

Food hygiene:

It is defined as “all conditions and measures necessary to ensure the safety and suitability of food at all stages of the food chain” (FAO/WHO, 1999).

Meat hygiene:

It is the branch of food hygiene which includes all conditions and measures necessary to ensure the safety and suitability of meat at all stages of the food chain. Meat hygiene is a demanding science and must deal with different classes of hazards. Chemical hazards entering the food chain at the level of primary production include: residues of veterinary drugs and pesticides, environmental and industrial contaminants and illegal growth promotants. For many years, meat inspection focused on forms of microbiological contamination that cause macroscopic lesions. This includes, for example, tuberculosis, anthrax, salmonellosis in pigs, and parasites such as *Cysticercus*. Now a days these forms of contamination are under control in most countries, better monitoring and surveillance make it possible to deal with other microbiological pathogens that can be detected only by laboratory techniques. The type and prevalence of these pathogens change markedly with different production, processing and foodhandling practices in different countries, and new zoonoses such as *Escherichia coli* O157:H7 and the infectious agent of bovine/transmissible spongiform encephalopathy (BSE/TSE) continue to emerge.

Recent reviews identify microbiological hazards carried primarily by healthy animals as causing the majority of meat-borne risks to human health, e.g. *Salmonella enteritidis*, *Campylobacter jejuni*, *E. coli*, *Clostridium perfringens*, *Yersinia enterocolitica* and *Listeria monocytogenes*.

GENERAL PRINCIPLES OF MEAT HYGIENE

- i. Meat must be safe and suitable for human consumption and all interested parties including government, industry and consumers have a role in achieving this outcome.
- ii. The competent authority should have the legal power to set and enforce regulatory meat hygiene requirements, and have final responsibility for verifying that regulatory meat hygiene requirements are met. It should be the responsibility of the establishment operator to produce meat that is safe and suitable in accordance with regulatory meat hygiene requirements. There should be a legal obligation on relevant parties to provide any information and assistance as may be required by the competent authority.
- iii. Meat hygiene programmes should have as their primary goal the protection of public health and should be based on a scientific evaluation of meat-borne risks to human health and take into account all relevant food safety hazards, as identified by research, monitoring and other relevant activities.
- iv. The principles of food safety risk analysis should be incorporated wherever possible and appropriate in the design and implementation of meat hygiene programmes.
- v. Wherever possible and practical, competent authorities should formulate food safety objectives (FSOs) according to a risk-based approach so as to objectively express the level of hazard control that is required to meet public health goals.
- vi. Meat hygiene requirements should control hazards to the greatest extent practicable throughout the entire food chain. Information available from primary production should be taken into account so as to tailor meat hygiene requirements to the spectrum and prevalence of hazards in the animal population from which the meat is sourced.
- vii. The establishment operator should apply HACCP principles. To the greatest extent practicable, the HACCP principles should also be applied in the design and implementation of hygiene measures throughout the entire food chain.
- viii. The competent authority should define the role of those personnel involved in meat hygiene activities where appropriate, including the specific role of the veterinary inspector.
- ix. The range of activities involved in meat hygiene should be carried out by personnel with the appropriate training, knowledge, skills and ability as and where defined by the competent authority.
- x. The competent authority should verify that the establishment operator has adequate systems in place to trace and withdraw meat from the food chain. Communication with consumers and other interested parties should be considered and undertaken where appropriate.

- xi. As appropriate to the circumstances, the results of monitoring and surveillance of animal and human populations should be considered with subsequent review and/or modification of meat hygiene requirements whenever necessary.
- xii. Competent authorities should recognise the equivalence of alternative hygiene measures where appropriate, and promulgate meat hygiene measures that achieve required outcomes in terms of safety and suitability and facilitate fair practices in the trading of meat.

LIVESTOCK INDUSTRY IN INDIA

The contribution of animal husbandry and dairying to the total gross domestic product (GDP) was 5.9 percent in 2000-2001. Of the total value of output of Rs. 5,61,717 crores from agriculture and allied sector, the value of output from livestock and fisheries sector accounted for 30.3 percent ie. Rs. 1,70,205 crores (Govt. of India, 2002). It is gratifying to note that while the percentage share of agriculture to total GDP is declining over the years, the share of livestock is growing. Livestock sector provides employment to 18 million people (1993-94) and nearly 70 percent of them represent women.

Table 1: Livestock Population – 2002 (in Million Nos.)

Livestock	World	India	India’s Share (%)	India’s Rank
Cattle	1360.47	219.6	16.1	1
Buffalo	166.42	94.1	56.5	1
Goat	746.51	123.5	16.5	1
Sheep	1057.9	58.2	5.5	5
Pig	939.31	17.5	1.9	17
Poultry	47478	661.5	1.4	5

Meat Production

The present production of beef, buffalo meat, sheep meat, goat meat, pig meat and poultry meat and the demand for these meats by the year 2010 and 2020 are given in Table 2. To meet the future demand, it is very imperative that the meat production Programmemes have to be substantially enhanced for all categories of meats, excepting beef. A general statement on future demand for meat can be made as: “a minimum of doubling the meat production level, over a period of 8 years from 2002 to 2010, is required to meet the increase in demand.”

Table 2: Production and future requirements (2010 & 2020) of meat in India (‘000 Tonnes)

Livestock	Present Production	Requirements by		Increase (%)	
		2010	2020	2010	2020
Beef	1462	1460	1460	---	---
Buffalo meat	1443	3250	3552	125	211
Sheep meat	232	600	687	159	196
Goat meat	470	850	935	81	99
Pig meat	612	770	840	26	37
Poultry meat	1401	2930	3162	109	126

* FAO 2002

Meat Consumption

The increase in per capita income and urbanization are fuelling the demand for meat and meat products. While the population is expected to double in Asia and Africa by the year 2020, the demand for meat and meat products is expected to triple. Per capita meat consumption in India is relatively low at less than 5 Kg/ year as compared to other developing countries such as Pakistan (13.7 Kg), China (38.6 Kg) and Brazil (58.6 Kg). Based on the minimum requirement of 20g animal protein per capita per day sourced from milk (10 g), meat (4 g), fish (4 g), and eggs (2 g), the estimated demand for meat is 7.7 million metric tonnes as against the present production of 4.6 million metric tonnes.

Markets and Marketing Channels in Meat Sector

Livestock are transacted in more than 2000 **upcountry livestock markets** of the country. Meat stocks are eventually taken on foot or by truck to the **terminal livestock markets**, located in close proximity to the slaughterhouses. They are sold to meat traders and get slaughtered by them. Raw hides and skins are the most valuable slaughter byproducts and are marketed at slaughterhouses level to the hides & skins merchants. They preserve these hides and skins by salting and dispose the materials to the tanneries at nearby wholesale hides & skins markets. Meat marketing is done from retail stalls of respective species of meat. Edible oils are also usually marketed in the retail meat stalls. About 1.7% of total meat is processed into meat products and sold through retail network comprising company outlets, supermarkets and high-end grocery shops located in big cities and metropolitan towns.

Slaughter Facilities

Adequate slaughter facilities are not available to produce meat under sanitary conditions. Slaughter takes place both in authorized (2702) and unauthorized places (more than 12000) (so called illegal slaughter) and effective meat inspection has not been feasible. Floor slaughter is practiced for large animals with poor hygiene. Overcrowded slaughter in unaesthetic premises is quite common. Slaughterhouses are regulated by the local bodies, which have been criticized for lack of interest for development. A good number of attempts to (a) relocate the existing slaughterhouses, (b) improve the existing slaughterhouses and (c) establish new abattoirs have met with resistance from the local residents, meat industry personnel and persons staunchly opposing animal slaughter and meat consumption. Increased demand for the meat is being met from the existing slaughterhouses and unauthorized slaughter, compromising hygiene and possible public health risks. At times, the sourcing of meat for export from the existing domestic slaughterhouses further complicates the situation. Hygiene in the retail meat shops is also not effectively regulated.

Meat Export Trade

Export of Indian meat, especially buffalo meat, to Gulf countries has proved to be a thriving business over the last several years. Now, the meat is also exported to Malaysia and Singapore. At present, more than 60 countries are importing meat from India. Many corporate firms have set up modern integrated meat complexes having state-of-the-art facilities for livestock holding, slaughter, carcass deboning, packing, chiller and frozen storages, byproducts processing, effluent treatment etc. Current figures for meat export trade are given in Table 3.

Table 3: Export meat trade data for 2003-04

Commodity	Qty (Metric Tonnes)	Value (Rs. Cr.)
Buffalo Meat	343817	1537
Sheep/Goat Meat	16820	110
Poultry Products	20240	202
Processed Meats	986	8
Animal Casings	733	12
Total	382596	1869

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MEAT

“All parts of an animal that are intended for, or have been judged as safe and suitable for, human consumption is termed as meat.” Meat is the post-mortem aspect of flesh of food animals during which a series of biophysiological and biochemical changes takes place in the muscle. Muscle is the ante-mortem aspect of flesh having physiological function such as contraction and relaxation. Meat may be **lean meat** (it is the muscle portion), **glandular meat** or **organ meat** (liver, heart etc.). **Deboned meat** is the carcass from which bone is separated. The word *meat* comes from the Old English word *mete*, which referred to food in general. *Mad* in Danish, *mat* in Swedish and Norwegian, and *matur* in Icelandic, still mean food.

Livestock are being kept for the production of meat, milk and draught power. Some species of livestock are reared for the production of animal fibre. Manure is an important byproduct. Meat has a special place among livestock products because it is harvested as a “**terminal produce**” even from livestock that are reared for purposes other than meat. In the case of livestock reared for meat production, it is a “**principal produce**”. Thus, meat is a product of all livestock enterprises. The difference between the two types of meats is in its quality. The terminal produce meat is harvested from aged animals after completion of their productive and reproductive performances. This meat is tougher and it is popularly called as “**spent animal meat**” in the case of livestock and “**culled bird meat**”, in the case of poultry. When the meat is obtained as a principal produce, it is harvested from animals specifically reared for meat and slaughtered at specific weight/age. The meat from these animals is tender in quality. The approach for processing of tough and tender meats is quite different. Value addition through processing of meat into meat products increases the returns from animal agriculture to a great extent. Processed meat products provide tasty, convenience and designer foods to the meat consuming population with exceptional level of satiety.

RISKBASED APPROACH IN MEAT HYGIENE

The practical application of a risk-based approach in meat hygiene requires an understanding of:

A. The “building blocks” of a meat hygiene programme: GHP, HACCP and risk assessment):

- GHP generally consists of a qualitative description of all practices regarding the conditions and measures necessary to ensure the safety and suitability of food requirements. The requirements are generally prescriptive and describe processes rather than outcomes.
- HACCP identifies, evaluates and controls hazards that are significant for food safety. The system has designated CCPs at particular steps in the food chain, which may be based on empirical scientific judgement, or on risk assessment.
- A risk assessment programme entails knowledge of the level of control of hazards that is attained at a particular step in the food chain relative to the expected level of consumer protection. The control points are science- and risk-based regulatory limits, which may either be performance criteria (e.g. allowable levels of microbial contamination, zero tolerance for TSEs) or process criteria (e.g. specified time, temperature or dose at a specified process control step).

B. Application of a risk management framework, which includes:

- preliminary risk management activities: risk profiling, risk assessment policy formulation, risk assessment.
- evaluation of risk management options: reaching a decision in order to minimize risks using available meat hygiene measures. The meat hygiene measures selected for implementation are determined through risk assessment.
- implementation of meat hygiene measures: by means of a tailor-made programme based on GHP, or one or more CCPs (HACCP), or regulatory limits or procedures derived from risk assessment.
- monitoring and review: gathering and analysing data on human health so as to give an overview of food safety and consumer health.

C. Risk assessment: a separate and distinct scientific process commissioned by government in most cases and carried out by national science providers. It involves the four steps of:

- **Hazard identification:** the identification of biological, chemical and physical agents in food capable of causing adverse human health effects;
- **Hazard characterization:** the qualitative or quantitative evaluation of the nature of the adverse health effects, ideally including human dose-response assessment.
- **Exposure assessment:** the qualitative or quantitative evaluation of the likely intake of food borne hazards by consumers, taking into account other hazard exposure pathways where relevant.
- **Risk characterization:** the qualitative or quantitative estimation, including attendant uncertainties, of the probability of occurrence and severity of adverse health effects in a given population.

D. Risk management: decision-making on managing meat-borne risks in an optimal way to achieve the agreed level of consumer protection. The decisions are based on data generated by risk assessors on the impact of different measures on minimizing food-borne risks.

E. The different roles of industry, government and other stakeholders in the design and implementation of a meat hygiene programme, e.g. – The competent authority should facilitate application of all components of the generic framework for managing risks, set risk-based regulatory requirements as appropriate, and verify that these are being met on an ongoing basis.