Value addition to domestic meat products

Meat is the flesh of animals that is consumed as food by humans. It normally refers to all the skeletal muscles and their associated far and the other edible parts such as the organs(offal) and skin.

Meat is rich in proteins, essential amino acids, vitamin (e.g. B12) and minerals such ass iron and zinc

Different sources of meat for processing and the meat products made

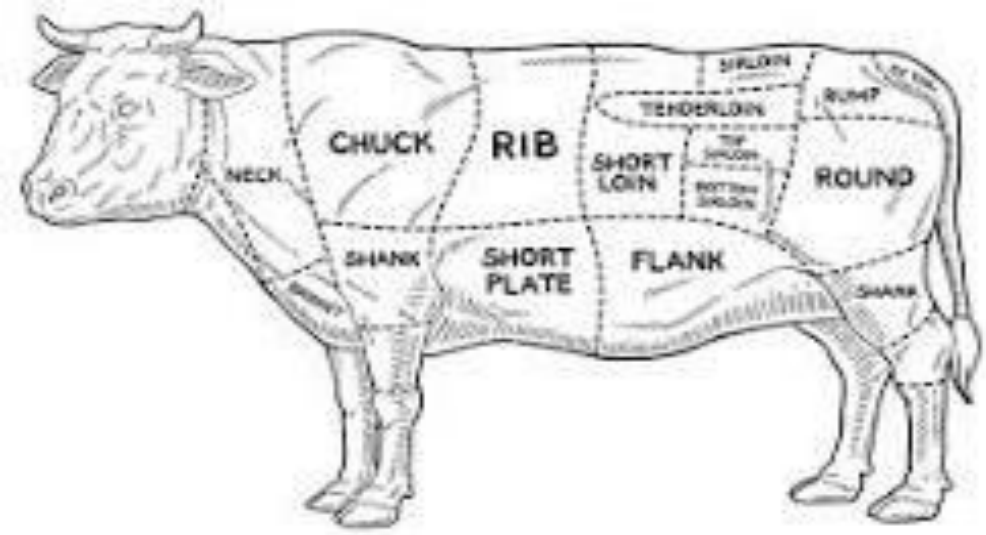
The main sources of meat include

(i) Livestock: such as cattle (beef), pigs (pork), sheep (lamb or mutton), goats (goat)

(ii) Poultry such as chicken, turkey, duck and goose

The two sources of meat above produce meat with different properties. The meat from poultry is classified as white meat, while the meat from the bigger animals is called red meat. Red meat has more saturated fat than white meat and is often associate with increased risk of certain health issues such as heart disease, colorectal cancer and type 2 diabetes.

Meat selection



Factors considered when choosing a beef cut to buy

- Tenderness: cuts from less exercised muscles tend to be tender compared to the more exercised muscles such as the shoulder and legs though the more exercised parts have more flavor.
- Flavor: some parts have a more intense beef flavor due to their fat content and marbling.
- Marbling: This refers to the amount of intra muscular fat within the meat. Higher marbling typically indicates better flavor and juiciness.
- Grade of the beef: people want to buy high quality beef
- Cooking method: Choose cuts to match your preferred cooking method. For grilling, tender cuts are chosen while for slow cooking, the tougher cuts can be chosen.
- Thickness: Thicker cuts are generally better for grilling or roasting to ensure even cooking while thinner cuts are suitable for quick cooking methods like stir frying.

- Purpose and recipe: consider what dish you are preparing because different dishes require different cuts.
- Freshness and appearance: Look for meat that is bright red (indicating freshness) with no brown or grey patches. The fat should be white or creamy, not yellow.
- Price: Balance your needs with your budget. Buy what you can afford.
- Personal preference: Your taste preferences and dietary requirements will determine what you choose to buy.

Meat handling

Slaughter

Before the animal can be eaten, it has to be slaughtered. Slaughtering is the process through which the animal's neck is cut and the animal allowed to bleed.

The process of slaughter goes through the following stages:

(i) **Before slaughter**: The animals are treated humanely, starved to reduce contamination of meat by intestinal contents and rested to preserve body glycogen. The glycogen turns to lactic acid after slaughter and the lactic acid preserves the meat.

(ii) **Stunning:** Rendering the animal senseless before slaughter to reduce pain. It can be done by use of a hammer or electric shock.

(iii) **Slaughter**: The neck of the animal is cut and the animal allowed to bleed by hoisting it by the hind legs.

(iv) **Inspection:** Animal is inspected for infection and passed for human consumption or condemned.

(v) **Grading**: Done according to fat, texture and color of meat.

(vi) A**geing and tenderization:** Makes the meat more tender and palatable. The meat is stored in a cold room to allow its enzymes to soften it.

(vii) Curing: Is done to preserve meat. It preserves the red color of the meat and adds flavour.

Factors which make meat unfit for human consumption

(i) Pests and diseases: Some animal diseases e.g. anthrax and tuberculosis are zoonoses and can attack man. Infected animals should then not be eaten.

(ii) Drugs: Some time must elapse after treatment of an animal with certain drugs before it can be eaten by man e.g. chickens castrated with Stilboesterol should not be eaten before the expiry of at least six weeks.

(iii) Bad flavours: The meat may have an unacceptable flavour e.g. if the animal has been fed on Mexican marigold.

(iv) Rotting/ attack by bacteria: This is usually due to poor preservation.

(v) Unhygienic slaughter house: May contaminate the meat and make its rotting easier.

(vi) Poor bleeding: Leaves a lot of blood in the meat and encourages rotting.

(vii) Age of the animal: Old animals become tough and fibrous and may instead be used to make dog food or other animal feeds instead of being used for human food.

(viii) Meat quality: The ratio of muscle and fat must be acceptable.

(ix) Unhygienic transportation: May also contaminate the meat.

Factors that influence the rate of meat spoilage.

- Temperature: Tropical temperatures are high and these encourage rapid multiplication of bacteria and encourage rotting. Meat should then be refrigerated if it is to be stored for long.

- Rumen content at slaughter: If the rumen is so full at slaughter, the rumen contents contaminate the meat and the rate of rotting is increased.
- Diseases: Carcasses of animals that have been diseased or have been undergoing treatment for a disease tend to deteriorate faster than those that were normal.
- Slaughter house: Unhygienic slaughter houses/area tend to increase contamination of the meat and increase the rate of spoilage.
- Transportation: If meat is transported in unhygienic containers, bacteria multiply easily and the meat deteriorates rapidly.
- Bleeding: Poor bleeding leaves a lot of blood in the meat and this encourages rapid rotting of the meat.
- Moisture content of the meat: Bacteria that cause rotting are only active in moist conditions. Meat stored in dry conditions or that dried using heat deteriorates less rapidly than fresh meat or meat kept in wet conditions.
- Application of preservatives: Preservatives such as smoke and house hold salt reduce the rate of spoilage of meat significantly.

Meat processing

This involves the steps taken to prepare and convert animal flesh into various meat products for consumption.

Reasons for processing meat

- **Preservation** Some processes such as curing, smoking, canning and salting extend the shelf life of meat by inhibiting the growth of spoilage organisms such as bacteria.
- **Safety**: Cooking, curing and other methods of processing help to make the meat safe for human consumption by killing harmful bacteria and reducing the risk of food borne diseases.
- **Convenience:** Processed meat products such as sausages, deli meats and ready to eat meals offer convenience for consumers, saving time on meal preparation.
- **Flavor and texture**: Processing techniques such as marinating, smoking and fermenting enhance the flavor and texture of meat, making it more palatable and appetizing.
- **Variety**: Processing allows for the creation of a wide range of products, catering to diverse tastes and dietary preferences
- **Nutritional modification:** Some processes can fortify meat with additional nutrients or alter its nutritional profile to meet specific dietary needs, such as by reducing the fat content or by adding vitamins
- **Maximising value:** Processing allows for the use of all parts of the animal, minimizing waste and maximizing economic returns. By products can be converted into value added products like gelatin, animal feed or pet food.
- **Uniformity:** processing ensures consistent quality which is important for consumers and businesses in the food industry.
- **Enhanced storage and transport:** Processing methods like canning and freezing make it easier to store and transport meat over long distances without spoilage.
- **Cultural and culinary traditions:** Many cultures have traditional methods of meat processing such as making sausages or making of fermented meat products that are integral to their culinary heritage.
- **Functional properties:** Processing can improve the functional properties of meat, such as

its binding, emulsifying and water holding properties which are important in the production of various meat products.

- **Innovation:** Advances in meat processing technologies enable the development of new products and flavors, keeping the market dynamic and responsive to changing consumer preferences.
- **Food security:** By extending the shelf life and enhancing the safety of meat products, processing contributes to overall food security, making nutritious protein sources available to a larger population.

Methods of meat processing

(i) Curing: This is the addition of salt, nitrites and sometimes sugar to the meat to enhance its flavor. Examples include in ham, bacon and corned beef.

(ii) Drying: This is the removal of moisture from the meat to inhibit microbial growth. This method includes air drying, sun drying or using dehydrators. Jerky is an example of such a meat product.

(iii) Fermentation: Beneficial bacteria are allowed to grow in the meat and produce acids that preserve the meat and develop unique flavours. Salami and other fermented sausages are examples.

(iv)Canning: Meat is cooked and then sealed in air tight containers to extend its shelf life without refrigeration. Canned meats like corned beef and chicken are examples.

(v) Freezing: Rapidly lowering the temperature of meat can be done to preserve it. Freezing can be done for raw or cooked meat products.

(vi)Cooking: the meat is heated to kill pathogens and improve its flavor and texture. Cooking methods include boiling, roasting, baking, grilling and frying.

(vii) Emulsification: Finely ground beef is mixed with fat and water to create a uniform texture. This is often used in making sausages and hot dogs.

(viii) Grinding: The meat is broken down into smaller pieces or a fine paste which can be used for making ground beef, sausage and meatloaf.

(ix) Brining: Meat is soaked into a solution of salt and water, sometimes with added sugar and spices to enhance its moisture content and flavor.

(ix) Marinating: The meat is soaked into a mixture of oil, acid (like vinegar or citrus juice), and seasonings to tenderize and flavor the meat.

(x)Tenderizing: The meat is softened and its fibres broken down using mechanical methods (e.g. pounding or cutting). Enzymes, or marinades, to make the meat tenderer.

(xi) Smoking: The meat is exposed to smoke from burning wood or other materials to add flavor and preserve it, Smoking preserves meat in several ways

- The smoking process reduces the moisture content of the meat which helps to inhibit the growth of bacteria and moulds.
- Smoke contains various chemicals such as formaldehyde, methanol, tars and phenols which have anti- microbial properties. These compounds coat the meat and help prevent the growth of spoilage organisms.
- Heat: Smoking typically involves low heat which can kill some bacteria and pathogens present on the surface of the meat.
- Flavor: The smoke also imparts a distinctive flavor to the meat which can act as a natural deterrent to spoilage by masking off flavours that might develop.
- The smoke also creates a protective barrier on the meat surface, further inhibiting

microbial growth.

Process of smoking meat

- Choose the meat you intend to smoke
- Prepare the meat: trim off the excess fat, season it with a rub or marinade and let it sit for a few hours or overnight in the refrigerator.
- Set up the smoker: Preheat your smoker to the desired temperature. Ensure that you have enough fire wood or materials to provide the smoke.
- Place the meat on the smoker, maintain a consistent temperature and smoke by adding the wood chips or material as required depending on the size of the meat.
- Monitor and maintain the meat and regularly turn it to ensure it is uniformly done
- Rest the meat: when the meat is properly smoked, remove it from the smoker and let it rest for some time to allow the juices to redistribute.

How to store smoked meat

Smoked meat can be stored in several ways to ensure its longevity and safety.

- Refrigeration: Smoked meat can be stored in a refrigerator for up to 4 days. It should be placed in air tight containers or wrapped tightly in plastic wrap or aluminum foil to prevent moisture loss and contamination.
- Freezing: For longer storage, the smoked meat can be frozen. It should be wrapped in heavy duty aluminum foil, freezer paper, or placed in a vacuum sealed bag to prevent freezer burn. Properly wrapped smoked meat can be stored in the freezer for up to 3 months.
- Vacuum Sealing: Vacuum sealing removes air from the packaging which helps to to preserve the meat for longer periods. Vacuum sealed meat can last up to 2 weeks in the refrigerator and for several months in the freezer.
- Canning: Smoked meat can be canned using a pressure canner. This method involves placing the meat in jars and processing them at high temperatures to kill bacteria. Properly canned smoked meat can be stored at room temperature for up to a year.
- Certain types of smoked meats like smoked sausages can be stored at room temperature if they are completely dried and have a low moisture content. These should be kept in a cool dry place in air tight containers.
- Pickling: The smoked meat can be preserved in a pickling solution, typically made from vinegar, salt, and spices. Pickled smoked meat should be stored in the refrigerator and can last for up to a few months.
- Dehydration: Fully drying smoked meat into jerky and then storing it in air tight containers at room temperature can preserve it for several months.
- Fermentation: Fermentation involves curing the meat with salt and then allowing beneficial bacteria to develop in the meat. The meat is then stored in a cool dry place or refrigerated.
- Oil Preservation: Smoked meat can be submerged in oil to create an anaerobic environment that inhibits bacterial growth. This method is often used for smoked fish and the meat should then be stored in a refrigerator.
- Salt preservation: In addition to smoking, the meat can be heavily salted to draw out water and inhibit bacterial growth. Salt cured and smoked meat can be stored in a cool dry place or refrigerated.

Sausage making

Ingredients: Meat, fat, casings, and seasonings (salt, pepper, garlic, herbs and spices

Equipment: Meat grinder, sausage stuffer, mixing bowl, sharp knife and a large bowl of ice

water.
Steps
(i) Prepare the meat and fat:

- Cut the meat and fat into small pieces that will fit into your meat grinder
- Keep everything cold, ideally in the freezer for about 30 minutes before grinding

(ii) **Grind the meat:** Grind the meat and fat together using the coarse grind
(iii) **Mix the seasonings:** In a large bowl, mix the ground meat with your chosen seasonings and knead the mixture until it is well combined and sticky (about 5- 10 minutes).
(iv) **Prepare the casings**:

- Rinse natural casings thoroughly to remove any salt
- Soak the casings in warm water for at least 30 minutes.
- Rinse the insides by running warm water through them.

(v) **Stuff the sausages:**

- Attach the casing to the sausage stuffer
- Fill the stuffer with the mixture, ensuring that there are no air pockets.
- Slowly feed the meat mixture into the casing, being careful not to over stuff.
- Twist into links of your desired size.

(vi) **Cook or store**: You can cook the sausages immediately by grilling, frying or boiling or, alternatively, refrigerate them for up to 2 days or freeze them for longer storage.
Note: Keep all your ingredients cold throughout the process to ensure the best texture and to prevent the fat from melting. Also, cook the sausages to an internal temperature of about 71^0 c to ensure they are safe to eat.

Food safety regulations relating to meat
(i) Slaugter houses and Anima Handling
Pre- Slaughter Inspection: Animals must be inspected by a qualified veterinarian before slaughter to ensure they are healthy and free from diseases.
Slaughter procedures: slaughter houses must adhere to hygienic practices, including the proper cleaning and disinfection of slaughtering equipment and facilities.
Post slaughter Inspection: After slaughter, carcasses are inspected to detect any sign of disease or contamination. Carcasses that pass inspection are stamped to indicate they are safe to indicate they are safe for consumption.
(ii) **Transport and Storage**:
Hygienic Transportation: Meat must be transported in clean, refrigerated vehicles to prevent contamination and spoilage.
Proper Storage: Meat should be stored at appropriate temperatures in clean, refrigerated facilities to maintain its safety and quality.
(iii) **Retail outlets (Butcher Shops and Supermarkets)**
Hygiene and Sanitation: Retail outlets must maintain high standards of hygiene and sanitation. This includes regular cleaning of equipment and surfaces and ensuring that staff handling the meat are trained in hygienic practices.
Temperature Control: Meat must be kept at safe temperatures to prevent bacterial growth. This typically means keeping meat refrigerated or frozen until it is sold.
(iv) **Training and Compliance**:

HACCP Training: Meat handlers and inspectors are encouraged to undergo training in Hazard Analysis and Critical Control Points (HACCP) to identify and manage food safety risks.
Compliance with Standards: Businesses involved in the meat supply chain must comply with the standards set by the Uganda National Bureau of Standards (UNBS) and the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF)

Meat processing tools