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Safety Standards of Meat



Training Manual Developed for Balochistan Food Authority

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This report has been authored by ITC's National Consultant Dr. Mohsin Kiani. The views expressed in this report are those of the author's and do not necessarily coincide with those of the International Trade Centre.

ACRONYMS

BFA	Balochistan Food Authority
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FMD	Foot and Mouth Disease

GRASP	Growth for Rural Advancement and Sustainable Progress
GOP	Government of Pakistan
HACCP	Hazard Analysis and Critical Control Point
ITC	International Trade Centre
MSTQ	Metrology, Standards, Testing and Quality
MSMEs	Micro Small Medium Enterprises
NEP	National Enquiry Point
OIE	World Organization for Animal Health
PCP	Progressive Control Pathway
PSQCA	Pakistan Standards and Quality Control Authority
PPE	Personal Protective Equipment
QCC	Quality Control Centre
QA	Quality Assurance
SOP	Standard Operating Procedure
SDC	Standards Development Centre
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TOR	Terms of Reference
TSC	Technical Services Centre
TB	Tuberculosis
USAID	United States Agency for International Development

INTRODUCTION AND ACKNOWLEDGEMENT

GRASP is a five and a half year project designed to reduce poverty in Pakistan by strengthening small-scale agribusinesses in the livestock and horticultural in Balochistan and Sindh. This project is funded by European Union and implemented by International Trade Centre – the joint agency of the United Nations and the World Trade Organization with active participation from local partners. The project has three main components:

- **Improve the institutional and policy environment** for small firms by enhancing policy dialogue, reforming policies, making the firm registration process more efficient and improving quality infrastructure. GRASP will also improve coordination through value chain roadmaps, business development strategies and new private sector-led alliances.
- Support small-scale farmers and producers in a holistic way by **promoting climate-smart agriculture, improving dissemination of market information through digital tool and improving access to financing**
- Boost the competitiveness of small-scale firms by building inclusive supply chains, providing **access to finance, grants and technical assistance**, and improving quality. There will be a special focus on improving sustainability by enabling firms to acquire the appropriate technology.

Under the quality and SPS component, GRASP is providing technical support to the Balochistan Food Authority (BFA) to strengthen its institutional and technical capacities in laying down standards, procedures, processes and guidelines in relation to food. In this context, GRASP has designed a training program on “Safety Standards in Meat” for BFA to address the capacity building need of the organization, and to provide training to its pool of master trainers on food safety standards, relevant laws, and compliance mechanism including monitoring protocols etc. or the meat sector. The key staff, including food inspectors responsible for monitoring the meat markets, slaughter- houses and meat houses have been trained on the standards adopted by the authority, their importance and relevant laws, and best international practices including in compliance and reporting mechanisms.. This manual was developed for the facilitation of the trainees as reference technical material in field operations.

I am honored and thankful to International Trade Centre (ITC) for giving me this opportunity to deliver the assignment on “Safety Standards of Meat” for Balochistan Food Authority. I express my sincere gratitude to ITC leading team at home office Mr. Robert Skidmore, Mr. Khemraj Ramful, Mr. Qasim Chaudhry and in Pakistan to Mr. Azhar Chaudhry , Mr. Muhammad Owais Khan, Mr. Jahanzeb Khan and GRASP Balochistan team for their support and facilitation during the entire assignment.

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Chapter 01

Regulatory framework and institutional mandate

Food Safety is a global concern that refers to handling, preparing and storing food in a way that reduces the risk of individuals becoming sick from foodborne illnesses. In Pakistan there are various laws about food safety and food hygiene, however, the country does not have an

integrated legal framework but has a set of laws, which deal with various aspects of food safety. These laws, despite being enacted a long time ago, have tremendous capacity to achieve at least the minimum level of food safety. To round it up, the legal system of food safety in Pakistan consists of 4 acts. These are four laws that specifically deal with food safety. Three of these laws directly focus on issues related to food safety, while the fourth, the Pakistan Standards and Quality Control Authority Act, is indirectly relevant to food safety.

- 1.1 West Pakistan Pure Food Ordinance 1960:** The Pure Food Ordinance 1960 consolidates and amends the law in relation to the preparation and the sale of foods. All provinces and some northern areas have adopted this law with certain amendments. Its aim is to ensure purity of food being supplied to people in the market and, therefore, provides for preventing adulteration. The West Pakistan Pure Food Ordinance was created to control standards for the preparation and sales of food in what was then known as West Pakistan. It prohibits things such as false guarantees about food quality and the unauthorized mixing of ingredients and chemicals in food
- 1.2 Cantonment Pure Food Act, 1966:** The Pure Food Ordinance 1960 does not apply to cantonment areas. There is a separate law for cantonments called "The Cantonment Pure Food Act, 1966". There is no substantial difference between the Pure Food Ordinance 1960 and The Cantonment Pure Food Act. Even the rules of operation are very much similar.
- 1.3 Pakistan Hotels and Restaurant Act, 1976:** Pakistan Hotels and Restaurant Act, 1976 applies to all hotels and restaurants in Pakistan and seeks to control and regulate the rates and standard of service(s) by hotels and restaurants. In addition to other provisions, under section 22(2), the sale of food or beverages that are contaminated, not prepared hygienically or served in utensils that are not hygienic or clean is an offense.

There are no express provisions for consumer complaints in the Pakistan Restaurants Act, 1976, Pakistan Penal Code, 1860 and Pakistan Standards and Quality Control Authority Act, 1996. The laws do not prevent citizens from lodging complaints with the concerned government officials; however, the consideration and handling of complaints is a matter of discretion of the officials.

- 1.4 Pakistan Standard and Quality Control Authority act 1996:** The purpose of this Act is to prevent the adulteration of food in all cantonments in Pakistan and to regulate the sale and manufacture of food. This Act prohibits the following activities: mixing, colouring, staining of food in contravention of the rules; preparation, manufacture, sale of adulterated food; manufacture, import and sale of unwholesome food; etc. Any person who intends to keep or store for sale, manufacture, and sell any food for human consumption shall be in possession of a license as prescribed in the Act. It further makes provision for the following: duties of local authorities; powers of inspectors; appointment of Public Analysts for the analyses of food samples; penalties; Standards constitute important aspects of trade, commerce and diffusion of technology. The Development of Metrology, Standards, Testing and Quality (MSTQ) infrastructure, therefore, are necessary for industrial progress and prosperity of a country or region.

Realizing the importance of MSTQ infrastructure, the Government of Pakistan has established the Pakistan Standards and Quality Control Authority (PSQCA) by Act-VI of 1996 to provide one window services for Standardization and Conformity Assessment.

The Authority functioning comprising three integrated Components, namely Standards Development Centre (SDC), Quality Control Centre (QCC), and Technical Services Centre (TSC). The PSQCA is now acting as National Enquiry Point (NEP) for Pakistan. The Pakistan Standard and Quality Control Authority oversees food testing and inspecting mechanisms. It has the authority to inspect, sample, fine, and revoke the licenses of any authorities that do not comply with standards. It also provides training to local authorities to oversee standards. National inquiry control point for technical regulations relating to food and health safety is Ministry of Health, Social Welfare and Population Planning.

- 1.5 Pakistan Pure Food Laws (PFL) of 1963 and revised in 2007, 2011:** Processed foods are regulated under the Pakistan Pure Food Laws (PFL) of 1963 and revised in 2007. The PFL is the basis for the food quality and safety regulatory framework and covers 104 food items falling under nine broad categories: milk and milk products, edible oils and fat products, beverages, food grains and cereals, starchy food, spices and condiments, sweetening agents, fruits and vegetables, and miscellaneous food products. These regulations also address purity issues in raw food and deal with additives, food preservatives, food and synthetic colors, antioxidants, and heavy metals. For certain products and ingredients, the PFL also applies to imported foods. If an imported food or ingredient is not listed in the PFL or subject to domestic regulations, Codex and possibly the provisions of the exporting country (FDA for the United States) are consulted and applied as appropriate.
- 1.6 Pakistan Halal Authority Act, 2016:** An Act to establish the Pakistan Halal Authority to promote trade and commerce in Halal articles and processes. This Act, consisting of 13 sections and two Annexes, creates the Pakistan Halal Authority. This Authority is a corporate body having perpetual succession and a common seal, with powers, subject to the provisions of this Act, to acquire and hold property, both movable and immovable, and shall by the said name sue and be sued. The Act establishes composition, duties and responsibilities of the above mentioned Authority, entitled to:
- a) develop and implement strategies, plans and programmes for promotion of imports/exports, trade with foreign countries and inter-provincial trade and commerce in Halal articles and processes;
 - b) recommend the Halal Standards developed for articles and processes;
 - c) recommend mechanism for the Accreditation of Halal Certification Bodies and adoption of Halal Certification systems;
 - d) develop policies, plans and programmes for ensuring compliance of Halal articles and processes with the Halal Standards;
 - e) develop and authorize use of Halal logo;
 - f) operate as a certification body after obtaining due accreditation;
 - g) levy fees for issue or renewal of the Halal certificate;
 - h) maintain a register to use the Halal logo;
 - i) inspect/test Halal products and processes for their quality Standards;
 - j) prohibit production, storage and sale in the Islamabad Capital Territory of such Halal products as do not conform to the Halal Standards;
 - k) arrange and conduct public awareness campaigns;
 - l) secure international recognition of the Halal logo;
 - m) co-ordinate with national and international organizations for strengthening the Halal sector;
 - n) promote the

establishment of libraries and laboratories for the purpose of developing the Halal sector; o) collect and circulate statistical and other information relating to the Halal sector; and p) any other function assigned by the Government for development of the Halal sector and promotion of Halal products and processes.

- 1.7 Punjab Food Authority Act 2011** This Act may be cited as the Punjab Food Authority Act 2011. *An Act to provide for the safety and standards of food and for establishment of the Punjab Food Authority.* Whereas, it is expedient to protect public health, to provide for the safety and standards of food, to establish the Punjab Food Authority and for other connected matters.

Balochistan Food Authority Act, 2014:

- 1.8** The Government of Balochistan has enacted the Balochistan Food Authority (BFA) Act, 2014. It aims to provide for the safety and standards of food and for establishment of an authority known as the Balochistan Food Authority (BFA). Whereas it is expedient to provide safe, hygienic and healthy food as per stands of Government of Balochistan and to provide for establishment of the Authority known as Balochistan Food Authority, and to provide for the matters connected therewith. The Food Authority is a corporate body, having perpetual succession and a common seal with power to enter into a contract, acquire, possess or dispose of property and may, by its name, sue or be sued.

The BFA Bill was passed in 2014. The Authority practically started in March 2019. Balochistan food authority has not been fully functional till now and the related regulations for food safety standards and rules of business are in the process of approval from competent authority.

1.8.1. Powers and functions of the Food Authority

The Food Authority shall regulate and monitor the food business in order to ensure provision of safe food. The Food Authority may:

- Formulate standards, procedures, processes, and guidelines in relation to any aspect of food including food business, food labelling, food additive and specify appropriate enforcement systems;
- Specify procedures and guidelines for setting up and accreditation of food laboratories.
- Formulate method of sampling, analysis of samples and reporting of results;
- Specify licensing, prohibition orders, recall procedures, improvement notices or prosecution;
- Determine terms and conditions of service of its employees;

- Provide scientific advice and technical support to the government in matters relating to food;
- Collect and analyze relevant scientific and technical data relating to food;
- Establish a network of food operators and consumers to facilitate food safety and quality control;
- Organize training programmes in food safety and standards;
- Promote general awareness to food safety and standards;
- levy fee for registration, licensing and other services; certify food for export;
- Perform any other prescribed function; and do any other thing which is necessary for the discharge of its functions under this Act.

The Food Authority shall exercise its functions, as far as possible, in accordance with the well-established scientific principles and international best practices.

1.8.2 Duties of Food Authority.

It shall be the duty of a Food Authority to:

- Take steps for the creation of the post of one Food Safety Officer for every 500,000 population or part thereof and for his/her appointment;
- Ensure that the Food Safety Officer collects a minimum of 100 samples a month, and an *ex-officio* Food Safety Officer, at least 20 samples a month;
- Maintain permanent registers of licensees' category-wise as required under these rules;
- Ensure that the cases of food offence are neither withheld nor compounded, without the approval of the Government in writing;
- Maintain permanent record of the prosecution of food offenders and of revenues from the costs realized; and enforce provisions of the Ordinance and the rules;
- The Food Authority shall, within a period of seven days of receipt of copies of the report of the result of analysis, before initiating prosecution, forward a copy of the report of said analysis, by registered post or by hand, to the person from whom the sample of the article was taken by the Food Safety Officer, and also to the person with name, address and other particulars;
- Where a Food Authority, without reasonable cause, fails to enforce the Ordinance and the rules for a period exceeding six months, the District Coordinator Officer may invoke

1.8.3 Appointment of Food Safety Officer

- No person shall be appointed as Food safety officer unless he possesses a Master's or Bachelor's degree in Science with Food Science, Food Technology, Food Science and Technology from a recognized University. On appointment, a Food Safety Officer shall receive three months' training in food inspection and sampling work in an institution approved for the purpose by the Government.

1.8.3.1 Powers of Food Safety Officer

A Food Safety Officer may:

- Take sample of any food or any substance, which appears to him to be intended for sale, or has been sold as food;
- seize/seal any food, apparatus or utensil which appears to the Food Safety Officer to be in contravention of this Act, the rules or the regulations;
- enter or seal any portion of the premises where he proves any food is prepared, preserved, packaged, stored, conveyed, distributed or sold, examine any such food and examine anything that he proves are used, or capable of being used for such preparation, preservation, packaging, storing, conveying, distribution or sale; impose fine on a food operator if the Authority has delegated such power to him;
- open and examine any package which, he believes, to contain any food;
- examine any book or documents with respect to any food and may request to produce the same within 7 working days ;
- demand to see the identity card, business registration certificate, licence or any other relevant document from person in charge (PIC)/food operator;
- mark, seal or otherwise secure, weigh, count or measure any food or appliance;
- search and seize sample from any vehicle carrying food.
- A Food Safety Officer shall prepare a statement describing the food, apparatus, utensil or vehicle seized and shall deliver a copy of the statement to the person from whom it is seized or, if such person is not present, send such copy to him by mail.
- A person claiming back anything seized under sub-section (1) may, within fourteen days of the seizure, apply to the Court and the Court may confirm such seizure, wholly or in part, or may order that it be restored to the claimant.
- If the Court confirms the seizure of the food, apparatus or utensil, it shall be forfeited to the Food Authority or the Court may direct that such food, apparatus, utensil may be destroyed at the cost of the owner or person in whose possession it was found.
- If an application is not made within fourteen days under sub-section (3), the food, apparatus or utensil seized, shall be forfeited to the Food Authority.
- Any person may make an application in writing to the Food Safety Officer asking him to purchase a sample of any food from a food operator and get it analyzed from the public analyst.

1.8.3.2 Duties of Food Safety Officer. It shall be the duty of a Food Safety Officer:

- To inspect, as frequently as may be prescribed by the Food Authority or the Local Authority, all establishments licensed for the manufacture, storage, or sale of an article of food within the area assigned to him/her;
- to satisfy himself/herself that the conditions of a licence are being observed;
- to procure and send for analysis, samples of any article of food which he/she has reason to suspect are being manufactured, stocked or sold or exhibited for sale in contravention to the provisions of the Ordinance or these rules;
- to maintain a record of all inspections made and action taken by the officer in the performance of duties, including the collection of samples to send for analysis in prescribed storage conditions and the seizure of stocks, and to submit copies of such record to the Health Officer of the Food Authority as directed on their behalf;
- to make such inquiries and inspections as may be necessary to detect the manufacture, storage or sale of articles of food in contravention of the Ordinance or these rules;

- Perform such other duties as may be entrusted to him/her by the Health Officer with jurisdiction in the local area or the Food Authority.
- A Food Safety Officer shall maintain the record of the court decisions of each case, as the case may be, for the production as evidence of the facts contained therein the name, address, the nature and the location of the business for which a license has been granted or suspended, in any enquiry, trial or other proceedings under this Rule; and, shall send a copy of the court decision of each case under this Rule to the concerned Food Authority.
- When so authorized by the Balochistan Food Authority, having jurisdiction in the local area concerned or the Food Authority, a Food Safety Officer may detain an imported package which, he/she has reason to suspect, contains the food, the import, or sale of which is prohibited.
- On receipt of a complaint in writing about the contravention of the any provisions of the Ordinance or these rules, the Food Safety Officer shall investigate the complaint and, where necessary, seize a sample in fulfillment of the requirements.

Chapter 02.

Importance of food safety and quality standards

2.1 Hygiene and Sanitation

2.1.1 Hygiene

Hygiene came from the Greek word “Hygienos” which means healthy, clean and sensible; often equated with “cleanliness”.

2.1.2 Sanitation

Sanitation is the reduction of contamination with foreign matter including micro-organism to a level harmless to health.

2.2 Hygiene of Manpower at Abattoir (Meat Plant) and Butchery Operation

People are common source of pathogenic bacteria, so everyone who works with food must have the highest possible standards of personal hygiene and personal habits to avoid contaminating food.

2.2.1 Personnel hygiene

A. Control of disease

A healthy food handler means he/she is free from:

- Disease of the respiratory tract-cold, sore throat, pneumonia and tuberculosis (TB).
- Intestinal disorder-typhoid fever, infectious hepatitis and diarrhea.
- Skin disorders- sores, abrasion, lesions, infected ears, boils, scabies and severe rashes.

Requirements

- Pre-employment physical/ medical examination.
- Regular medical check-up when employed.
- Manager/supervisor should monitor health condition of employees.
- Employees should report any illness to supervisor.

Goal Employee health condition should not contribute to food contamination.

B. Attire/ Clothing for Staff

- Hair restraint or hair nets.
- Apron and uniform. Avoid use of buttons, zipper for aprons/gowns
- No pencils or cigarettes in pockets.
- Foot wear (gum shoes)
- Face mask and gloves

Goal Wearing the prescribed attire will prevent cross contamination.

C. Habits/Workers personal Hygiene

- Take a bath daily.
- Use an effective deodorant
- Shave as needed
- Well-trimmed nails
- Wash and sanitize hands as needed
- No eating, smoking, drinking and spitting in the processing area.
- Wash hand after sneezing, coughing, scratching, or touching any body part.
- Try to catch sneeze with your elbow.
- Do not use teeth as a package opener.
- Never blow air by breathing into plastic bags.

Proper hand washing

- It is a very simple practice, but a very powerful food safety tool

How to wash your hands?

- Turn on water
- Wet your hand
- Add soap and lather hands, including the backs, wrist, and up to elbow.
- Wash each finger and scrub for 30-60 seconds.
- Rinse hands under running water.
- Sanitize the hands.
- Dry hands with air dryer, or other sanitary hand drying device.
- Turn off water using paper towel.
- Check hands, fingers and nails are clean.

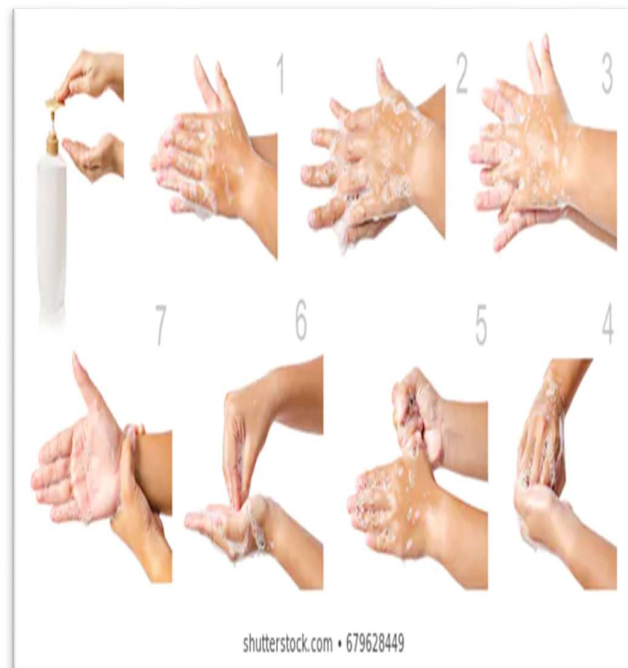
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When to wash your hands

- On arrival at the workplace before starting the work.
- After going to toilet.
- After handling garbage/container.
- After scratching or touching reservoir areas of the body.
- Before resuming work.
- Before handling cooked or ready to eat foods.
- After handling raw foods.
- After smoking.
- After handling money.

D. Education and training

- Appropriate training for expected performance.
- Awareness on role/responsibilities regarding food safety.
- Effectiveness of training by evaluation.
- Use of signs, poster as a reminder.



2.3 Benefits of good food safety

- It prevents harmful additives and ingredients
- Excludes sick and diseased animals
- Eliminates misleading labeling and packaging
- Prohibits contaminated and unwholesome meats
- Satisfied customers
- Good reputation – customer recommendations

- Operating costs under control
- Profit
- Legal compliance – no criminal prosecutions or civil lawsuits
- Pleasant working environment
- Healthy employees
- Motivated employees
- Better job security

2.4 Costs of poor food safety

- Consumer complaints and loss of custom
- Loss of income
- Operating costs increase – employee absenteeism, reduced productivity, food wasted
- Increased insurance premiums
- Lost profit
- Court cases and bad publicity
- Legal fees and possible lawsuit damages
- Personal pain and suffering
- Hospitalizations and even death
- Possible bad impact on loved-ones
- Low employee morale

2.5 Meat Contamination and its Sources

2.5.1 Type of Meat Contamination Hazards

There are three types of contamination in meat

1) Microbial Hazards 2) Chemical Hazards 3) Physical Hazards

2.5.1.1 Microbial/Biological Hazards

- Bacteria
- Fungi
- Viruses
- Parasites

Contamination by bacteria is the greatest threat to meat/food safety. Under ideal conditions bacteria can multiply by dividing into 2 every 20 minutes; in this way a single bacterium could increase to 2,097,152 within 7 hours.

What bacteria need to grow?

Bacteria can live anywhere a human can live. In fact, they can even survive extreme temperature better than people. Generally, bacteria live well in potentially hazardous foods because these foods are often warm, moist, protein rich, and neutral or low in acid.

These conditions can be remembered by the acronym FAT-TOM:

F (Food) - although different types of food poisoning bacteria can live on a range of food, most bacteria prefer something that is moist, and high in protein. These foods are prone to bacterial growth even if they are cooked and served cold later.

A (Acidity) - acidity is measured on a scale from 0 (very acidic) to 14.0(very alkaline, basic). A solution with a pH (acid-alkaline measurement) of 7.0 is neutral. Most potentially hazardous foods have a pH level between 4.6 and 7.0. However, high acid foods, such as citrus fruits, rarely allow the growth of harmful bacteria. Adding vinegar or lemon juice to food items will help slow bacterial growth- but it does not ensure control and should not be used as the only defense against bacteria growth.

T (Time) - highly perishable foods should not remain in the temperature danger zone for more than four hours during the entire food handling process.

T (Temperature) - the temperature danger zone for potentially hazardous food is 4.4 °C to 60 °C (40 F-140 F) However, since bacteria can survive at (and some bacteria can grow at) lower temperatures, refrigerating food is not protection against bacterial growth. Discard food if it is past expiration date.

O (Oxygen) - some bacteria require oxygen to grow, while others require no oxygen. However, most of the bacteria that cause food borne illness can either grow with or without oxygen.

M (Moisture) - the amount of available water in food is called water activity(Aw). The lowest water activity (Aw) at which harmful bacteria can grow is 0.85. Most potentially hazardous foods have water activity values of 0.97-0.99, which is ideal for bacterial growth. Water activity can be reduced to safe level by freezing, dehydrating (removing the water) adding sugar, salt, or cooking. Dry foods such as beans and rice, become potentially hazardous when water is added.

Table 01. Bacteria causing food poisoning

Bacteria Responsible	Description	Habitat	Types of Foods	Cause
Staphylococcus aureus	Produces a heat-stable toxin	Nose and throat of 30 to 50 percent of healthy population; also skin and superficial wounds.	Meat and seafood salads, sandwich spreads and high salt foods.	Poor personal hygiene and subsequent temperature abuse.
Salmonella	Produces an intestinal infection	Intestinal tracts of animals and man	High protein foods - meat; poultry, fish and eggs.	Contamination of ready-to-eat foods, insufficient cooking
Clostridium perfringens	Produces a spore and prefers low oxygen	dust, soil and gastrointestinal	Meat and poultry dishes,	Improper temperature control

	atmosphere. Live cells must be ingested.	tracts of animals and man.	sauces and gravies.	of hot foods, and recontamination.
Clostridium botulinum	Produces a spore and requires a low oxygen atmosphere. Produces a heat-sensitive toxin.	Soils, plants, marine sediments and fish.	Home-canned foods.	Improper methods of home-processing foods.
Listeria monocytogenes	Survives adverse conditions for long time periods.	Soil, vegetation and water. Can survive for long periods in soil and plant materials.	Raw and uncooked meat, Milk, soft cheeses, vegetables fertilized with manure.	Contaminated raw products.
Campylobacter jejuni	Oxygen sensitive, does not grow below 86° F.	Animal reservoirs and foods of animal origin.	Meat, poultry, milk, and mushrooms.	Improper pasteurization or cooking. Cross-contamination.
Enter pathogenic coli	Can produce toxins that are heat stable and others that are heat-sensitive.	Feces of infected humans.	Meat and cheeses.	Inadequate cooking. Recontamination of cooked product.

2.5.1.2 Chemical Hazards

These are chemicals like pesticides, food additives and preservatives, cleaning supplies and toxic metals that leech through worn out food wares and equipment.

2.5.1.3 Physical Hazards

Physical hazards are foreign matters such as dirt, metal strips, wood splinters, broken glass, bone fragments and other objects that accidentally get into food

2.6 Hazard Identification

2.6.1 Hazard analysis and risk assessment in meat production practice

Animals are carriers of biohazards including foodborne pathogens *Clostridium perfringens*, *Campylobacter jejuni*, *Salmonella*, enterohaemorrhagic *Escherichia coli*. Chemical and physical hazards can be present in meat and ingredients or occur during processing. The meat industry is the most prepared for HACCP implementation. The results of assessments for chemical hazard, PAHs, and microbiological hazard, *S. aureus*, are presented.

Consumer expectations about meat product quality can be shortened to several criteria: it should be safe, delicious, juicy, fresh, healthy, and easy to prepare.

Risk profiling is needed at the first step. In many countries, the strategy of risk analysis is used for risk assessment. A general description of obligations for HACCP implementation to: (1) develop safety limits, (2) create hazard analysis methodology, (3) create hazard database. The aim is to describe some results of risk management application to meat processing: identification, control and management of hazards at each stage of the production chain, namely transportation, processing, storage, sale and consumption, producer responsibility for the output of hazardous products for human health and life.

Hazard analysis and risk assessment were done for each part of meat production chain, with average ratio of (micro)biological, chemical and physical hazards.

The presence of hazardous contaminants or other undesirable substances in food is often unavoidable as these substances may (1) occur ubiquitously; (2) be unable to be avoided technologically (nitrate, phosphates); (3) be of natural origin (plant alkaloids). Hazard identification and risk assessment is a good tool to get sufficient knowledge on hazard occurrence, human exposure and the absence of genotoxic potential. Many substances show genotoxic potential (e.g. aflatoxins, or polycyclic aromatic hydrocarbons (PAHs)). PAHs are of concern because some compounds have been identified as carcinogenic, mutagenic, and teratogenic. PAHs are found in meat cooked at high temperatures. According to the only benzo pyrene has to be identified in meat products with the approved level of 1 µm/kg or less.

Raw fermented meat products were declared to be low risk items if they are the result of controlled fermentation process. If a process is partly out of control, the risk of *Salmonella*, enterogaemorrhagic *Escherichia coli* occurrence is high. Low temperature, two weeks of curing and low sugar content help to avoid growth of *Staphylococcus aureus* during the process. *S. aureus* in meat and staphylococcal enterotoxin B are not determined in smoked meat products because this hazard was not critical for the traditional technology of smoked products.

As the range of hazards broadens and new meat processing techniques are implemented in the meat industry, it is likely that there will be an increasing demand for risk assessments. Science based approach to risk identification and risk assessment should be implemented in the food processing industry to meet the WTO/EU requirements for food safety assurance, objectivity and transparency. It is important to implement new processing techniques (when traditional hurdles are changed) after proper risk assessment. It is advisable to divide the responsibility between the people carrying out the risk assessment process, and those who conduct risk management.

2.6.2 Meat Hygiene

Meat hygiene consists of three major activities: post-mortem inspection; monitoring and surveillance for chemical hazards; and maintenance of good hygienic practice throughout all

stages between slaughter and consumption of meat. Improving the safety and wholesomeness of meat and meat products in local and international trade. Risk analysis, in one form or another, is well developed with respect to establishing standards and specifications for chemical hazards; methods for risk analysis of post-mortem meat inspection programmes are beginning to emerge. However, risk analysis of microbiological hazards in meat and meat products presents particular difficulties. All areas of application currently suffer from a lack of international agreement on risk assessment and risk management methodology.

2.7 Hazard Analysis and Critical Control Point system in meat plants

How to comply with food regulations that aim to reduce contamination of meat and maintain safety for consumers.

The HACCP system is internationally accepted as the system of choice for food safety management.

The seven principles it is based on are to:

1. identify any hazards that must be prevented eliminated or reduced
2. identify the critical control points (CCPs) at the steps at which control is essential
3. establish critical limits at CCPs
4. establish procedures to monitor the CCPs
5. establish corrective actions to be taken if a CCP is not under control
6. establish procedures to verify whether the above procedures are working effectively
7. establish documents and records to demonstrate the effective application of the above measures

The HACCP approach provides a systematic way of identifying food safety hazards and making sure that they are being controlled every day.

Chapter 03

Food Safety Standards of Meat – National and International

3.1 Components of meat inspection

3.1.1 Meat Inspection

The objectives of meat inspection Programme are twofold:

- To ensure that only apparently healthy, physiologically normal animals are slaughtered for human consumption and that abnormal animals are separated and dealt with accordingly.
- To ensure that meat from animals is free from disease, wholesome and of no risk to human health.

These objectives are achieved by ante mortem and postmortem inspection procedures and by hygienic dressing with minimum contamination. Whenever appropriate the Hazard Analysis Critical Control Point (HACCP) principles should be used: The inspection procedures should be appropriate to the spectrum and prevalence of diseases and defects present in the particular class of livestock being inspected using the principles of risk assessment.

3.1.2 Ante-mortem and Postmortem inspection of Food animals

3.1.2.1 Ante-mortem examination is done within 24 hours of slaughtering and repeated if slaughtering has been delayed over a day. Animals affected with extensive bruising or fractures require emergency slaughtering, are separated. Animals showing clinical signs of disease are held for veterinary examination and judgment. They are treated as “suspected animals” and are segregated from the healthy animals. The disease and management history is recorded on an A/M inspection sheet.

3.1.2.2 Ante-mortem objectives

The major objectives of ante-mortem inspection are as follows:

- To screen all animals destined to slaughter.
- To ensure that animals are properly rested and that proper clinical information, which will assist in the disease diagnosis and judgment is obtained.
- To reduce contamination on the killing floor by separating the dirty animals and condemning the diseased animals if required by regulation.
- To ensure that injured animals or those with pain and suffering receive emergency slaughter and that animals are treated humanely.
- To identify reportable animal diseases to prevent killing floor contamination.
- To identify sick animals and those treated with antibiotics, chemotherapeutic agents, insecticides and pesticides.
- To require and ensure the cleaning and disinfection of trucks used to transport livestock.



3.1.2.3 Ante-mortem inspection is carried out in adequate lighting where the animals are observed both collectively and individually at rest and motion. The general behavior of animals is observed, as well as their nutritional status, cleanliness, signs of diseases and abnormalities. Some of the abnormalities which are checked on ante-mortem examination include:

3.1.2.3.1 Abnormalities in respiration: Abnormalities in respiration commonly refer to frequency of respiration. If the breathing pattern is different from normal the animal should be segregated as a suspect.

3.1.2.3.2 Abnormalities in behavior

- Abnormalities in behavior are manifested by one or more of the following signs: The animal may be:

- ✓ walking in circles or show an abnormal gait or posture
- ✓ pushing its head against a wall
- ✓ charging at various objects and acting aggressively
- ✓ showing a dull and anxious expression in the eyes



3.1.2.3.2 Abnormalities in gait

An abnormal gait in an animal is associated with pain in the legs, chest or abdomen or is an indication of nervous disease.

3.1.2.3.3 Abnormalities in posture

Abnormal posture in an animal is observed as tucked up abdomen or the animal may stand with an extended head and stretched out feet. The animal may also be laying and have its head turned along its side. When it is unable to rise, it is often called a “downer”. Downer animals are handled with caution in order to prevent further suffering.

3.1.2.3.4 Abnormalities in structure and conformation

- Abnormalities in structure (conformation) are manifested by:
- swellings (abscesses) seen commonly in swine
- enlarged joints

- umbilical swelling (hernia or omphalophlebitis)
- enlarged sensitive udder indicative of mastitis
- enlarged jaw (“lumpy jaw”)
- bloated abdomen

3.1.2.3.5 Abnormal discharges or protrusions from body openings

- Abnormal discharges or protrusions from the body are:
 - ✓ discharges from the nose, excessive saliva from the mouth, afterbirth
 - ✓ protruding from the vulva, intestine
 - ✓ protruding from the rectum (prolapsed rectum) or uterus
 - ✓ protruding from the vagina (prolapsed uterus)
 - ✓ growths on the eye and bloody diarrhea

3.1.2.3.6 Abnormal color: Abnormal color such as red areas on light colored skin (inflammation), dark blue areas on the skin or udder (gangrene).

3.1.2.3.7 Abnormal odour: An abnormal odour is difficult to detect on routine A/M examination. The odour of an abscess, a medicinal odour, stinkweed odour or an acetone odour of ketosis may be observed. Since many abattoirs in developing countries have not accommodation station or yards for animals, Inspector's ante-mortem judgment must be performed at the admission of slaughter animals.

3.1.2.2 Postmortem inspection

Routine postmortem examination of a carcass should be carried out as soon as possible after the completion of dressing in order to detect any abnormalities so that products only conditionally fit for human consumption are not passed as food. All organs and carcass portions should be kept together and correlated for inspection before they are removed from the slaughter floor.

Postmortem inspection should provide necessary information for the scientific evaluation of pathological lesions pertinent to the wholesomeness of meat. Professional and technical knowledge must be fully utilized by:

- viewing, incision, palpation and olfaction techniques.
- classifying the lesions into one of two major categories - acute or chronic.
- establishing whether the condition is localized or generalized, and the extent of systemic changes in other organs or tissues.
- Determining the significance of primary and systemic pathological lesions and their relevance to major organs and systems, particularly the liver, kidneys, heart, spleen and lymphatic system.
- coordinating all the components of ante mortem and postmortem findings to make a final diagnosis.
- submitting the samples to the laboratory for diagnostic support, if abattoir has holding and refrigeration facilities for carcasses under detention.

3.1.2.2.1 Carcass judgement

Trimming or condemnation may involve:

- Any portion of a carcass or a carcass that is abnormal or diseased.
- Any portion of a carcass or a carcass affected with a condition that may present a hazard to human health.

HEADS

General View external surfaces. For cattle, horses view the oral and nasal cavities.

Lymph nodes (Fig. 1)

Submaxillary

Parotid

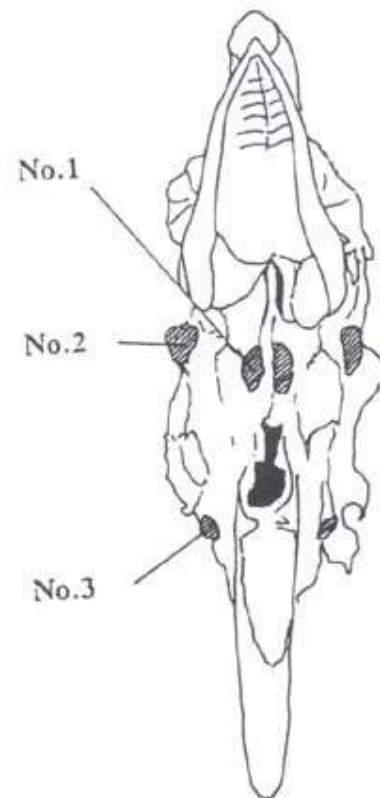
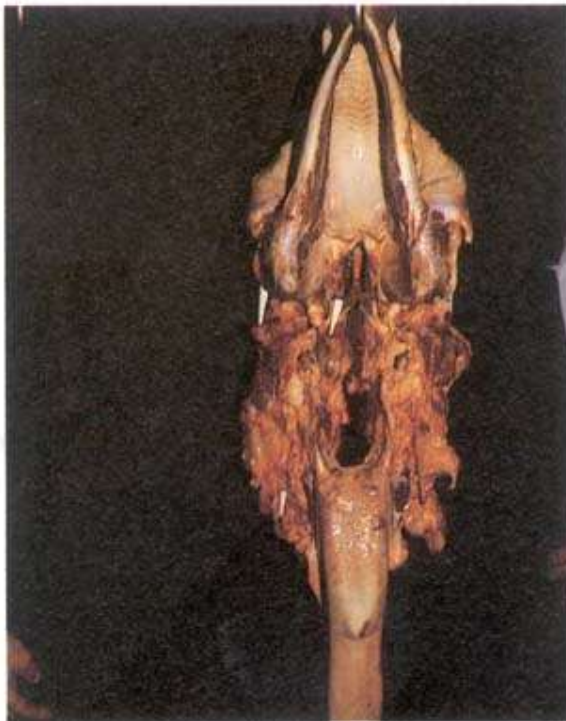
Retropharyngeal

Incise(a)

Incise(a)

Incise(a)

View and incise by multiple incision or slicing.



Head inspection. Retropharyngeal (No. 1), parotid (No. 2) and submaxillary (No. 3) lymph nodes are viewed and incised by multiple incisions and slicing.



Head inspection in buffalo.

Retropharyngeal lymph nodes (No. 1) are viewed and incised by multiple incisions and slicing.

Tongue View and palpate (view only in calves up to 6 weeks of age).

Other

Cattle - except in calves up to six week of age, the oesophagus of all cattle and calves should be separated from its attachment to the trachea and viewed.

- as part of inspection of all cattle and calves over the age of 6 weeks for *Cysticercus bovis*, the muscles of mastication should be viewed and one or more linear incisions made parallel

to the lower jaw into the external and internal muscles of mastication; in addition one incision into M.triceps brachii, 5 cm behind the elbow, should be made.

3.1.3 Guidelines for minimum Postmortem Inspection Requirements in large and small ruminants

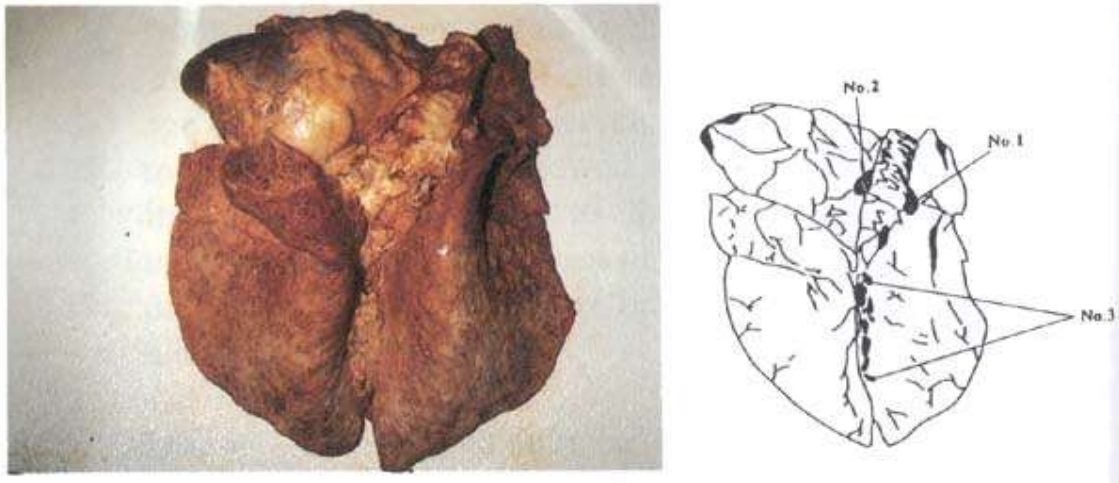
VISCERA

Lungs

View and palpate. Except in sheep and goats, the bronchi should be opened up by a transverse incision across the diaphragmatic lobes. For horses and cattle, the larynx, trachea and main bronchi should be opened along their length.

Lymph nodes

Bronchial (tracheobronchial) and mediastinal: Incise, (a) (see "Notes")



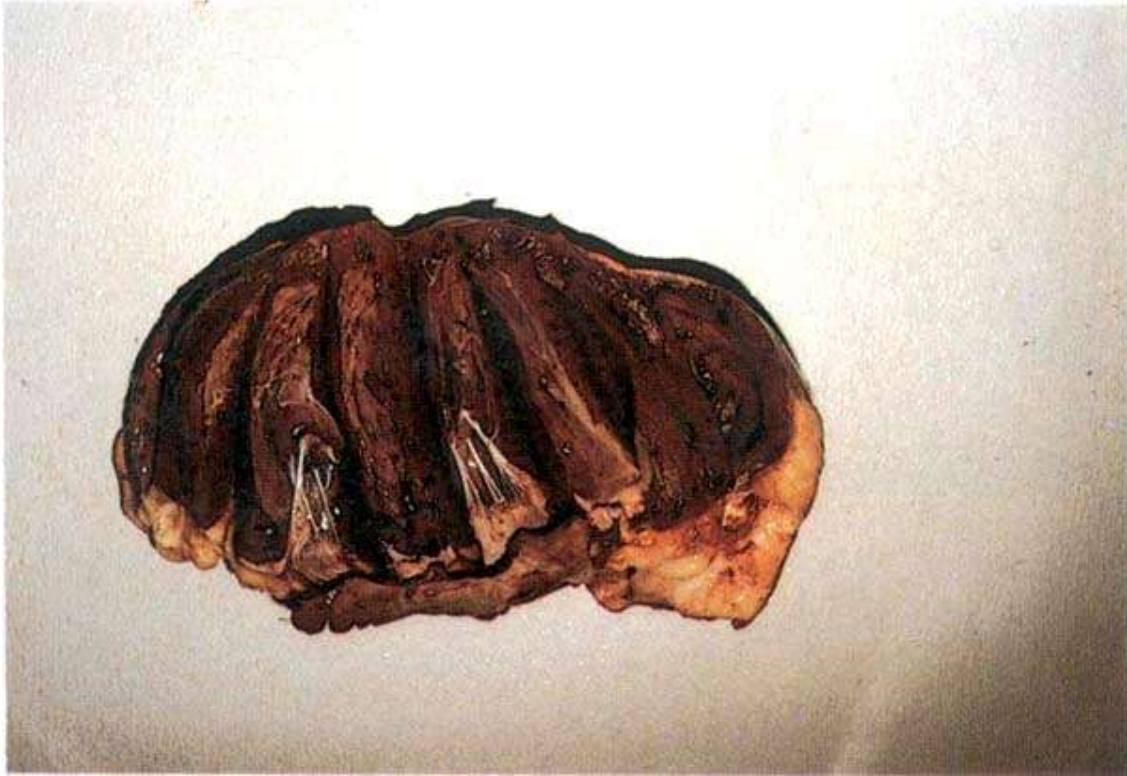
Lung inspection - Bronchial left (No. 1) and right (No. 2) and mediastinal (No. 3) lymph nodes are viewed and incised.



Lung inspection in buffalo - Open trachea and incised bronchial and mediastinal lymph nodes.

Heart

View after the removal of the pericardium. Additional inspection requirements for cattle as per (b).



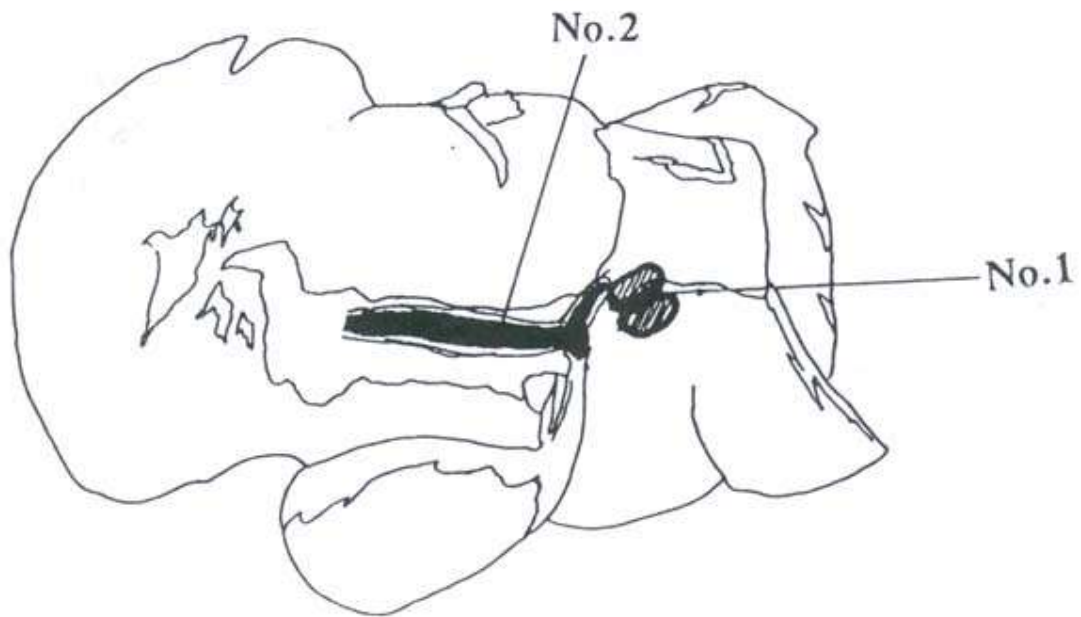
Heart inspection - Lengthwise incisions (minimum four) from base to apex into the heart muscles. Observe cut surfaces.

Liver

View and palpate entire surface (both sides). View the gall bladder. For cattle over 6 weeks of age, incise as deemed appropriate to detect liver flukes. Open large bile ducts. For sheep incise as deemed appropriate for parasite.

Lymph nodes

Portal (hepatic), view and incise



Liver inspection - Incised portal (hepatic) lymph nodes (No. 1) and opened large bile duct (No. 2).

Spleen

Palpate



Stomachs and spleen inspection - Viewing of rumen and viewing and palpation of spleen.

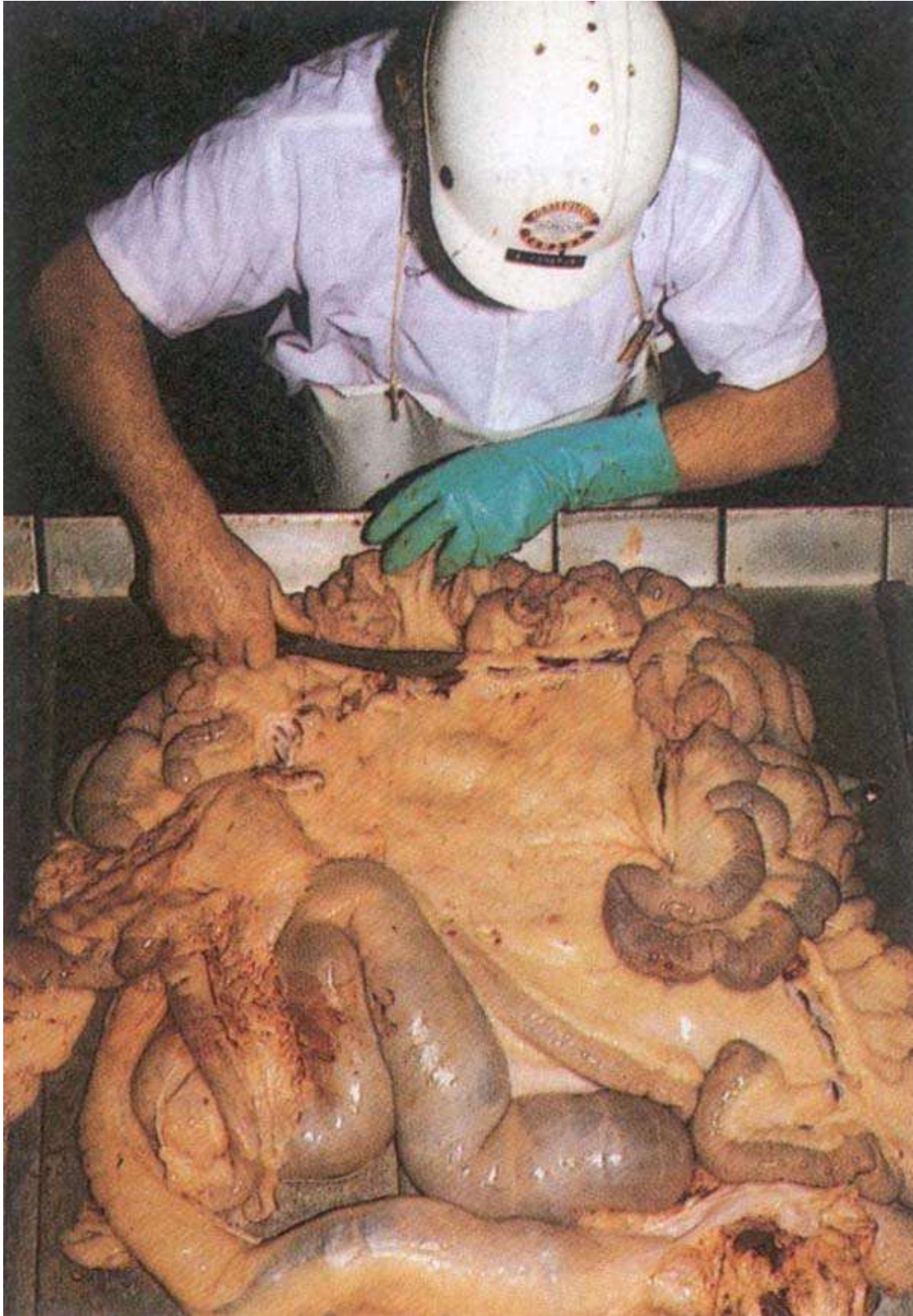
Gastrointestinal tract

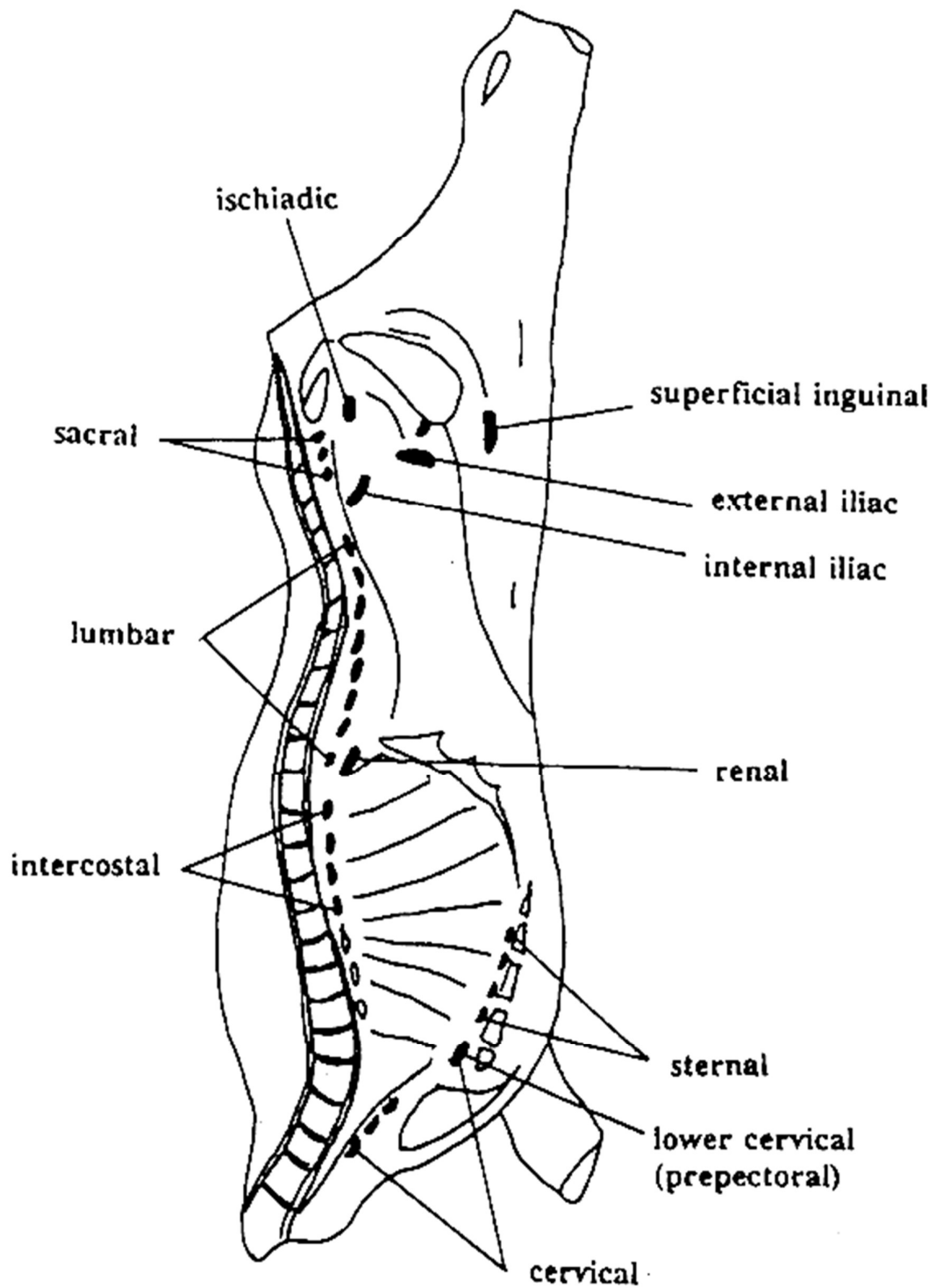
View (a)

Mesenteric lymph nodes



Viewing of rumen, reticulum, omasum and abomasum.





Medial view of carcass with relevant lymph nodes

3.2 Quality of Meat

To the consumer an enjoyable [meat](#) eating experience is one that associates meat with being tender, juicy, and flavorsome. Consumer studies show that [tenderness](#) and [flavor](#) are the most important characteristics determining the acceptability of meat. However, there is a wide range of other attributes that can potentially influence acceptability of meat.

Visual appearance is very important in determining the likelihood of purchase. Bright red in the case of [beef](#) and [lamb](#) is the desirable [color](#) of [lean](#) meat. The amount of [fat](#) can also influence meat's visual appeal.

3.2.1 Factors affecting meat quality

The key factors that affect meat quality have been intensively researched for the production of consistent [eating quality](#) in beef, lean and tender lamb quality.

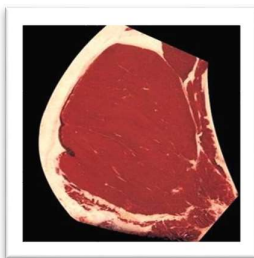
Age - there is clear differences in the attributes of meat from young and older animals.

Breed - the observed differences from various breeds are small for [cattle](#) and [sheep](#).

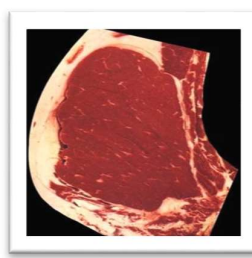
Gender - is a factor but modern production methods have reduced variability.

Fat content - marbling (intra muscular fat) can increase juiciness and flavor scores.

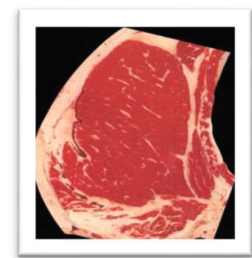
Diet - is an important factor in fat type, which in turn affects flavor.



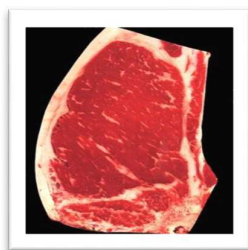
Slight



Small



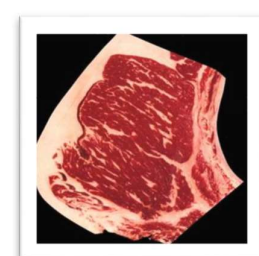
Modest



Moderate



Slightly



Moderate

Production systems and pre-slaughter handling - the avoidance of stress in the live animal is important in livestock production, during transport and when the animal enters the [abattoir](#) before slaughter it can cause dark, firm and dry meat affecting both tenderness and flavor.

Tenderness There are a number of factors that can influence the tenderness of meat

Chilling conditions - Rigor mortis (the stiffening of the carcass) occurs naturally following slaughter. Muscles shorten as they go into rigor and the pH of the muscle (measure of acidity or alkalinity) falls. The amount of muscle shortening affects the meat's tenderness. If carcasses are enter rigor mortis below 10-12°C, 'cold shortening' of the muscle fibers can

occur, causing toughness and preventing tenderization through ageing. Cold shortening is a problem where rapid chilling systems are used, particularly for sheep carcasses where the low volume of meat means the muscle cools very rapidly. Similarly, if carcasses enter rigor mortis above 20°C, 'hot shortening' occurs. The reduction in tenderness is not as appreciable as in cold shortening.

Hanging– The method of carcass suspension influences the degree of tension which muscles are under when rigor mortis occurs. Suspending lamb and beef carcasses from the hip rather than by the Achilles tendon, allows the commercially more important muscles of the carcass to be stretched, thus improving tenderness. In beef, correct hanging is more beneficial to meat tenderness than electrical stimulation.

BEEF HANGING METHODS: TENDER STRETCHING VS ACHILLES HUNG

The tenderness of your meat can be attributed to the way the meat is hung rather than the cut you choose. Natural factors, like age and breed, play a small part, the butcher does the rest. Let me tell you why.

JUST HANGING OUT

The process of meat stretching or hanging takes place after the animal is harvested and skinned, followed by the removal of its internal organs, head, and feet. It is hung in cold storage for around 24 hours until it is the right temperature to be broken down into the basic cuts. While the lower temperature helps preserve muscle mass and prevent bacterial growth, it also has a disadvantage. As soon as the temperature goes below 12°C, the meat fibres contract until they reach a stage called "cold shortening". If the cold shortening occurs before the carcass approaches the point of rigor mortis – or the stiffening of the body – it can turn the meat significantly tougher.

This is where the role of hanging the carcass comes into play. Hanging allows the muscles to stretch and puts a curb on cold shortening. Industrially speaking, there are two methods of meat hanging used, which are:

The Achilles method – The hanging hook is positioned through the rear heels. Gravity causes tension in these muscles as the carcass goes through rigor mortis which can result in tougher meat than tender-stretch method.

Tender stretch method – The hanging hook is positioned under the ligament that runs down the back of the carcass, or under the hip-bone of the pelvis. In this position, the legs are suspended at a 90° angle, which limits the contraction of muscles during rigor mortis. This method especially benefits the hindquarter cuts.



Ageing – Tender stretched carcasses age at a much faster rate, producing a level of tenderness much quicker than Achilles-suspended animal bodies. Meat yielded from the Achilles tendon method, however, does become equally tender when given the time to age sufficiently.

No electrical stimulation – When being readied for commercial consumption, Achilles-suspended carcasses typically need to be electrically stimulated in order to achieve the ideal pH levels and temperature. Tender stretching, on the other hand, helps avoid the use of electrical stimulation altogether as it attains tenderization solely on the basis of positioning.

Spreads meat out evenly – Due to its right-angled posture, tender stretched leg portions can experience significant changes from their natural form. This results in the meat surrounding the bone in equal proportions. This is particularly appreciated by professional chefs and food connoisseurs.

- **Flavor** is the combined result of the [taste](#) and smell senses and because it is a subjective property, is difficult to evaluate. Each species has its own characteristic flavor. The flavor of meat can be influenced by the diet of the animal. Grass or forage-fed cattle and sheep tend

to produce meat with a more intense flavor than grain-fed animals. Grass-feeding increases certain polyunsaturated [fatty acid](#) concentrations in the muscle and improves flavor.

- **Color** is a major influence on the visual appeal of meat rather than on quality. The color of meat is primarily dependent on the concentration and chemical state of the pigment myoglobin, which is responsible for moving oxygen through the muscle. The amount of myoglobin varies widely between the species, which accounts for the marked differences in color between their meats. The type of packaging used at retail and thus the amount of oxygen to which the meat is exposed, influences the meat's color and appeal to the customer

3.3 Carcass grading

3.3.1 Quality Grades of Carcass Beef (steer, heifer, cow)

3.3.1.1 Prime.

Depending on their degree of maturity, beef carcasses possessing the minimum requirements for the Prime grade vary in their other indications of quality as evidenced in the ribeye muscle. Minimum quality characteristics are described for two maturity groups, which cover the entire range of maturity permitted in the Prime grade.

Carcasses in the younger group, range from the youngest that are eligible for the beef class to those at the juncture of the two maturity groups, which have slightly red and slightly soft chine bones and cartilages on the ends of the thoracic vertebrae that have some evidence of ossification. In addition, the sacral vertebrae are completely fused and the cartilages on the ends of the lumbar vertebrae are nearly completely ossified. The rib bones are slightly wide and slightly flat and the ribeye muscle is light red in color and is fine in texture. In carcasses throughout the range of maturity included in this group, a minimum slightly abundant amount of marbling is required and the ribeye muscle is moderately firm.



Carcasses in the older group range from those described above as representative of the juncture of the two groups to those at the maximum maturity permitted in the Prime grade, which have chine bones tinged with red and cartilages on the ends of the thoracic vertebrae that are partially ossified. In addition, the sacral vertebrae are completely fused, the cartilages on the ends of the lumbar vertebrae are completely ossified, and the cut surface of the lean tends to be fine in texture. The minimum degree of marbling required increases with advancing maturity throughout this group from minimum slightly abundant to maximum slightly abundant and the ribeye muscle is firm.

3.3.1.2 Choice.

Carcasses in the younger group range from the youngest that are eligible for the beef class, to those at the juncture of the two maturity groups, which have slightly red and slightly soft chine bones and cartilages on the ends of the thoracic vertebrae that have some evidence of ossification. In addition, the sacral vertebrae are completely fused and the cartilages on the ends of the lumbar vertebrae are nearly completely ossified. The rib bones are slightly wide and slightly flat and the ribeye muscle is moderately light red in color and is fine in texture. In carcasses throughout the range of maturity included in this group, a minimum small amount of marbling is required and the ribeye muscle may be slightly soft.



Carcasses in the older group range from those described above as representative of the juncture of the two groups, to those at the maximum maturity permitted in the Choice grade, which have chine bones tinged with red and cartilages on the ends of the thoracic vertebrae are partially ossified. In addition, the sacral vertebrae are completely fused, the cartilages on the ends of the lumbar vertebrae are completely ossified, and the cut surface of the lean tends to be fine in texture. In carcasses throughout the range of maturity included in this group, a minimum modest amount of marbling is required and the ribeye muscle is slightly firm.

3.3.1.3 Select.

In carcasses throughout the range of maturity permitted in the Select grade, the minimum marbling required is a minimum slight amount and the ribeye may be moderately soft.

Carcasses in the maturity group permitted range from the youngest that are eligible for the beef class, to those at the juncture of the two maturity groups, which have slightly red and slightly soft chine bones and cartilages on the ends of the thoracic vertebrae that have some evidence of ossification. In addition, the sacral vertebrae are completely fused and the cartilages on the ends of the lumbar vertebrae are nearly completely ossified. The rib bones are slightly wide and slightly flat and the ribeye muscle is slightly light red in color and is fine in texture. In carcasses throughout the range of maturity included in this group, a minimum slight amount of marbling is required and the ribeye may be moderately soft.



3.3.1.4 Standard.

Carcasses in the younger group range from the youngest that are eligible for the beef class to those at the juncture of the two maturity groups, which have slightly red and slightly soft chine bones and cartilages on the ends of the thoracic vertebrae that have some evidence of ossification. In addition, the sacral vertebrae are completely fused and the cartilages on the ends of the lumbar vertebrae are nearly completely ossified. The rib bones are slightly wide and slightly flat and the ribeye muscle is slightly dark red in color and is fine in texture. In carcasses throughout the range of maturity included in this group, a minimum practically devoid amount of marbling is required and the ribeye muscle may be soft.

Carcasses in the older group range from those described above as representative of the juncture of the two groups to those at the maximum maturity permitted in the Standard grade, which have chine bones tinged with red and cartilages on the ends of the thoracic vertebrae that are partially ossified. In addition, the sacral vertebrae are completely fused, the cartilages on the ends of the lumbar vertebrae are completely ossified, and the cut surface of the lean is moderately fine in texture. The minimum degree of marbling required increases with advancing maturity throughout this group from minimum practically devoid to maximum practically devoid and the ribeye muscle may be moderately soft.

3.3.1.5 Commercial.

Commercial grade beef carcasses are restricted to those with evidences of more advanced maturity than permitted in the Standard grade. Depending on their degree of maturity, beef carcasses possessing the minimum requirements for the Commercial grade vary in their other indications of quality as evidenced in the ribeye muscle. Minimum quality characteristics are described for the youngest and the most mature of these groups. The requirements for the intermediate group are determined by interpolation between the requirements indicated for the two groups described.

Carcasses in the youngest group permitted in the Commercial grade range from those with indications of maturity barely more advanced than described as maximum for the Standard grade, to those with moderately hard, rather white chine bones and with cartilages on the ends of the thoracic vertebrae that show considerable ossification but the outlines of the cartilages are still plainly visible. In addition, the rib bones are moderately wide and flat and the ribeye muscle is moderately dark red and slightly coarse in texture. The minimum degree of marbling required increases with advancing maturity throughout this group from a minimum small amount to a maximum small amount and the ribeye muscle is slightly firm.

The youngest carcasses in the most mature group included in the Commercial grade have hard, white chine bones and the outlines of the cartilages on the ends of the thoracic vertebrae are barely visible, the rib bones are wide and flat, and the ribeye muscle is dark red and coarse in texture. The range of maturity in this group extends to include carcasses from the oldest animals marketed. The minimum degree of marbling required increases with advancing maturity throughout this group from a minimum moderate amount to a maximum moderate amount and the ribeye muscle is firm.

3.3.1.6 Utility.

Carcasses in the first or youngest maturity group range from the youngest that are eligible for the beef class, to those at the juncture of the first two maturity groups, which have slightly red

and slightly soft chine bones and cartilages on the ends of the thoracic vertebrae that have some evidence of ossification. In addition, the sacral vertebrae are completely fused and the cartilages on the ends of the lumbar vertebrae are nearly completely ossified. The rib bones are slightly flat and the ribeye muscle is slightly dark red in color and fine in texture. In carcasses throughout the range of maturity included in this group, the ribeye muscle is devoid of marbling and may be soft and slightly watery.

Carcasses in the third or intermediate maturity group range from those with indications of maturity barely more advanced than described as maximum for the Standard grade, to those with moderately hard, rather white chine bones and with cartilages on the ends of the thoracic vertebrae that show considerable ossification but the outlines of the cartilages are still plainly visible. In addition, the rib bones are moderately wide and flat and the ribeye muscle is dark red in color and slightly coarse in texture. The minimum degree of marbling required increases with advancing maturity throughout this group from minimum practically devoid to maximum practically devoid and the ribeye muscle may be moderately soft.

The youngest carcasses in the fifth or oldest maturity group have hard, white chine bones, and the outlines of the cartilages on the ends of the thoracic vertebrae are barely visible, the rib bones are wide and flat, and the ribeye muscle is very dark red in color and coarse in texture. The range in maturity in this group extends to include carcasses from the oldest animals produced. The minimum degree of marbling required increases with advancing maturity throughout this group from a minimum slight amount to a maximum slight amount and the ribeye muscle is slightly firm.

3.3.1.7 Cutter.

Depending on their degree of maturity, beef carcasses possessing the minimum requirements for the Cutter grade vary in their other indications of quality as evidenced in the ribeye muscle. Carcasses within the full range of maturity classified as beef are included in the Cutter grade. Thus, five maturity groups are recognized. Minimum quality requirements are described for three of these groups -- the first or youngest, the third or intermediate, and the fifth or the most mature. The requirements for the second and fourth maturity groups are determined by interpolation between the requirements described for their adjoining groups.

Carcasses in the first or youngest maturity group range from the youngest that are eligible for the beef class to those at the juncture of the first two maturity groups, which have slightly red and slightly soft chine bones and cartilages on the ends of the thoracic vertebrae that have some evidence of ossification. In addition, the sacral vertebrae are completely fused and the cartilages on the ends of the lumbar vertebrae are nearly completely ossified. The rib bones are slightly wide and slightly flat and the ribeye muscle is slightly dark red in color and fine in texture. In carcasses throughout the range of maturity included in this group, the ribeye muscle is devoid of marbling and may be very soft and watery.

Carcasses in the third or intermediate maturity group range from those with indications of maturity barely more advanced than described as maximum for the Standard grade, to those with moderately hard, rather white chine bones and with cartilages on the ends of the thoracic vertebrae that show considerable ossification but the outlines of the cartilages are still plainly visible. In addition, the rib bones are moderately wide and flat and the ribeye muscle is dark

red in color and slightly coarse in texture. In carcasses throughout the range of maturity included in this group, the ribeye muscle is devoid of marbling and may be soft and watery.

Carcasses in the fifth or oldest maturity group have hard white chine bones and the outlines of the cartilages on the ends of the thoracic vertebrae are barely visible, the rib bones are wide and flat, and the ribeye muscle is very dark red in color and coarse in texture. The range in maturity in this group extends to include carcasses from the oldest animals produced. The minimum degree of marbling required increases with advancing maturity throughout this group from minimum practically devoid to maximum practically devoid and the ribeye muscle is soft and slightly watery.

3.3.1.8 Canner.

The Canner grade includes only those carcasses that are inferior to the minimum requirements specified for the Cutter grade.

3.4 Meat Quality standards in global market

3.4.1 Yield Grade 1.

A carcass in Yield Grade 1 usually has only a thin layer of external fat over the ribs, loins, rumps, and clods, and slight deposits of fat in the flanks and cod or udder. There is usually a very thin layer of fat over the outside of the rounds and over the tops of the shoulders and necks. Muscles are usually visible through the fat in many areas of the carcass.

A 700-pound carcass of this yield grade, which is near the borderline of Yield Grades 1 and 2, might have two-tenths inch of fat over the ribeye, 12.5 square inches of ribeye, and 1.5 percent of its weight in kidney, pelvic, and heart fat.

A 1,100-pound carcass of this yield grade, which is near the borderline of Yield Grades 1 and 2, might have four-tenths inch of fat over the ribeye, 19.1 square inches of ribeye, and 2.0 percent of its weight in kidney, pelvic, and heart fat.

3.4 .2 Yield Grade 2.

A carcass in Yield Grade 2 usually is nearly completely covered with fat but the lean is plainly visible through the fat over the outside of the rounds, the tops of the shoulders, and the necks. There usually is a slightly thin layer of fat over the loins, ribs, and inside rounds and the fat over the rumps, hips, and clods usually is slightly thick. There are usually small deposits of fat in the flanks and cod or udder.

A 700-pound carcass of this yield grade, which is near the borderline of Yield Grades 2 and 3, might have five-tenths inch of fat over the ribeye, 12.3 square inches of ribeye, and 2.5 percent of its weight in kidney, pelvic, and heart fat.

A 1,100-pound carcass of this yield grade, which is near the borderline of Yield Grades 2 and 3, might have six-tenths inch of fat over the ribeye, 18.1 square inches of ribeye, and 3.0 percent of its weight in kidney, pelvic, and heart fat.

3.4 .3 Yield Grade 3.

A carcass in Yield Grade 3 usually is completely covered with fat and the lean is usually visible through the fat only on the necks and the lower part of the outside of the rounds. There usually is a slightly thick layer of fat over the loins, ribs, and inside rounds and the fat over the rumps, hips, and clods usually is moderately thick. There usually are slightly large deposits of fat in the flanks and cod or udder.

A 700-pound carcass of this yield grade, which is near the borderline of Yield Grades 3 and 4, might have seven-tenths inch of fat over the ribeye, 11.0 square inches of ribeye, and 3.0 percent of its weight in kidney, pelvic, and heart fat.

A 1,100-pound carcass of this yield grade, which is near the borderline of Yield Grades 3 and 4, might have eight-tenths inch of fat over the ribeye, 16.9 square inches of ribeye, 3.5 percent of its weight in kidney, pelvic, and heart fat.

3.4.4 Yield Grade 4.

A carcass in Yield Grade 4 usually is completely covered with fat. The only muscles usually visible are those on the shanks and over the outside of the plates and flanks. There usually is a moderately thick layer of fat over the loins, ribs, and inside rounds and the fat over the rumps, hips, and clods usually is thick. There usually are large deposits of fat in the flanks and cod or udder.

A 700-pound carcass of this yield grade, which is near the borderline of Yield Grades 4 and 5, might have nine-tenths inch of fat over the ribeye, 9.8 square inches of ribeye, and 3.5 percent of its carcass weight in kidney, pelvic, and heart fat.

A 1,100-pound carcass of this yield grade, which is near the borderline of Yield Grades 4 and 5, might have one inch of fat over the ribeye, 15.6 square inches of ribeye, and 4.0 percent of its weight in kidney, pelvic and heart fat.

3.4.5 Yield Grade 5.

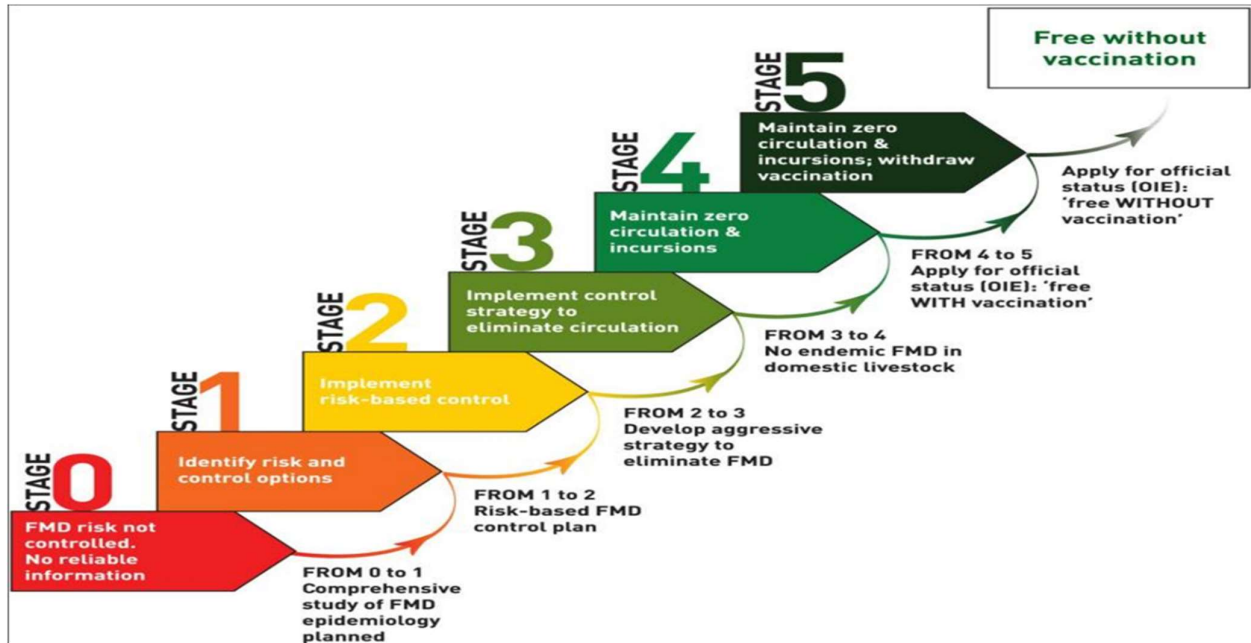
3.5 A carcass in Yield Grade 5 usually has more fat on all of the various parts, a smaller area of ribeye, and more kidney, pelvic, and heart fat than a carcass in Yield Grade
Sanitary and PhytoSanitary (SPS) requirements for global markets

In Pakistan, livestock is the largest sector of agriculture and plays a pivotal role in the economy. Despite the enormity of animal number, animal health and production are compromised due to presence of Foot and Mouth Disease (FMD), which is a highly contagious viral disease of animals and remains one of the most important disease and the biggest trade barrier for animals and animal products to high end markets despite having huge potential of animals and animal products trade of the country.

Government of Pakistan is engaged in prevention and control of FMD through its own resources and support from international development partners. Based on the successful demonstration of development of technical framework for control of FMD, Pakistan moved to Stage 2 of the Global Progressive Control Pathway (PCP) in 2015 (FAO/OIE FMD-PCP), it followed a six-year National FMD Control Program namely "Risk based Control of Foot and

Mouth Disease in Pakistan” (2018-2024). The program is countrywide and is expected to move Pakistan FMD control efforts from stage 2 to stage 3.

In order to gain access to international markets such as China, Russia, Indonesia and other key Asian countries, Pakistan’s meat needs endorsement by the World Organization for Animal Health (OIE) to improve Pakistan’s ranking in Progress Control Pathways (PCP) from stage 2 to stage 3. This will allow meat exporters to access markets that had previously not allowed import of Pakistani meat due to potential FMD contamination.



OIE Progressive Control Pathway for FMD Control Program

Chapter 04

National and International Best Practices.

4.1 Cleaning and Sanitizing of Meat Plant Machinery/Equipment

The highest level of hygiene is required in meat plants

Meat can easily be contaminated by

- Germs (found in equipment, clothes and bodies)
- Molds.
- Chemicals
- Viruses
- Dirt

- Foreign objects

Contamination will affect the appearance of meat. Some forms of contamination may cause illness or even death. Most germs that contaminate food come from hands, the surfaces and equipment used in processing transport and storage.

All knives and other using equipment's, including clothing, can carry germs and may cause contamination. It is the responsibility of the food handler to make sure that everything used, touched, prepared and sold is clean and free from contamination.

Cleaning and sanitizing

Cleaning and sanitizing are two step processes which aim to control contamination by eliminating or reducing the presence of germs on the equipment that meat handler use.

Cleaning

Cleaning is the first step in this procedure. It is the process of removing dirt and grease from surfaces. Cleaning could remove all soil and foods build up on equipment surfaces but it does not guarantee the elimination of germs.

Detergents are substances that lift grease and dirt but do not destroy germs and their spores.

Sanitizing

Sanitizing is the second step. Sanitizing is the reduction of bacteria to level, safe to use. Different methods are used that kills most kinds of germs.

Different sanitizing methods include:

- Steam or very hot water
- Chemicals/Disinfectant

Sanitizers are chemical substances specifically produced for the food processing industry, which are used to kill germs.

Steps to clean and sanitize

Six steps that should follow when cleaning and sanitizing the equipment's.

- i. Remove all the solid particles on the surface of the equipment's.
- ii. Wash with water, use detergent and hot water (if necessary) to remove the grease and other particles.
- iii. Rinse well with tap water.
- iv. Sanitize with an approved sanitizer.
- v. Rinse with clean tap water.

- vi. Dry tools carefully with a clean dry cloth or air dry.

What to clean and sanitize

- Food contact surfaces.
- Hand contact surfaces.
- Production areas.

When to clean and sanitize

- Clearing and cleaning up immediately after every task.

Stages of wet cleaning sanitizing



- Pre-clean, remove loose and heavy soiling.
- Main clean, wash with hot/tap water and detergent.
- Rinses, remove any traces of detergent and food particles with clean hot/tap water.
- Disinfection, use chemical, disinfectant; make sure to leave it on for the correct contact time.
- Final rinse, use clean hot/tap water.
- Dry.

Assessment of the cleaning procedure

- No Visible dirt.
- No greasy or gritty feeling when rubbed.
- No off-odor.
- Wetting test: no excessive water break.
- Microbial assessment.

Cleaning agents

- Detergents.
- Solvent cleaners or degreasers.
- Acid cleaners.

Sanitizing agents

- Heat sanitizing.
- Chemical sanitizing.

Factor that influence chemical sanitizers

- Contact time.
- Selectivity.
- Concentration.
- Temperature.

Benefits of proper cleaning

- Minimum product rejection, returns, complaints.
- Increase product shelf life.
- Reduce risk of involvement in food poisoning.
- Facilities preventive maintenance.

Chlorination Levels as a sanitizer for the following areas of concern:

- Hand dip 20-30 ppm
- Foot bath 250-350 ppm
- Floor 250-350 ppm
- Equipment's 150-200 ppm

(Ppm- parts per million)

Chemicals and hazardous substances

When working with chemicals or hazardous substances, it is important to know:

- Which chemical you are using.
- How to use, handle and store each chemical according to manufacturer's specification.
- What to do when an accident occurs
- Wear protective clothing when using chemicals, do not mix chemicals.

Directions for use and dosing:

Follow the instructions on the cleaning agent. Generally, all surfaces that will later get into contact with meat and meat products must subsequently be rinsed thoroughly with water.

Packaging:

Never pour cleaning agents into other cans or containers.

Store: only in original containers.

Caution: Use with caution on sensitive materials.

Approval: The cleaning agent must be approved for use within the food industry.

Avoid contact with skin and eyes.

Wear suited personal protective clothing: gloves, goggles, apron and boots.

Store out of reach of children and in tightly closed, original container.

Precautions by spill and disposal

Small amounts of spill are rinsed away with water. Large amounts are absorbed with absorbing material and delivered to approve receiving station. Subsequently rinse with plenty of water.

Pest control

Basic rules

- Good housekeeping and keeping premises clean.
- Keeping a lookout for vermin.
- Keeping them out.
- Use only professional pest controllers.

4.2 Safety and Health in the workplace

The working environment should be planned so that any risk of accident is minimal. Following considerations shall be made when planning workplace for meat operations:

- Adequate lightening, cooling and ventilation facilities
- Adequate means of access and egress from all work place
- Clearly identified power, steam , compressed air and service lines
- Clearly identified access to emergency lines, rescue and fire equipment.
- In designing the building, factors that may result in slips, trips or falls should be taken into account.
- In the meat industry, fact, blood, meat scarps, water and other waste will tend to make floors more slippery. Floors and work platforms should be even and normally horizontal; slopes for drainage should be minimized.
- The area under hydraulic platform should be designed as hazardous zone during normal working operations.

Personal hygiene of workers

- Workers are the main source of meat contamination in plant and butchery operation. All the workers must wear the personal protective equipment for their own protection and meat safety and hygiene point of view.

Personal Protective Equipment (PPE)

- Personal protective equipment and clothing are items worn by employees to minimize or eliminate exposure to occupational hazards. It include Helmet, gum shoes, surgical gloves, face mask, hair net / mask, water proof aprons etc. should be used in slaughtering halls, processing units and butchery operations.



The employer should further ensure provision of eye and face protection, hand protection, hearing protection and leg and foot protection equipment for all employees.

4.3 Care and Handling of animals before slaughtering

Pre slaughter care and handling of animals are very important for production of good quality meat. Preslaughter transportation and handling is accompanied by many stressful factors involve in animal welfare and quality. The critical points include loading of animals at farm, transport from farm to abattoir, unloading of animals at abattoir and slaughtering. Following are the guidelines for animal transport management.

- Vehicles used for animal transport should have adequate ventilation.
- Non slip floor with proper drainage and protection from sun and rain.
- Size of the vehicle should be adequate for the no of animals
- Surface of sides may be smooth to avoid injury to animals.
- Transport during cooler morning and evening an at night hours.
- Provide water and feed in longer distances
- Drive the vehicles smoothly without jerks and sudden stops.
- Poor transportation cause stress lead to DFD beef.
- Suffocation, bloat, dehydration due to poor transportation cause significant loss of meat quality and production.

- After loading and during transportation record the temperature of the container. Both sides of an animal are examined at rest and in motion.

4.4 Standard Operating Procedure of Abattoir Operation

4.4.1. Lairage

- i. **PURPOSE:** To collect the animals from farms and livestock markets for slaughtering. Buffalo, cattle, sheep and goat, brought for slaughtering by suppliers, are purchased from cattle market or from the registered farm. Animals stay in the lairages which are selected for slaughtering after ante-mortem inspection by the qualified doctors.

- ii. **SCOPE:** Provide shading for protecting animals from sunlight and rain, good ventilation, suitable temperature and water. Animals are kept for resting for until slaughtering. Treat the animals humanely so that they should be free from stress. At the time of slaughtering move the animals to the slaughtering hall.

- iii. **Instructions:**
 - Off load the animals
 - Tag the animals for traceability
 - Perform the anti-mortem
 - Sick animal shall be separated from healthy ones
 - Weight the animals
 - Give them rest
 - Provide them feed and water.
 - There shall be sufficient water supply for animals at all time
 - There shall be a walkway connecting from lairage to slaughtering room which should be narrow to prevent animal from turning around, normally not wider than 76 cm (depending on breed and size of animals).
 - Every cattle and buffalo shall be cleaned by spraying with water before slaughtering
 - Non-slippery and slightly tilted floor
 - Ante-mortem inspection shall be performed not to exceed 24 hours prior to slaughtering
 - Keep ordering of slaughtering shall be done
 - Lairage shall be cleaned and disinfected after each slaughtering.

- iv. **Corrective Action**
 - Separate the sick animals having abnormal conditions like
 - Having any wound
 - high breathing rate,
 - high temperature and fever,
 - foamy or frothy mouth,

- Diarrhea and discharges of various sorts from the body are all evidence of a state of ill-health.

v. Verification and Record Keeping

- Keep the record of all the animals for traceability
- Treatment of sick or wounded animals

4.4.2 Anti-Mortem Inspection

Ante-mortem examination is done within 24 hours of slaughtering and repeated if slaughtering has been delayed over a day. Animals affected with extensive bruising or fractures require emergency slaughtering, are separated. Animals showing clinical signs of disease are held for veterinary examination and judgment. They are treated as “suspected animals” and are segregated from the healthy animals. The disease and management history is recorded on an A/M inspection sheet.

i. Corrective Action

- All the animals are thoroughly examined during anti-mortem inspection. Rejection is done based on localized or generalized problem. Animals rejected and their details are mentioned on anti-mortem report.
- Any diseased animal rejected.

ii. Record Keeping

- Ante-mortem Inspection & Registration Form

4.4.3 Slaughtering and Bleeding

i. Purpose:

Slaughter the animals according to Islamic Laws. Use sharp and sterilize knife for slaughtering and use alternate knives.

ii. Pre-conditions of Halal Slaughtering

- Halal slaughtering shall be done only for Halal animals.
- The slaughter man shall be an adult Muslim who is mentally sound and fully understands the fundamental rules and conditions related to the slaughter of animals in Islam
- The direction of animals should be towards QIBLA
- The place of slaughter shall only be used for the purpose to slaughter Halal animals
- Slaughtering lines, tools and utensils shall only be used for the purpose of

Halal slaughtering

- Only Manual Slaughtering is allowed. Mechanical slaughtering of Halal animals is prohibited

iii. Scope:

Shackle the slaughtered animals on the bleeding rail for proper bleeding. To be ensure that maximum blood should be bleed out so that provide Halal, wholesome and hygienic meat to the consumers

iv. Instruction

- Restrain the animals in the ritual killing box
- Knife or equipment used for slaughtering shall be cleaned and disinfected, such as dipping in hot water with temperature not less than 82°C, before being used with individual animal and used alternate knives.
- Slaughter the animals with one continuous cut
- Cut jugular veins, trachea, esophagus and carotid arteries
- The act of slaughtering shall be done with intention that the slaughterer well aware of his action
- Esophagus shall be firmly tightened to prevent the reflux of feed from stomach
- Sterilize the knives

v. Conditions of Halal Slaughtering

- At the time of slaughtering the animals, the slaughterer must say "takbir" "BISMILLAH-O-ALLAHUAKBAR" (in the name of Allah Almighty., Allah is Great") and no other name. Reciting the "takbir" must be on each animal. Slaughtering must be done only once to each animal.
- The act of Halal slaughtering shall begin with an incision on the neck at some point just below the glottis (Adam's apple) and after the glottis for long necked animals.

iii. Corrective Action

- Check the head, if animals are not slaughtered properly take the corrective action not to repeat again
- Knife to be rinsed in sterilizer after each process and alternate knives are used.
- Scheduled cleaning of plant.
- Proper cleaning of floors and walls is being done

iv. Verification and Record Keeping

Keep the record of each animal along with name of slaughtered person, Shriah Advisor

4.4.4 Removal of Head and Trotillas

i. Purpose

Remove the head and tortillas of the animals for further processing

ii. Scope

Provision of hygienic and disease free meat to the end consumer also ensure that meat is fit for human consumption

iii. Instruction

- When animal is completely dead and bleeding is stopped
- Remove the head at the first cervical vertebrae
- After removal of head send for post-mortem
- Remove fore and hind tortillas with the help of knife or hock cutter
- Remove the shackle, fix the hook in the tendon and hoist the carcass on the conveyor
- In each step wash your hands and use sterilize and alternate knife
- Sterilize the Knife

iv. Corrective Action

- Trained staff involved in head and trotillas cutting.
- After cutting head will be placed in steel trolley

v. Verification and Record Keeping

- Keep the record of each head for post-mortem

4.4.5 Dehiding

i. Purpose

- i. The purpose is to remove the hide/skin of the slaughtered animals for further processing of evisceration and to remove red and white offal's.

ii. Scope

- i. To provide halal, hygienic and wholesome meat to end consumer

iii. Instruction

- Use sterilize knife
- De-hide the rear shank with knife
- De-hiding should be started at the midline at thorax and abdomen
- Remove the skin from belly, sternum, and up to ribs manually with the help of knife
- Pull out the remaining skin with the help of de-hider
- Sterilize the knife and use alternate knife for next animal

iv. Corrective Action

- Use correct hide removal technique.
- Trained operators and dirty hide never touches the meat portion.
- Knife to be sterilized after each process and placed in sterilizer.
- Plant and equipment cleaning and maintenance schedule followed.

v. Verification and Record Keeping

4.4.6 Evisceration

i. Purpose:

- i. Removal of red and white offal's from the belly for further processing and post-mortem inspection.

ii. Scope:

- i. To provide hygienic wholesome meat to the consumer

iii. Instruction

- Using sterilize knife to open the abdomen to thorax by letting the hilt inside the peritoneal cavity
- The sharp side of the blade facing peritoneum and to take out the white offal
- Place them in the offal container for post-mortem inspection.
- Use sterilized knife to open thorax and to take out red offal
- Place them in the offal container for post-mortem inspection.
- In case of visceral rupture, do not use water to wash but allow cutting the contaminated part or use other means to prevent cross contamination to other parts of the carcass
- Keep the knife in the sterilizer for sterilization and use alternate knife

iv. Corrective Action

- Take the corrective action in case of visceral rupture not to repeat again
- Trained staff is used in correct evisceration procedure to avoid any contamination due to gut breakage.
- In case of gut breakage: bunging performed immediately to avoid further contamination from ruptured stomach / intestine.
- If waste from ruptured intestine touch with carcass, then carcass will be thoroughly washed and then checked by the VO.
- Knife to be sterilized and placed in sterilizer at 82°C.
- Use two knives during working; On each step sterilized knife is used to avoid any bacterial contamination.

v. Verification and Record Keeping

- Keep the record of the carcass whose viscera was ruptured

4.4.7 Post-Mortem Inspection

i. Purpose

- Examination of a carcass is carried out as soon as possible after the completion of dressing in order to detect any abnormalities so that products only conditionally fit for human consumption are not passed as food.

ii. Scope:

- To provide disease free meat to the consumer

iii. Instruction

- Visual inspection of the animal carcass and offal;
- Examination of lymph nodes, in particular the sub maxillary and bronchial, by multiple incisions along their main axis;
- Palpation of the organs, in particular the lungs, the liver, the spleen, the uterus, the udder, and in cattle, also the tongue;
- Investigation for abnormalities in consistency, colour and smell;
- Examination for parasitic infections by multiple incisions of the parasites

iv. Corrective Action

- Coordinating all the components of ante-mortem and post-mortem findings to make a final diagnosis.
- Line incharge will closely monitor the inspection process to ensure healthy meat is dispatched to customers.
- Any suspected carcass will be thoroughly examined during post-mortem inspection. Rejection is done based on localized or generalized problem. In case of localized only portion of the meat is removed which is rejected; while in generalized case whole carcass will be rejected and the details are mentioned on Post-mortem report.
- Any diseased part or organ after rejection will be incinerated.

v. Verification and Record Keeping

- Vet. Doctor inspects each carcass and prepares post-mortem inspection report. All animals are inspected on daily basis.
- Carcass inspection log is filled if the carcass is "rejected" then a detailed "Post Mortem Inspection Report" is prepared.

4.4.8 Splitting /Half Cutting of Carcass

i. Purpose:

- Split/cut the carcass into two or four pieces for further cutting/de-boning.

ii. Scope:

- Easy to handle

iii. Instruction

- Splitting saw shall be used by making a straight line cut at the mid of vertebral column for half cutting of carcass
- Spinal cord shall be removed properly and it shall not be used for consumption or further processing.
- Remove small pieces of meat and bone from the cutting process out of the carcass.
- Weight the carcass
- Sterilize the saw

iv. Corrective Action

- After each cutting, cutter is sterilized. Also cutter has water sprinkler during cutting
- In case saw cutter contain oil due to maintenance it will be first properly cleaned

v. Verification and Record Keeping

- Maintenance staff and Line Incharge checks it before working.

4.4.9. Carcass Cleaning/ Washing

i. Purpose:

After bleeding, evisceration, and half cutting, the whole carcass shall be cleaned to eliminate all visible dirt

ii. Scope:

To provide hygienic meat to the consumer

iii. Instruction:

- Rinsing of carcass from top to bottom from inside of the carcass
- Remove all the dirt particles

vi. Corrective Action:

- Inspect the carcass if find any dirt or blood etc repeat the process
- Water used for washing is potable.

vii. Verification and Record Keeping:

- Regular water tests are conducted yearly basis

4.4.10 Chilling

i. Purpose: Chilling has to be carried out quickly to prevent or even to reduce the deterioration process, and the chilled state has to be maintained until the meat is processed for consumption

ii. Scope: To keep the meat fresh and reduce the microbial growth

iii. Instruction:

- After cleaning, carcass shall be transferred to the chilling room immediately.

- Chill the carcass, the core temperature of the round muscle shall be set 2-5 °C within 24 hours.
- Maintain the Temp of chiller 5 °C before enter the carcass in the chiller
- Systematic ordering of the carcass shall be arranged by the principle of first in-first out.
- The carcass shall be arranged with space in between to allow sufficient flow of cool air.
- The carcass storage room should be provided with dehumidifying system to prevent condensation.
- Chilling room is clean and shall be cleaned regularly, no pieces of meat as well as blood on the floor, and also no water accumulation.
- Operator shall examine carcass stored including monitoring and recording of both carcass and room temperatures.
- There shall be strictly controlling worker in and out the chilling room and ban unauthorized person to the chilling room.
- There shall be opening mechanism and alarm set inside the chilling room.

viii. Corrective Action

- If a deviation from a critical limit occurs, the following corrective actions will be taken:
- The cause of the temperature exceeding or decreasing will be identified and corrected.
- The temperature of carcass will be closely monitored after the corrective action is taken to ensure that it is under control.
- In case of any problem found in the chiller, product is immediately transferred into other chiller (back up) so that product quality is not affected.
- Maintenance staff will check chiller condition and make adjustments as and when required. Any necessary repairs will also be made on immediate basis to avoid reoccurrence.

ix. Record Keeping

- After every hour temperature for chiller is checked and recorded by shift In-charge.
- After every 3 hours product temperature is checked by Lab In-charge/Microbiologist and recorded in Temp register
- QA in-charge will verify the accuracy of the chiller's and product's temperature once per shift.
- QA in-charge will check all thermometers used for monitoring of temperature and verify their calibration records.

4.4.11. CUTTING

i. Purpose:

- A **primal/retail cut** of meat is a piece of meat initially separated from the carcass of an animal during butchering. Examples of primal include the beef Chuck, shank, round, loin, rib, and flank.

ii. Scope

- Meat cuts marketed as fit for human consumption. It provides purchasers with a variety of options for meat retail cuts to conform to good commercial practice for products intended to be sold.

iii. Instruction

- Cutting and deboning should be done after chilling.
- Cutting shall be done in the cutting room that can control the core temperature of the meat 7-10 °C where the carcass may be directly transferred to the packing section or to the another specific cut section.
- Cutting shall be done quickly to prevent the growth of microorganism.
- In case of using conveyor for beef and meat, conveyor belt and container shall be cleaned without blood. If there is blood, the container shall be cleaned with clean water and wiped out immediately with wiper blade. The use of sponge is strictly prohibited.
- During cutting, there shall not be over piling up of meat on the conveyor belt.
- Each operator shall wash their hands with soap and disinfectant regularly.
- Entry and exit of the cutting room shall be strictly controlled in particular those not directly involved in the operation shall be strictly prohibited.
- Knife and utensils shall be cleaned and disinfected

iv. Record Keeping

- Date of slaughtering
- Date of expiry

4.4.12. Packaging

i. Purpose: The basic purpose of Vacuum packaging is to remove the air from the package prior to sealing and protect meat and meat products from undesirable impacts on quality including microbiological and physio-chemical alterations.

ii. Scope: Increase the shelf life of the product.

iii. Instruction

- Put the meat in the recommended plastic bag
- Keep it in the vacuum machine close the lead and seal the bag
- Insert the gases according to product requirements.
- Type of carcass, meat or products of cattle and buffalo.
- Net weight by gram or kilogram.
- Date of production (date of slaughtering) and date of best before

- Storage instruction
 - Name and address of producer or distributor, or trade mark
 - In case of packaging made of material that cannot be cleaned, the packaging room shall be separated from other rooms with the design to prevent dust, insect and rats.
- iv. Corrective Action**
- In case if the bag is rupture replace it
- v. Record Keeping**
- Keep the production record
 - Best before use
 - Temp record of the product and storage

4.4.13 Blast Freezing and Storage

- i. Purpose:** It has to be carried out quickly to reduce the temperature of the product and prevent or even to reduce the deterioration process.
- ii. Scope:**
To increase the shelf life and reduce the microbial growth
- iii. Instruction:**
- Maintain the Temp of blast room -35 to -40°C before start to keep the product
 - After packaging, product shall be transferred immediately.
 - After the blast freezing, the core temperature of the round muscle shall be set -18 to -20°C within 24 hours.
 - Systematic ordering of the boxes shall be arranged by the principle of first in-first out.
 - The boxes shall be arranged with space in between to allow sufficient flow of cool air.
 - Blast room shall be cleaned regularly, no pieces of meat or blood on the floor, and also no water accumulation.
 - Operator shall examine product stored including monitoring and recording of both temperatures.
 - There shall be strict controlling of workers allowed in and out the chilling room and ban entry of unauthorized person to the blast room.
 - There shall be opening mechanism and alarm set inside the blast room.
- iv. Corrective Action**
- If a deviation from a critical limit occurs, the following corrective actions will be taken:
- The cause of the temperature exceeding or decreasing will be identified and corrected.
 - The temperature of the product shall be closely monitored after the corrective action is taken to ensure that it is under control.

- In case of any problem found in the blast, product is immediately transferred into other system (back up) so that product quality is not affected.
- Maintenance staff will check chiller condition and make adjustments as and when required. Any necessary repairs will also be made on immediate basis to avoid reoccurrence.

v. Record Keeping

- After every hour, temperature is checked and recorded by Shift In-charge.
- After every 3 hours product temperature is checked by Lab In-charge/Microbiologist and recorded in Temp register
- QA in-charge will verify the accuracy of the chiller's and product's temperature once per shift, thermometers used for monitoring of temperature and verify their calibration records
- QA in-charge will check.

4.4.14 Dispatch/Transportation

i. Purpose To deliver the products at its destination and provide wholesome meat to the consumers

ii. Instruction

- Vehicles for transporting meat and carcasses should be considered as an extension of the refrigerated storage. The object must be to maintain the meat temperature at or near 0°C and for frozen meat-2 0°C.
- Clean the refer container
- Meat should be chilled to 0°C before loading.
- Cool the roof, floor and walls of the containers
- Switch it off before loading
- Meat should hang on rails, not on the floor.
- Container door shall be tightly closed, if necessary it shall be locked or tightened with wire or other materials with a sign of not open during the transport.
- The refrigeration is usually produced by injecting liquid nitrogen or carbon dioxide (CO₂) into the compartment or by blowing air over CO₂ chunks (dry ice). The temperature in these vans can be set and controlled to minimize the temperature rise and to avoid condensation on the meat surface.
- Insulated vans without refrigeration may be refrigerated by adding dry ice. While this is a reasonably good alternative to the refrigerated truck it does not allow the temperature to be controlled.
- Vehicle shall be cleaned and disinfected before and after transportation

vi. Corrective Action

- Before loading plug in the refer container and check the temperature
- If cooling unit is not working properly or container is damaged replaced it

vi. Record Keeping: Before loading check the temperature of the product and record

4.5 Guidelines for Model Butchery Operation

Butchery is a place for marketing of fresh, clean and wholesome meat. Fresh meat is a protein rich food for micro-organisms and can be spoiled easily. It is highly perishable and an expensive food commodity, having short shelf-life. So, any kind of negligence or lapse in the display, handling and marketing can lead to spoilage and ultimate wastage of meat. Inappropriate handling of fresh meat, at any stage after slaughter, can bring financial loss to the business. Butchery should install chilled/ refrigerated sale outlets.

Starting a modern high tech butchery needs selection of a suitable site in localities of cities evaluated carefully and critically. In fact, the high-tech modern butchery causes a value addition to the same meat being sold in other low tech butcheries elsewhere. One has to handle and exercise care for the meat in this category from the stage of slaughter to the stage of consumer's home and even storage. Strict hygienic controls in slaughtering, dressing transport and in storage house and butcher display shop are the hallmark of its retail exposure. Exercising proper temperature control is critical as it is related to the shelf life of fresh meat. The whole sequence requires high level of precision management. One can even obtain HACCP (Hazard Analysis for Critical Control Points) certification for the promotion / high ranking of the outlet in the market. Hygiene protocol for Manpower and equipment at Butchery is same as described in detail in chapter 2.2 and 4.1

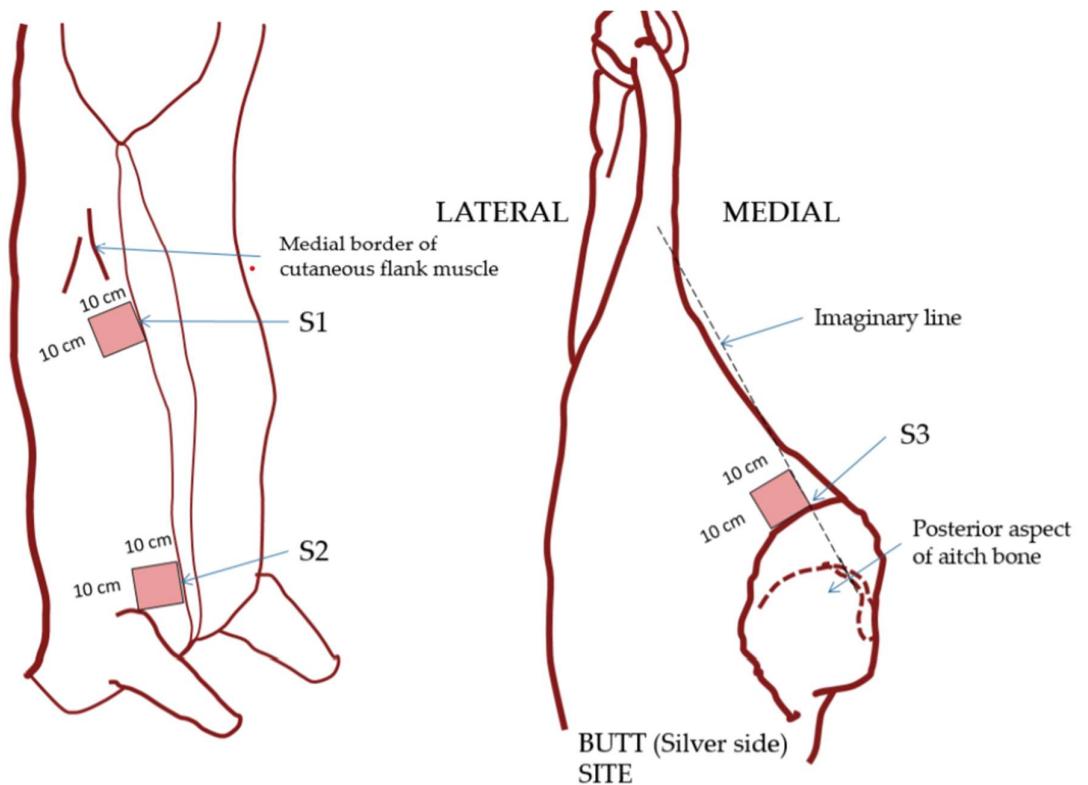
Chapter 05

Sample collection, testing and compliance

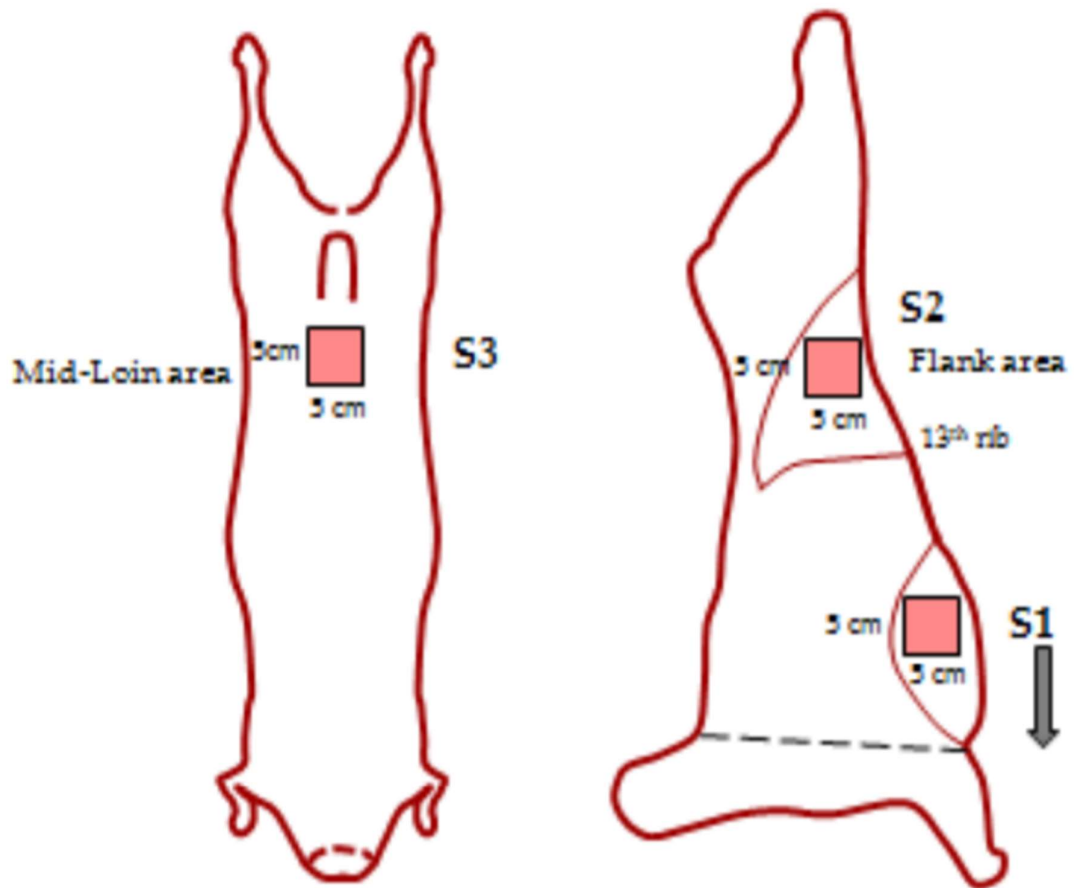
5.1 Meat Safety sampling

5.1.1 Selection of carcasses for sampling

In most instances, the number of carcasses tested is proportional to the production volume. Carcasses from different shifts, slaughter chains, species and/or chillers must be sampled and tested independently based on the production volume for each shift, chain, species or chiller. Carcasses should also be selected randomly from those available for sampling. One of the key elements of the microbiological testing is to assess and validate chiller performance. Therefore, sampled carcasses should not be selected from one chiller only, but all chillers must be included in the sampling frame for the selection of sample carcasses.



Sampling sites for large stock carcasses



Sampling sites for small stock

5.2 Sample collection Procedures

1. Put latex gloves on hands.
2. Open the bag containing the sterile 10cm X 10cm sampling template and place opened bag on a clean surface until ready for use.

3. Open and remove collection kit from its package at a horizontal angle to prevent contaminants from entering the vial.
4. Place collection kit on clean surface until ready for use.
5. Remove swab from vial by holding the cap and twisting counter-clockwise.
6. Remove the sampling template from its bag and place template over the desired location on the meat carcass that is to be sampled.
7. Collect the sample within the template by rubbing the swab in a downward motion with firm pressure approximately 10 times.



8. Turn swab to opposite side and collect the sample within the sampling template with firm pressure in a horizontal, side-to-side motion.



9. Aseptically return swab into vial by turning clockwise until tension is felt.

10. Remove and dispose of gloves properly.



11. Label vial with appropriate information.

5.3 Laboratory Testing

- Deliver samples to laboratory for testing.
- If immediate testing cannot be performed, refrigerate samples.

5.3.1 Sample Handling and Transport

The following requirements for the handling and transport of specimens apply across all testing programs in this manual.

- Where samples are tested for, a temperature range of 0-5°C must be used.
- The information must include the date of collection, and the time that the first sample was collected.
- Samples must be transported in appropriate packaging and should maintain sample temperature during transport such that on receipt at laboratory, the temperature of the sample does not preclude its testing.
- Establishments should contact their laboratory for advice on the packaging of samples or follow the International Air Transport Association (IATA) or a similar packaging and dispatch methodology.
- Swab Samples - Carcass swab samples must be packed in such a manner as to maintain the sample temperature between 0 and 5°C during transport to the laboratory. The procedure for preparing samples for transport to achieve this outcome must be documented.
- Carcass swab samples must arrive at on-site laboratories at between 0 and 5°C - Carcass or surface swabs must not be frozen for transport. If a delay in transport of

the sample is expected, the carcasses should be put aside and sampled at a time when the transport time/temperature objectives can be met.

- Samples should be dispatched on the day of collection and analysis commenced on the day following collection and no later than on the second day following collection.
- Bags containing sample sponges should be firmly secured to prevent leakage.
- Samples of fresh meat must be packed in such a manner as to maintain the sample temperature between 0 and 5°C during transport to the laboratory. Unless otherwise specified, unfrozen fresh tissue samples must not be frozen prior to or during transport.
- Samples of frozen meat - Frozen meat samples can be maintained frozen for up to 7-days after collection. Frozen meat samples can be held frozen during transport or transported at 0-5°C to allow thawing during transportation. Frozen samples must not be re-frozen once thawed or transported at 0-5°C. Samples arrive at temperatures above 5°C - Where samples arrive at the laboratory at a temperature >7°C but 10°C without written approval from the department - In all cases where high temperature precludes analysis the laboratory must notify the department and establishment and a new sample provided.
- Laboratory, on arrival at the laboratory, laboratory personnel must: - Verify the integrity and temperature of the sample - Determine that analysis of the sample can commence on the day of arrival or no later than the day following receipt of the sample.

5.4 MSMES sensitization tools and techniques for compliance

Micro, small and medium food processing enterprises, or MSMFEs, play an important role in the different stages of development in meat value chain. MSMFEs also play a critical role in socio-economic development through their contribution to food security, poverty reduction in urban and rural areas, their income generating activities and their contribution to exports. MSMFEs have the advantage of producing foods that are culturally accepted and continue to provide the poor with an affordable source of food and contribute significantly to nutrition. At the same time, they are heavily reliant on labour and absorb a significant proportion of the unskilled labour force, while making a substantial contribution to employment. They, however, tend to work in isolation with limited interaction with other MSMFEs or institutions in their surrounding environment. An analysis of the strengths, weaknesses, opportunities and threats faced by MSMFEs is summarized in Table 2.

Table 2. Analysis of the strengths, weaknesses, opportunities and threats of MSMFEs related to compliance to food safety regulations.

STRENGTHS	WEAKNESSES
<ul style="list-style-type: none"> ▪ Technical expertise ▪ Less overhead charges ▪ Rapid decision-making ability. ▪ Flexibility in production and planning. ▪ Limited investment and capital requirements. 	<ul style="list-style-type: none"> ▪ Conventional mindset and practices ▪ Low efficiency and productivity due to limited access to technology support. ▪ inadequacy of appropriate knowledge and skills (technical, management).

<ul style="list-style-type: none"> ▪ Availability of local labour, raw materials and indigenous technologies. ▪ Ability to minimize PHL and production losses. ▪ Capacity to create jobs, enhance livelihoods and business in rural areas. ▪ Ability to keep sustaining the economy in times of crisis. ▪ Ability to produce a wide-range of products that are locally accepted. 	<ul style="list-style-type: none"> ▪ Limited financial support and finance access. ▪ Inefficient market/limited access to market and marketing support. ▪ No division of labour. ▪ Lack of knowledge about food laws and regulations. ▪ Weak linkages and networking on marketing, financial, technical and institutional issues. ▪ Limited capacity to undertake R&D.
<p>OPPORTUNITIES</p> <ul style="list-style-type: none"> ▪ Expanding domestic markets. ▪ Increasing availability of ICT, product and technological innovations. ▪ Increasing middle income class, leading to high purchasing power. ▪ More market opportunities for processed products due to the change in lifestyle in cities (women working, less time for cooking) ▪ Growing consumer demand for quality improved food. ▪ Exchange of resources (business and technology) 	<p>THREATS</p> <ul style="list-style-type: none"> ▪ Climate change affecting raw material supply, cultivation and cultivation patterns. ▪ Unreliable supply of raw materials. ▪ Limited availability for credit loan schemes. ▪ Frequent changes in politics resulting in changes in priorities in development policy. ▪ Technical barriers to trade. ▪ Open market: more competition from regional and global companies. ▪ Unsustainable consumption patterns.

The MSMFE in the Food chain are currently in a phase of change brought about by changing economic and demographic trends. These are described below:

Urbanization – The MSMFE sector is a major source of food for the rural and urban middle class. The factor may contribute positively by creating new opportunities for MSMES to abide food safety compliances.

Changing consumer lifestyles and preferences– Changing lifestyles and an increasing number of women in the work place is bringing about change in consumption patterns and shopping habits. With this changing scenario, consumer demand for traditional foods that are safe, of good quality and which are conveniently packaged is increasing. As consumers become more aware and educated, they are also more concerned about nutrition, health and wellness. Consumer tastes are also changing, and with their busier lifestyles, with less time available for food preparation, their demand for food that has a reasonable shelf-life is growing. These changing demands pose major challenges for MSMFEs who must strive to improve and innovate in their processing and packaging operations and upgrade the quality and safety standards of their products in order to position their products on supermarket shelves and compete with imports. An evolutionary trend is already becoming evident within the MSMFE sector in order to respond to consumer and market demand for traditional foods of good quality, that are properly packaged and which are safe.

Developments in information technology Information technology facilitates access to market information and serves as an excellent mechanism for product marketing. All of the countries highlighted the critical role of information technology in all aspects of the work of MSMFEs – starting from production to marketing and sales. Information technology is required by MSMFEs to fast-track each process and ensure accuracy at every step of the chain. The increasing availability and affordability of ICT as a key opportunity for MSMFEs may act as a tool for sensitization

Environmental and sustainability concerns MSMFEs need for policies and programs to improve infrastructure, access to indigenous and low-priced raw materials, as well as financial support and credit, were highlighted by all countries as key areas requiring governmental support. the requirement for greater cooperation between government and farmer-operated cooperatives to assure the supply of raw materials. The establishment of linkages and networks with various stakeholders such as chambers of commerce, food associations, academic and research institutes, development agencies, and consumer groups, are needed. Assuring food safety and product quality – With growing consumer education and awareness on food safety issues and in order to enter into modern trade, MSMFEs must comply with stringent national and international standards and guidelines. While market oriented MSMFEs are able to comply with food safety requirements, traditional MSMFEs lag behind in terms of improving their capacity to comply with food safety requirements.

Human resource capacity – The level of skill and capacity in food processing in MSMFEs still low owing largely to a shortage of trained and skilled labour. This low level of formal education in food processing not only reduces the ability of MSMFEs to innovate, but considerably reduces opportunities for accessing credit to upgrade food processing enterprises. MSMFEs also suffer from a dearth of skilled managers to guide enterprises toward feasibility and profitability. Poor quality packaging also reduces the quality and competitiveness of their products on local and international markets. Price fluctuations and the unreliability of local and foreign markets also pose major constraints for MSMFEs. Moreover, few MSMFEs invest in long-term planning in the marketing of their processed outputs.

Access to finance – Access to finance is critical if MSMFEs are to improve the quality and competitiveness of their outputs. Poor and/or limited access to finance across most countries poses a serious challenge for MSMFEs. Many MSMFEs resort to borrowing at usurious lending rates in order to access financial resources.

Access to suitable levels of technology the technology used for processing by SMEs is still at the bottom end of the technology gradient. In many cases this is due to the absence of modern technology suited to their specific processing applications and/or to their limited access to finance to upgrade their equipment requirements. Quite often, this technology is locally fabricated and is inefficient in use with no maintenance support. Some imported technology such as canning, freezing, pasteurization and sterilization is used in the production of conventionally processed foods. the need for technology of an appropriate level that is suited to the needs of MSMFEs. Appropriate levels of technology must synchronize with the skills of the local labour force and their ability to sustain its operation the MSMFE food processing sector.

Following tools and technologies may be appropriate to sensitize the MSMES in meat product line.

- Strengthen human resource capacity development in the MSMFE sector.
- Support continuous training and capacity building to improve knowledge and skills of relevance to sustainability principles in MSMFE operations.
- Establish networks for information and technology exchange.
- Support research, development and innovation in MSMFEs.
- Create awareness among MSMFEs on the need to innovate and utilize appropriate levels of environmentally sound technologies that reduce drudgery, increase efficiency and assure the quality and safety of their outputs.
- Promote the development of effective branding and packaging.
- Promote linkages between MSMFEs and universities/research institutions. Provide an enabling environment to support MSMFE development.
- Support training and capacity building across a range of specializations and programs that meet the needs of MSMFEs.
- Promote cluster approaches to improve linkages between MSMFEs and large agri-businesses.
- Facilitate MSMFE access to finance.
- Provide assistance and support to MSMFEs in identifying market opportunities.
- Promote contract farming as a way of increasing clean\safe sourcing of raw material inputs for MSMFEs.

Chapter 06

Monitoring, reporting and food surveillance

6.1 Risk-based surveillance for meat-borne parasites

- There is a plethora of meat-borne hazards - including parasites - for which there may be a need for surveillance.
- Risk-based surveillance was originally introduced into veterinary public health in 2006. Since then, experience has been gathered, and the methodology has been further developed. Guidelines and tools have been developed, which can be used to set up appropriate surveillance programmes.
- Meat born parasites are found like *Trichinella* spp and *Toxoplasma gondii*.
- Animals infected with **Trichinella** usually don't appear to be sick, but may show some changes in behavior, such as being less active than what is normally expected. The parasite is microscopic, so it cannot **be seen** in infected **meat** with the naked eye.
- **In human it causes the nausea, diarrhea**, vomiting, **fatigue**, fever, and abdominal discomfort are often the first symptoms of trichinellosis.
- **Cooking above 100 C can kill the Trichenella spp.**
- Taeniasis in humans is a parasitic infestation caused by the **tapeworm** species **Taenia saginata (beef tapeworm)**.
- Humans can become infected with these **tapeworms** by eating raw or undercooked **beef** (*T. saginata*).
- *Taenia saginata* **infection** is asymptomatic, but heavy **infection** causes weight loss, dizziness, **abdominal pain, diarrhea**, headaches, **nausea, constipation**, chronic indigestion, and loss of appetite.
- **Toxoplasmosis** is a disease that results from infection with the **Toxoplasma gondii** parasite, one of the world's most common parasites. Infection usually occurs by eating undercooked contaminated meat, exposure from infected cat feces, or mother-to-child transmission during pregnancy.

6.2 Risk-based surveillance for meat-borne bacteria

- Meat has potential to carry foodborne pathogens that can cause illness and lead to food safety problems.
- *Staphylococcus aureus* are relatively poor competitors and may be outgrown by other flora. Spoilage bacteria will cause food to deteriorate or lose quality by developing a bad odour or feeling sticky on the outside of the meat, signs that consumers would normally notice. These bacteria cause GIT disturbance.
- *Salmonella* spp. in their intestines, raw meat may be contaminated with bacteria during the slaughtering process such as evisceration and dressing procedures.
- *E. coli* can infect the meat during processing of meat with poor practices.

6.3 Bacteria in Cooked Meat

- Certain pathogenic bacteria (e.g. *Clostridium perfringens*) and spores are not readily destroyed by normal cooking temperature.
- Consuming foods that contain high levels of *Clostridium perfringens* vegetative cells may lead to foodborne illness.

6.4 Risk-based surveillance for meat-borne viruses: Three groups of viruses are commonly found in meat/ meat products.

- Norovirus/Caliciviridae, it sprads through feco-oral route and causes the gastro-intestinal problems.
- Hepatovirus A/Picornaviridae, it spreads through eating of under cooked meat.
- Orthohepevirus A/Hepeviridae, it spreads through eating of pork.

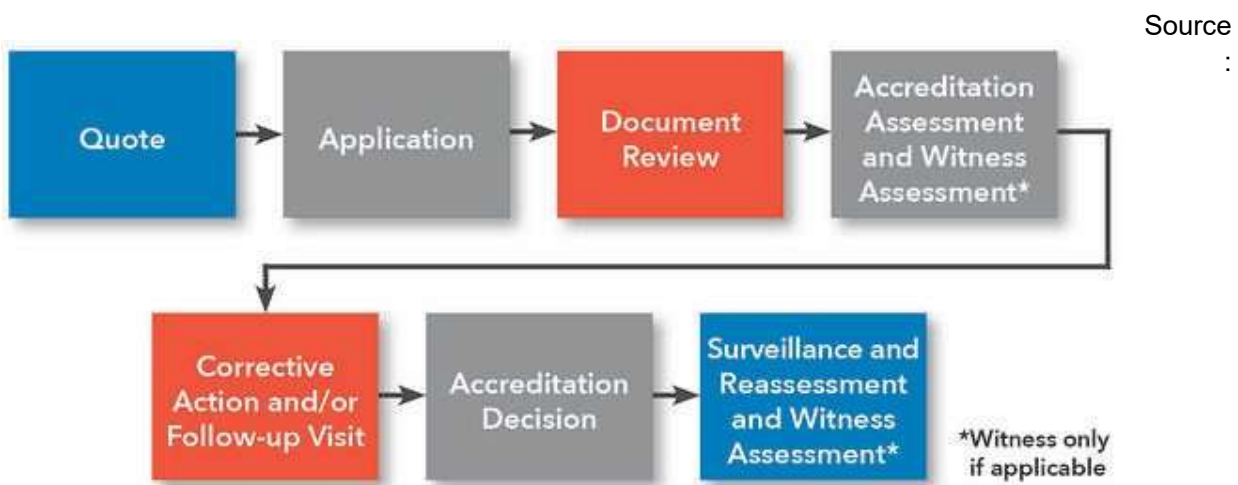
6.5 The requirements of ISO 17020 for inspection bodies

Accreditation to ISO/IEC 17020, Conformity assessment - Requirements for the operation of various types of bodies performing inspection, is gaining momentum in industries around the globe. The broad definition of inspection in the standard allows great flexibility in application from systems to services and raw material to finished products.

ISO/IEC 17020 incorporates same level of requirements for the organizational quality management system as ISO 9001 and ISO/IEC 17000 series standards such as ISO/IEC 17021-1, Conformity assessment - Requirements for bodies providing audit and certification of management systems, and ISO/IEC 17065, Conformity assessment - Requirements for bodies certifying products, processes and services. ISO/IEC 17020, however, puts greater emphasis on organizational ability to manage impartiality and conflicts of interest as well as the technical competence of people, inspection processes, and equipment.

Accredited inspection provides assurance of technically competent service and consistently reliable results, reducing costs and lowering risks. It is key in demonstrating that products, equipment, structures, and systems meet required specifications. Governments and industries around the world are increasingly requiring use of accredited inspection services. ANAB policies and the accreditation process are described in MA 2100, Accreditation Requirements for Laboratory-related Activities, and AR 2252, ISO/IEC 17020 Inspection Bodies.

This diagram outlines the accreditation process:



ISO/IEC 17020 Documents

6.5.1 Environmental Technology Verification

For third-party inspection bodies and verification bodies conducting verification of environmental technology

6.5.2 Forensic Inspection Agencies

Internationally recognized

6.5.3 Verification of Fire Resistance of Fire Doors and Frames

For third-party inspection bodies conducting fire resistance rating verification of fire doors and frames with a missing or compromised listing label.

6.5.4 Training for ISO/IEC 17020 Inspection Bodies

This provides training on a variety of topics relevant to calibration and testing laboratories.

6.5.5 Inspection Body Programs

- Forensic inspection agencies widely used internationally
- Inspection for quality assurance are listed below;
 - ✓ Determination of total ash
 - ✓ Determination of moisture content
 - ✓ Determination total fat contents
 - ✓ Determination of free fatty acids
 - ✓ Determination of chloride content
 - ✓ Determination of total Phosphorous
 - ✓ Determination of pH
 - ✓ Determination of nitrite
 - ✓ Determination of hydroxy proline
 - ✓ Determination of starch content
 - ✓ Determination of coloring agent
 - ✓ Determination of microbial agents

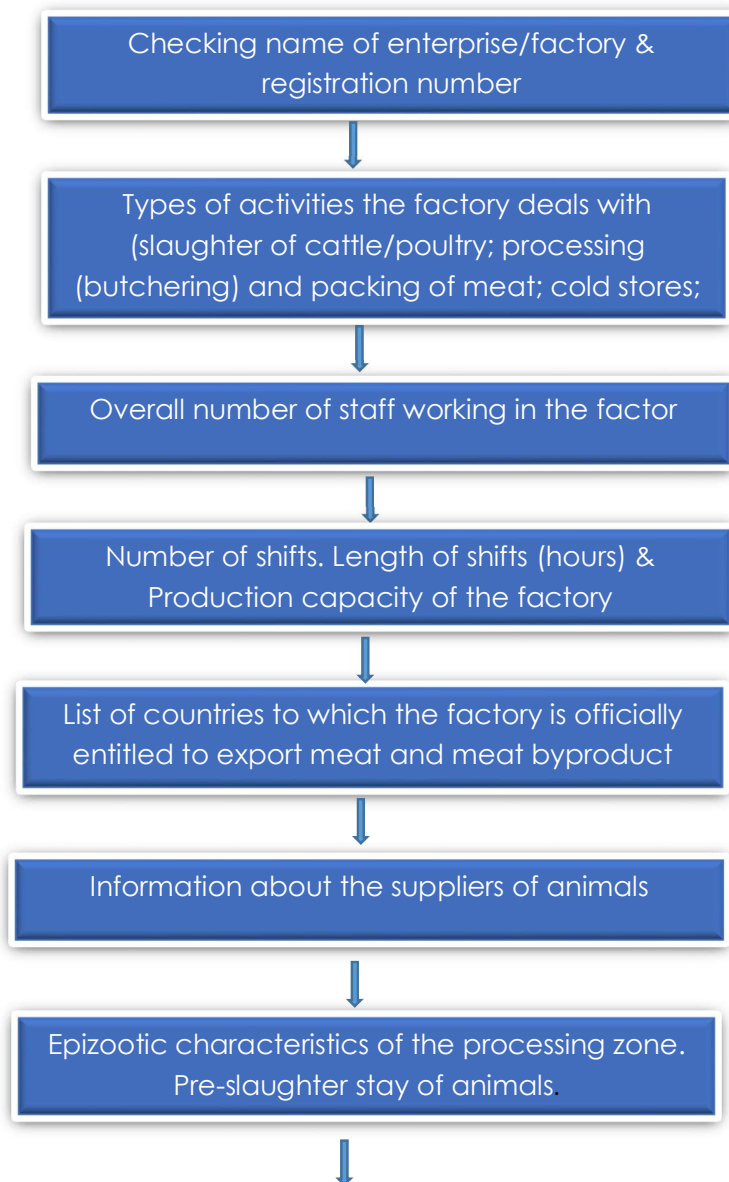
6.6 Benefits of ISO/IEC 17020 Accreditation

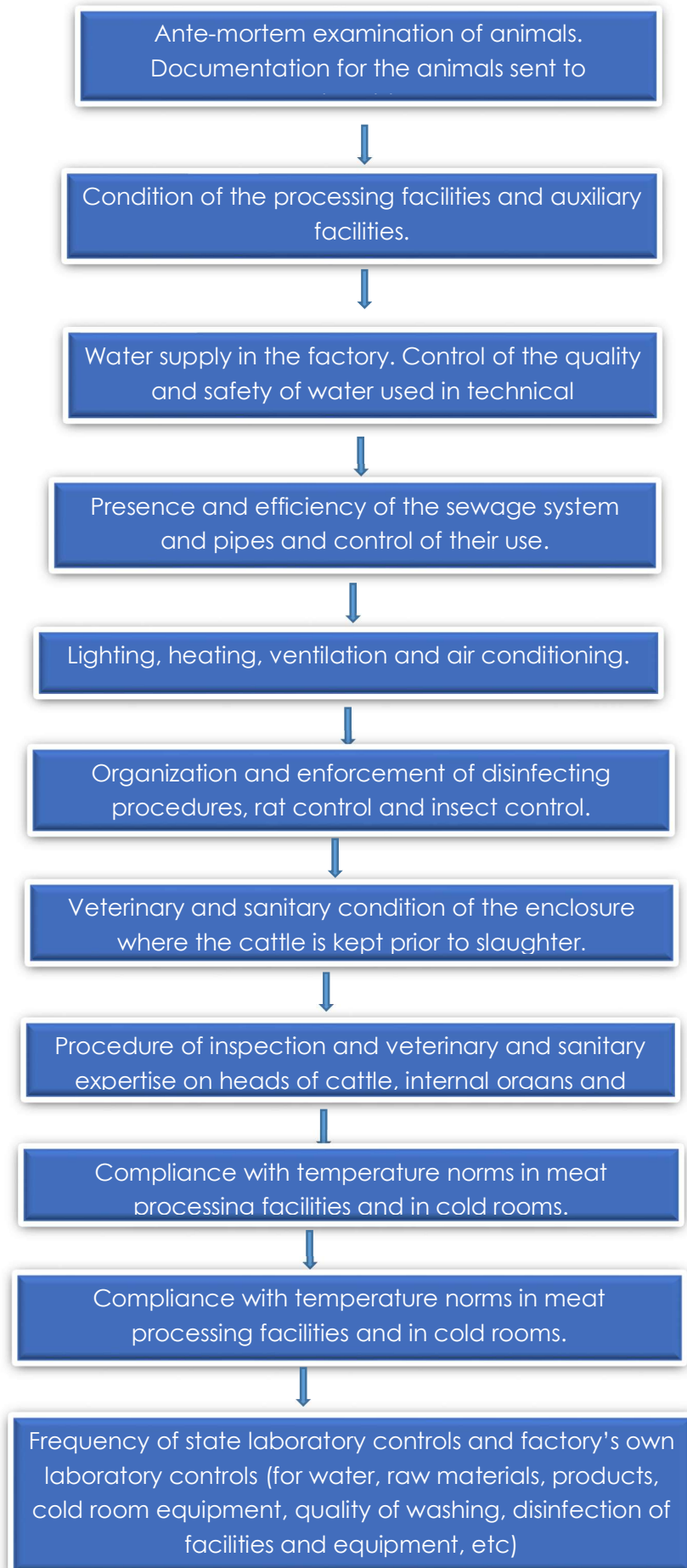
- Improved efficiency, productivity and effectiveness within the overall Inspection bodies operation.
- Improved degree of inspiration, co-activity, workmanship and quality mindfulness including capability.
- Increased trust in assessment information and of staff performing work. More prominent control of procedures and exercises all through review bodies. Reserve funds as far as your time and cash because of decrease or end of the need for re-assessment/re-work and so on.
- Provide recommendations on analysis of knowledge also as perfect record keeping.
- Provide guidelines and better control for maintenance of kit, preservation of inspection records, etc.

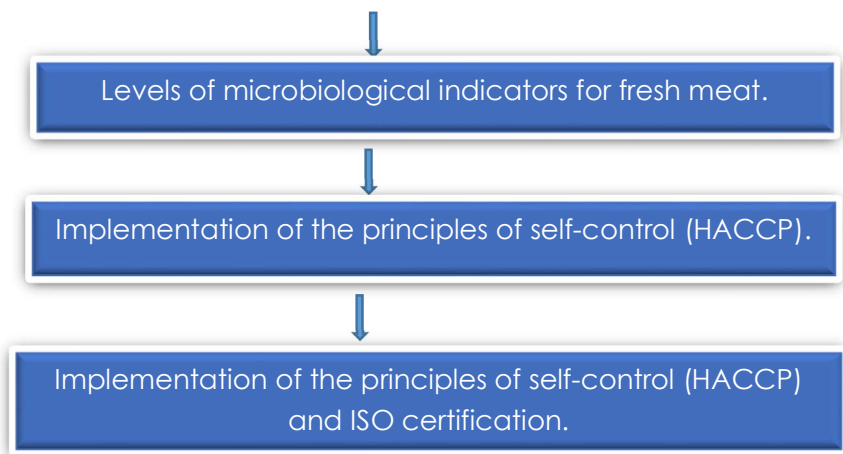
- Establish confidence of management and customers on results also as reports and increase customers trust also as market share.
- Better image of inspection bodies as a top quality inspection bodies in global market.
- Worldwide recognition and credibility.
- An ISO 17020:2012 accredited inspection body features a definite edge over competitors.

6.7 Slaughter House Inspection Plan/ steps

A general slaughter house inspection should consist of following steps.







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