



FOOD SAFETY AND STANDARDS
AUTHORITY OF INDIA

Inspiring Trust, Assuring Safe & Nutritious Food
Ministry of Health and Family Welfare, Government of India

Safety and Quality of Meat and Poultry

Guidance Note



This guidance note has been prepared by Dr. Firdaus Jahan (Technical Officer, FSSAI) under the guidance of Dr. A. C. Mishra (Joint Director, FSSAI). This note contains information collected and compiled by the author from various sources and does not have any force of law. FSSAI does not take any responsibility in any error and omission in this note.

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SUMMARY

Meat is a very important component of food basket of India for ensuring nutritional and nutrient security of the burgeoning population. About 71 % of the Indian population consumes meat and meat products. Ensuring availability of safe meat to consumers in this vast country is a challenge which FSSAI is striving hard to address. Some of the issues related to meat food safety are: spoilage, microbial contamination, chemical contamination, adulteration, improper storage etc. Producing and processing meat in hygienic environment is a prerequisite for quality meat production. There are several laboratories in the country who can evaluate the quality of the meat. But consumers must be aware of indicators of freshness of meat so that they make right decision while purchase. Organoleptic features like colour, smell and texture can give a primary indication of meat quality. Proper preservation of meat in low temperature is critical for maintaining meat quality and to slow down spoilage changes. Food Safety & Standards Authority of India (FSSAI) has notified minimum standards for meat quality and is implementing the guidelines across India. However, awareness among the consumers is critical to encourage best practices among the producers. This document is prepared with the aim to educate the consumers about safety issues in meat food and different methods of packaging and preservation of meat.

KEY TAKEAWAYS

- ✚ Meat and poultry represent an important component of human food and its quality is of great concern to the consumers, regulators, processors and the retailers.
- ✚ Major issues in meat food safety include microbial, physical and chemical contamination, sale of stale meat, adulteration of meat with lower-quality meat or non-meat food, mislabeling etc.
- ✚ Meat quality depends on its compositional quality (lean to fat ratio) and the palatability factors such as visual appearance, smell, firmness, juiciness, tenderness and flavor.
- ✚ Consumers as smart buyers can make an informed choice based on these parameters while purchasing meat and poultry. They can easily examine its visual appearance (colour, marbling), firmness and smell.
- ✚ Edible meat should be free from any discolouration, off-odour and off-flavour. It should also be free from any kind of blemishes and blood spots.
- ✚ Safe handling of meat and poultry products is extremely important for maintaining its quality. Consumers should follow basic steps for its safe handling which includes washing hands and contact surfaces properly, avoiding cross-contamination, cooking and storing the meat at ideal temperature and conditions.
- ✚ Meat should be stored at 4 °C for short term storage and at -18 °C or below for long term storage. Meat under normal chilling conditions (0 – 4 °C) of storage shall be consumed within 2 to 4 days. Frozen meat stored at -18 °C or below must preferably be consumed within 10 -12 months.

I. INTRODUCTION

The food consumption pattern in India is gradually getting diversified to high value commodities. The livestock products, especially meat and meat products are of paramount importance in this diversified menu. Meat is the most valuable livestock product which requires proper attention right from animal slaughtering to its human consumption. Meat is a highly demanded food item due to presence of plentiful proteins, minerals and all the B-complex vitamins with excellent digestibility and well-balanced composition of essential amino acids. According to National Sample Survey Office (NSSO), 71 % of the Indian population consumed meat in the year 2014. Providing adequate safe meat to consumers is paramount for nutritional security and to protect public health. Consumers and producers must join hands with regulatory agencies to ensure that meat produced in the country is as per set standards.

II. SAFETY AND HYGIENE ISSUES

Because of being nutritionally rich and highly perishable in nature, meat and poultry products are at high risk of contamination and spoilage. The unorganized meat sector functioning under minimal facilities is usually more prone to safety and hygiene concerns which may include the following:

(i) Microbiological contamination

Microbial pathogens may invade meat and poultry products due to improper hygienic and sanitary practices during slaughtering and meat processing/ handling, storage, transportation which poses a high risk of food borne infections/ illness. This may occur specifically due to the following:

- ✚ Slaughtering on the floor without the possibility of hanging the carcass; hanging too closely together both un-skinned and skinned carcasses in the slaughter line, carcass suspension too low touching the floor, careless evisceration that spreads intestinal content onto the meat surface. If carcass splitting, cutting and deboning is carried out on the same contaminated floor area, where slaughtering has been performed heavy contamination occurs.
- ✚ Microbial pathogens may be transferred on to raw meat/offal and ready to eat products, e.g., from worker's hands, tools, working surfaces, equipments, water, pests, packaging, different lot of meat/offal and during dressing. Pathogens can also grow during production, storage or transport, if condition, particularly temperature is suitable for their growth.
- ✚ Insufficient training, supervision, lack of awareness of the importance of hygiene measures & quality control tools (HACCP principles) leads to ineffective management systems, and thus increases the chances of contamination of meat and poultry products by microbial pathogens.

(ii) Chemical contamination

This could occur as a result of residues of veterinary medicines, antibiotics, pesticides, heavy metals, processing aids etc. The indiscriminate use of antibiotics and veterinary drugs either for therapeutic purpose or prophylactic purpose especially in poultry production results in drug residues in edible tissues/organs of the birds as well as eggs which is a potent health hazard. It may also lead to possible development of resistant strains of bacteria due to

continuous exposure leading to failure of antibiotic therapies in human beings. Application of antibiotics at prescribed levels for the prescribed period and following recommended withdrawal periods can help reduce the problem of drug residues in meat. Adopting good production practices and livestock feed produced with minimum chemical interventions helps reducing problem of chemical residues in meat value chain.

(iii) Physical contamination

This includes contamination of meat or poultry with materials such as metal from rails, clips, tags, machinery, knife blades, grease, oil, paint flakes, rust, plastic, rubber bands, hair, glass splinters, bone splinters, wood splinters, sawdust, dust, dirt, dead insects or animal droppings. Physical contaminations are completely avoidable. Processors must take all necessary steps to prevent physical contamination of meat and meat products.

(iv) Cross contamination

Cross contamination is also a major concern in meat industry. It may occur due to the following:

- ✚ Poor personal hygiene and working practices increases the risk of cross-contamination.
- ✚ Contaminated packaging material and breakdown of refrigeration may also result in cross contamination.
- ✚ Storage of spoiled meat with meat intended for human consumption may cross contaminate the food.
- ✚ Inadequate cleaning of reusable containers, inadequate separation between exposed and packaged meat during transport, poorly cleaned vehicle or containers which are used to transport meat may cause cross-contamination of meat and poultry.
- ✚ Inappropriate storage and handling of slaughter waste may lead to cross-contamination.

(v) Adulteration/substitution of meat for financial gains

The higher demand for meat and meat products accompanied by their escalating cost makes them prone to fraudulent adulteration or substitution. These practices may include: use of meat varieties of commercially lower value, use of meat from naturally dead/ diseased animals without ante-mortem and post-mortem examination, presence of unknown species, etc. However, compared to fresh meat, the chances of adulteration are more in processed and comminuted meat products wherein the processing techniques can mask the adulteration effects. The determination of food authenticity and the detection of adulteration are major safety issues in the meat industry owing to allergic reaction to certain meats among certain consumers and chances of contamination due to adulteration with inferior meats. Adulteration also hurts the religious sentiments of consumers due to taboo attached to meat originated from certain species.

(vi) Unauthorized practices for fetching better prices for meat

These practices includes- injecting water into meat for increasing its weight, washing meat with chemicals at higher level than prescribed limits to improve its appearance with a view

for increasing its acceptability etc. These practices are fraudulent practices which leads to serious public health concerns.

III. Preventive measures to ensure better quality and safety:

Some of the preventive measures that may be useful in addressing the safety and quality concerns related to meat and poultry products are given below:

A. Safe production practices

(i) Controlled use of antibiotics and veterinary drugs

Uncontrolled presence of residues of antibiotics and other drugs in food, as a result of their use in meat producing animals, has the potential to pose a threat to human health and also lead to the development of antimicrobial resistance (AMR) among disease causing bacteria. Therefore, FSSAI has notified the Food Safety and Standards (Contaminants, toxins and Residues) Amendment Regulations, 2018 specifying 'Tolerance Limits' of antibiotics and other veterinary drugs in meat/meat products and poultry. The FBOs dealing in this business should have a control over use of these antibiotics and drugs to ensure that the final product shall comply with these regulations.

(ii) Certification of animal feed/poultry feed/feed supplement

Feed is the major source from where many chemical residues like pesticides, antibiotics, heavy metals etc. contaminate meat and poultry. Thus, controlling animal feed would play an important role in restricting these chemicals from entering the food chain. As per FSS Act, animal feed does not come under the mandate of FSSAI. However, BIS has a voluntary standard for the same. All the producers of animal feed should obtain BIS certification for their feed to ensure safe meat production. Organic feed production system and raising meat animals under organic system by following National Program for Organic Production (NPOP) guidelines of Agricultural and Processed Food Products Export Development Authority (APEDA) needs to be promoted for health and safety of consumers.

B. Safety measures to be followed by food business operators

(i) Specific hygienic and sanitary practices across entire meat food chain

All food business operator involved in meat food chain from farm to fork should follow the basic principles of safety and hygiene. Food Safety and Standards (Licensing and Registration of Food Businesses) Regulations 2011, in Part IV of Schedule 4 outlines specific Hygienic and Sanitary Practices to be followed by Food Business Operators engaged in manufacture, processing, storing and selling of meat and meat products. This covers requirements to be followed by slaughter-houses, meat processing units and retail meat shops which include location, equipment and machinery, sanitary facilities, ante-mortem and post-mortem inspection, animal welfare, personal hygiene and health requirements and others. All FBO's engaged in meat business are required to strictly follow these guidelines and register themselves and obtain license from the authorized licensing authorities (Municipal corporation, Pollution control board, APEDA, FSSAI, State food authorities as the case may be) for their units.

(ii) Complying quality and safety standards

FSSAI has set meat and poultry product standards and safety requirements including microbiological criteria, food additives, processing aids and contaminants limit for meat and meat products (including poultry) under Food Safety and Standards Regulations. All the traders engaged in meat business should strictly follow these regulations.

C. Safety instructions for consumers

Consumers should have a sense of the characteristics of good quality meat for making more informed choice or to get rid of any kind of dilemma while purchasing meat or poultry. At the same time, they need to know about the safe handling practices for meat or poultry and the hazards associated with it.

(i) Meat quality

Meat quality is normally defined by the compositional quality (lean to fat ratio) and the palatability factors such as visual appearance, smell, firmness, juiciness, tenderness and flavor (FAO). Consumers must be aware of these attributes to make right choice while purchasing of meat and meat products.

Visual identification: The visual identification of quality meat is based on colour and marbling. Meat should have a normal uniform pink colour throughout the entire cut. Marbling is small streaks of fat that are found within the muscle and can be seen in the meat cut. Marbling has a beneficial effect on juiciness and flavour of meat. Beef, lamb and pork should also have marbling throughout the meat.

Smell: The product should have a normal smell. This will be different for each of the species (*i.e.* beef, pork, chicken), but should vary only slightly within the species. Any rancid or strange smelling meat should be avoided.

Firmness: Meat should appear firm rather than soft. When handling the retail package, it should be firm, but not tough.

Juiciness: Juiciness depends on the amount of water retained in a cooked meat product. Juiciness increases flavour, helps soften meat - making it easier to chew, and stimulates saliva production in the mouth. Water retention and lipid content determine juiciness. Water losses are from evaporation and drip losses. Meat aging can increase water retention and therefore increases juiciness.

Tenderness: Has been linked to several factors, such as the animal's age, sex or the muscle location. One important way to tenderize meat is by aging. Carcasses are aged by holding them at refrigeration temperatures for extended periods of time after slaughter and initial chilling.

Flavour: Flavour and aroma are intertwined to create the sensation the consumer has during eating. These perceptions rely on the smell through the nose and on the sensations of salty, sweet, sour and bitter on the tongue. Meat flavour is affected by type of species, diet, cooking method and method of preservation (e.g. smoked or cured).

(ii) Identification of meat adulteration

Laboratory testing is the best method for finding out the species of meat. However, consumers can observe certain features to detect such malpractices. Fat of beef will be yellow in colour which helps in differentiating it from buffalo meat, mutton and chevon which will

be white in colour. Pork will be soft and greasy as compared to meat from other livestock species which will be generally firm. Buffalo meat will be dark red in colour as compared to beef. Mutton and Chevon will be light red while chicken meat will be whitish. Meat from each species will have unique odour which can be differentiated with experience. If the whole carcass is available, meat species can be detected by dentition, number of ribs and features of long bones in the carcass. Pigs will have 14 to 15 ribs as compared to Cattle, buffalo, sheep and goat which will have 13 ribs. Whenever, there is a doubt, samples can be tested from accredited and FSSAI recognized laboratories.

(iii) Meat packaging

Packaging also plays an important role for consumer preference to decide meat quality. It maintains the quality of meat in terms of protection, preservation, information and marketing which affects consumer preference and satisfaction. A range of meat packaging materials are available such as aluminium foil and pouches, pouches or bags with inner lining of aluminium, plastic wraps, plastic bags, freezer paper and wax paper. Glass and metal containers can also be used as packaging material for these products. Low-density polyethylene (LDPE) is the most commonly used packaging material for fresh meat due to its oxygen permeability maintaining the bloom in meat. Oxygen permeable materials (like plastic wrap) can be used to wrap fresh meat for short term storage. For long term storage of meat or poultry vapour resisting laminates or co-extruded films in combination with vacuum packaging should be used to prevent water loss. Now a day's laminates used in vacuum and retort packaging methods are also evolved to improve the shelf life and consumer preference for fresh and processed meat.



(iv) Safe handling of meat and poultry

Consumers should always follow basic safe food handling rules to protect themselves and to ensure that the foods they eat are safe. Safe steps in meat handling, cooking, and storage are essential to prevent food-borne illness. You can't see, smell, or taste harmful bacteria that may cause illness. In every step of meat preparation, follow these four steps to keep food safe:

1. Clean — Wash hands and surfaces often.

- ✚ Always wash hands with soap and warm water for 20 seconds before and after handling meat/meat products.
- ✚ After cutting raw meats, wash cutting board, knife, and counter tops with hot, soapy water.

2. Separate — Don't cross-contaminate.

- ✚ Separate raw meat, poultry and eggs from other foods in your grocery shopping cart, grocery bags, and refrigerator.
- ✚ Use separate cutting board for raw meat or poultry.
- ✚ Never place cooked food on a plate that previously held raw meat, poultry or eggs unless the plate has been washed in hot, soapy water.

3. Cook — Cook to the right temperature.

- ✚ Color and texture are unreliable indicators of safety. Using a food thermometer is the only way to ensure the safety of meat, poultry and egg products for all cooking methods.
- ✚ Meat and poultry foods must be cooked to a safe minimum internal temperature of 75 °C to destroy any harmful bacteria.

4. Chill — Store properly

- ✚ Refrigerate or freeze meat, poultry and eggs within 2 hours of cooking or purchasing.
- ✚ Refrigerate within 1-2 hour if the product is handled at temperature danger zone (>5 °C to <60 °C).
- ✚ While storing meat and poultry in refrigerator, it should be wrapped securely to maintain quality and to prevent meat juices from getting onto other food.
- ✚ To maintain quality when freezing meat and poultry in its original package, wrap the package again with foil or plastic wrap that is recommended for the freezer.
- ✚ Marination of meat or poultry product must be done in the refrigerator.
- ✚ Never thaw food at room temperature. There are three safe ways to defrost food: in the refrigerator, in cold water, and in the microwave. Food thawed in cold water or in the microwave should be cooked immediately.
- ✚ Refrigerate the leftovers immediately or properly discard it.



Optimum storage conditions and consumption period for meat

- ✚ Meat must be stored at 4 °C for short term storage and at -18 °C or below for long term storage.
- ✚ Chilled meat shall be consumed within 2 to 4 days of storage under normal chilling conditions.
- ✚ Frozen meat shall be consumed within 10 -12 months.

IV. Tips for consumers

Consumers as smart buyers should keep in mind following basic points while purchasing meat and meat products:

- ✚ Freshness of meat, visual appearance (colour, texture, fat content) and odor;
- ✚ When purchasing meat and poultry, it's important to use your senses of touch, smell and sight. Always make sure the meat is firm to the touch, have no discolorations, stickiness/sliminess and off-odours;
- ✚ Also keep in mind the hygienic condition of the meat outlet and personal hygiene of the retailer;
- ✚ Buy meat from licensed/registered shops that have refrigerators;
- ✚ Never buy the meat that is wrapped in news paper or any ordinary paper;
- ✚ Look out for very dark bits on the edges of the meat which indicate poor storage and refrigeration.
- ✚ Coloured plastic bags should be avoided for carrying meat. If carrying meat in such plastic bags always make sure that there should be no visible colour migration.
- ✚ For packaged meat or poultry products, always closely examine the labeling with respect to its ingredients, use by date or expiry date whichever has been mentioned;
- ✚ Check that packaging doesn't have any tears, holes or excessive amounts of liquid.
- ✚ Never choose meat or poultry in packaging that is torn or leaking.

V. Dos and Don'ts for Consumers

Dos

- ✚ Prefer to buy packaged and chilled/ frozen meat
- ✚ Store the meat in refrigerator ($4\pm 1^{\circ}\text{C}$) immediately after purchase for short term storage (2 to 4 days).
- ✚ Store the meat in deep freezer ($-18\pm 1^{\circ}\text{C}$) for long term storage (upto 12 months)
- ✚ Buy meat only from shops having FSSAI registration and licence
- ✚ Enquire regarding location of slaughter and ensure their hygienic standards before buying meat
- ✚ In the packaged meat and meat product, do check for manufacturing date, best before date and other declarations before buying
- ✚ Cook the meat thoroughly before consumption
- ✚ Keep in mind following basic points while purchasing meat and meat products:
 - ✓ Freshness
 - ✓ Visual appearance (colour, texture, fat content)
 - ✓ Odour
 - ✓ Hygienic condition of the meat outlet
 - ✓ Licensing/registration status
 - ✓ Personal hygiene of the retailer

Don'ts

- ✚ Do not buy meat from retail shops having unhygienic production practices
- ✚ Do not consume the meat which is smelling, slimy and greenish in colour
- ✚ Avoid buying meat from retail shops who hang the carcasses in open

Furthermore, consumers should be aware of their responsibility in contributing towards safety and hygiene of the meat they consume. They should start questioning the meat FBO's about the registration and license status of their units as well the basic safety practices they follow. Consumers must also report to the concerned authority about the issues they have come across.

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