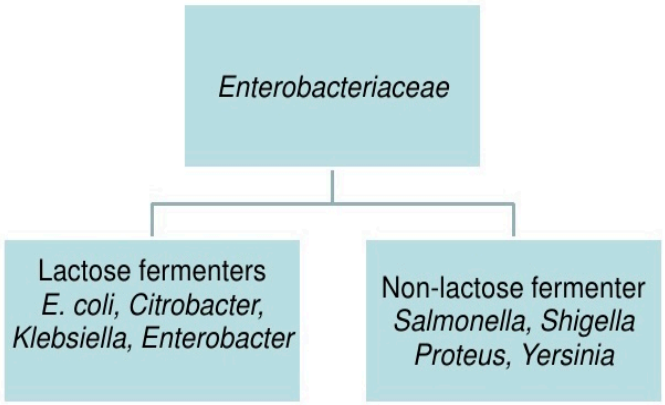
- The rejection/acceptance of meat products.
- The microbial conditions of the meat and meat products
- The evaluation of hazard-based management strategies

Therefore, Microbial examination of the meat can be placed in three categories:

- Test for pathogens and their toxins for e.g. (Salmonella, *Staphylococcus aureus* and it's toxin, *Listeria monocytogenes, Clostridium botulinum* toxin

- Tests for group of organisms for e.g., Pseudomonas spp. as spoilage organisms
- Tests for indicators organisms.

Indicators organisms are larger groups of bacteria, including certain pathogenic bacteria, which are relatively easy to measure as a group and whose presence is likely to indicate an increased risk of the presence of pathogenic bacteria. Testing for Enterobacteriaceae, a group of indicator organisms that live in the intestines of animals and the environment, will give a better indication of the risk of pathogenic organisms being present in meat.



- There are several selective and differential media used to isolate distinguishes between LF & LNF
- The most important media are:
  - MacConkey agar
  - Eosin Methylene Blue (EMB) agar
  - Salmonella Shigella (SS) agar
  - In addition to Triple Sugar Iron (TSI) agar

Tests for indicator organisms can be grouped into 3 categories:

- To assess numbers of micro-organisms and/or microbial activity by:
  - Aerobic plate count
  - Psychrotrophic count
  - Mesophyllic count
  - Pseudomonas spp. count
  - Yeast and mould count
  - Drect microscopic count
- To assess Potential presence of pathogens:
  Staphylococcus aureus, *Escherichia coli* (certain strains like E.coli O157:H7), Salmonella spp., *Clostridium perfringens, Campylobacter jejuni/coli*, *Bacillus cereus*, *Listeria monocytogenes*
- To assess Indication of potential faecal contamination:
  Enterobacteriaceae, coliform bacteria, Faecal coliforms, Enterococci.

Microbiological examination of meat usually consists of many steps represented by the Sampling,Transportation , storage and evaluation. Sampling included collecting meat samples for analysis and determine the suitable sampling method which be used to achieve accurate results.the sampling of meat should be taken in consideration.

- The choice of sampling site (the numbers of bacteria in the deep tissues of such products will always be less than those on the surface).
- The sample size (With excision of tissue, the area sampled is usually limited to no more than 100 cm2).
- The number of samples.

Sampling for microbiological examination must be done aseptically. Sterile equipment is needed for sampling. The Sampling methods include a variety of sampling techniques is in use in the meat industry. These can be either:

- Destructive method
- Nondestructive method

Surfaces may be sampled by excision of a portion of surface tissue or by swabbing part or all of a meat surface. It is generally believed that larger numbers of bacteria per unit area will be recovered by excision than by swabbing. Generally, mildly abrasive and absorbent materials, such as synthetic sponges, can be used to recover bacteria from all types of meat surface. sampling of meat surfaces by swabbing must be preferred to sampling by excision.
Some non-destructive methods break up the colonies of bacteria (e.g. swabbing, rinsing) and counts are usually higher than methods that replicate intact surface colonies (e.g. agar sausage, PetrifilmTM and Rodac plates). But, with destructive techniques a sample is removed and macerated or blended before counting bacteria The samples obtained by excision of tissue are macerated with appropriate volumes of diluent. with the use of a stomacher, The diluent is usually a buffering or nutrient solution, such as buffer phosphate diluent or peptone water. However, a sample may be macerated with a pre-enrichment or enrichment broth, when detection of a pathogen rather than enumeration of indicator organisms is intended.

Sample handling and transportation

The labelling of samples should be clear and appropriate records kept, detailing the timing and origin of each sample. samples should be analyzed as soon as possible after collection, Transportation and storage conditions should also aim to minimize any risk of microbial multiplication. This means that unfrozen samples should be transported with ice or freezer packs in insulated containers. it may be best to use a transport medium, such as Fastidious Anaerobe Broth.

Storage of Samples

The storing of samples to be used in total counts must be avoided as far as possible. Bacteria present in the sample may start multiplying under favourable conditions and this could lead to false high counts.If storage is unavoidable, the sample may be kept in a refrigerator or on ice at 0 to 2°C. Frozen samples must be allowed to thaw in a refrigerator between 1°C and 5°C for 18 to 24 hours.

Sampling and laboratory tests at the slaughterhouse can be used for different reasons:

- To facilitate meat inspection in deciding whether meat is fit for human consumption.
- For monitoring and control of zoonoses and transmissible animal diseases
- For diagnosis of transmissible spongiform encephalopathies (TSEs)
- For detection of residues to monitor microbial contamination of carcasses and the production environment.
- The sample and analyses can be part of official controls,
- Sampling protocols and laboratory analyses used can be based in, international and national standards as well as legislation or methods developed in accordance with scientific protocols. The reliability of laboratory results is important for the decision making.The methods should be practical, accurate, reproducible, sensitive and selective.

Common sampling problems:

- Small sample or sampling method may not be ideal for detection e.g., small swab device.
- Sanitizer or residual antimicrobial chemicals might interfere with the tests.
- Insufficient drip time prior to carcass sample collection
- Excessive liquid carryover for parts sample collection
- Temperature for the sample prior to testing
- Holding under refrigeration for long periods allows competing bacteria to grow.
- Freezing can kill some pathogens (e.g., Campylobacter)