Lecture –005

MEAT CUTTING TECHNIQUES

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Background

Meat cutting consists in cutting the carcass into different commercial pieces according to their organoleptic characteristics namely tenderness, juiciness and flavor. Large differences exist in the tenderness, juiciness and flavor of the various meat animal carcasses because of breeding, age, feeding and management. Within each animal carcasses and associated with the different muscles there are variations in tenderness that dictate how different cuts of meat should be prepared to yield the most palatable foods. Because of these differences in tenderness, juiciness and flavor, each meat cut should be merchandised according to its availability and palatability characteristics.

Consequently, different prices should be charged for different cuts from the various meat animals so that consumers have choices. The tenderloin of beef is a relatively small cut and therefore of limited quantity but it is extremely tender and requires a minimum of cooking. Generally it is high-priced because of its high quality and consumer demand for a cut that is easy to prepare and serve. Roasts from the chuck or shoulder of beef are less tender than the tenderloin; However, when properly prepared by pot roasting, they too will be tender, juicy, and flavorful and will provide good nutritional value. Because there are more kilograms of chuck roast on any one beef carcass and because they require more time and effort to cook correctly, chuck roasts do not and should not demand the same high price per kilogram as tenderloin.

All meat animal carcasses are composed of muscle, fat, bone and connective tissue. The chief edible and nutritive portion is the muscle or lean meat. The muscle is seldom consumed without some of the attached fat and connective tissue. The carcass composition of animals slaughtered after usual fattening periods is shown in Table 1. It can be noted that the carcass composition varies little between species and is somewhat dependent on the fatness of the animal at slaughter.

The age to slaughter animals varies depending on many things. The highest quality beef comes from animals that are under 36 months of age. Old cows produce highly acceptable beef if properly fattened and processed. Depending on the calf and the feeding regime, calves are best slaughtered between three and 16 weeks of age. Hogs may be killed any time after they reach six weeks of age, but for the most profitable pork production may need to be fed for five to ten

months. Sheep and goats may be killed anytime after six weeks, but the more desirable age is from six to 12 months.

Table 1. The carcass composition of animals slaughtered after usual fattening periods

	Beef	Pork	Lamb
Average live animal weight (*kg*)	454–544	95–104	45
Age (*months*)	36	6	8–12
Dressing percentage (*carcass/live weight*)	60	70	50
Carcass weight (*kg*)	272–318	68–73	23
Carcass composition (%)			
Lean	52	50	55
Fat	32	32	28
Bone	16	18	17

The lean of each meat animal carcass consists of about 300 individual and different muscles of which only about 25 can be separated out and utilized as single muscle or muscle combinations. The separated muscles are not all the same. They vary widely in palatability (tenderness, juiciness, and flavor) depending on the maturity or age of the animal and the body location from which they were taken.

Generally, muscles of locomotion found in the extremities or legs are less tender and more flavorful than muscles that simply support the animal such as those found along the back. The latter are usually tenderer and less flavorful. Other factors may influence palatability but maturity and body location are probably the most important.

Colors of the lean and fat are important characteristics of normal, wholesome products. Most diseased or unnatural conditions will change the color from what is considered normal for the species. Generally the color of the fat will be from pure white to a creamy yellow for all animals. Pink or reddish fat probably means that the animal had a fever or was extremely excited prior to slaughter. The color of the muscle tissues for normal meat carcass is described in Table 2

Almost always tissues from older animals are darker in colour. At times the fat on some carcasses from young animals will be dark yellow because of the breed which lacks the ability to convert yellow carotene to colorless vitamin A and/or because the animals have consumed large amounts of green forage. It is not uncommon for aged ruminant animals to have carcasses with yellow fat.

At times animals will suffer from stress prior to slaughter and signs of their reaction will be evident in the carcass. Stressed cattle often produce dark cutters in which the muscle is not the normal bright cherry red but rather is dark red and sticky. Hogs suffering from porcine stress syndrome (PSS) prior to slaughter may yield carcasses that are pale, soft and exudative (PSE) or dark, firm and dry (DFD). Exudative carcasses are watery and rapidly lose water. None of these conditions produced by antemortem stress renders the product inedible but both lower the palatability and eye appeal of the beef and pork and can be confused with other more serious disease conditions.

Table 2. Normal color of meat carcasses of different animal species

Meat	Color
Beef	Bright cherry red
Goat meat	Light pink to red
Lamb	Light pink to red
Pork	Greyish pink
Veal	Light pink to red
Venison	Dark red

1. Equipment for the meat cutting operations

The following are the minimal requirements in terms of equipments for meat cutting operations.

- Solid cutting table preferably made of non-corrosive material (stainless steel, aluminum or galvanized material) with hard plastic top. If wood has to be used instead of plastic only tight wooden tops/cutters should be used.
- oil or water sharpening stone

- sharpening steel
- knives
    - boning - 20 cm straight
    - steak - 30 cm curved
- meat saw - hand or electric
- totes, bins and meat trucks (plastic or other non-corrosive material)
- wrapping table
- paper or plastic foil/bags for meat wrapping
- tool holder
- metal mask/safety gloves
- boning aprons/safety aprons
- hand wash-basin
- knife sterilizer

2. Meat cutting operations for meat animals

Four essential points when cutting meat animals are the following:

- Cut across the grain of meat when possible.
- Use sharp knives and saws for speed and good workmanship.
- Keep the cutting table orderly and have a place for everything.
- Be clean and sanitary in all operations.

There are different ways to cut the animal carcasses depending on their use, the wishes of the consumers, and the quality of the carcass. Poor quality meat is normally used for further processing, while higher quality and thicker fleshed carcasses are used as fresh meat in the form of steaks and roasts.

2.1. Cutting operations for beef.

The cutting operations include the primary and secondary cutting of beef carcasses.

2.1.1. Primary beef cuts

The primary cutting also known as “halving” consists in splitting the carcass into two sides by cutting through the centre of the back bone. Each side is then cut into two quarters (quartering). Quartering or ribbing down is the division of a side of beef between the twelfth and thirteenth ribs into fore and hindquarters. One rib is usually left on the hindquarter to hold the shape of the loin and to make it easier to cut steaks.

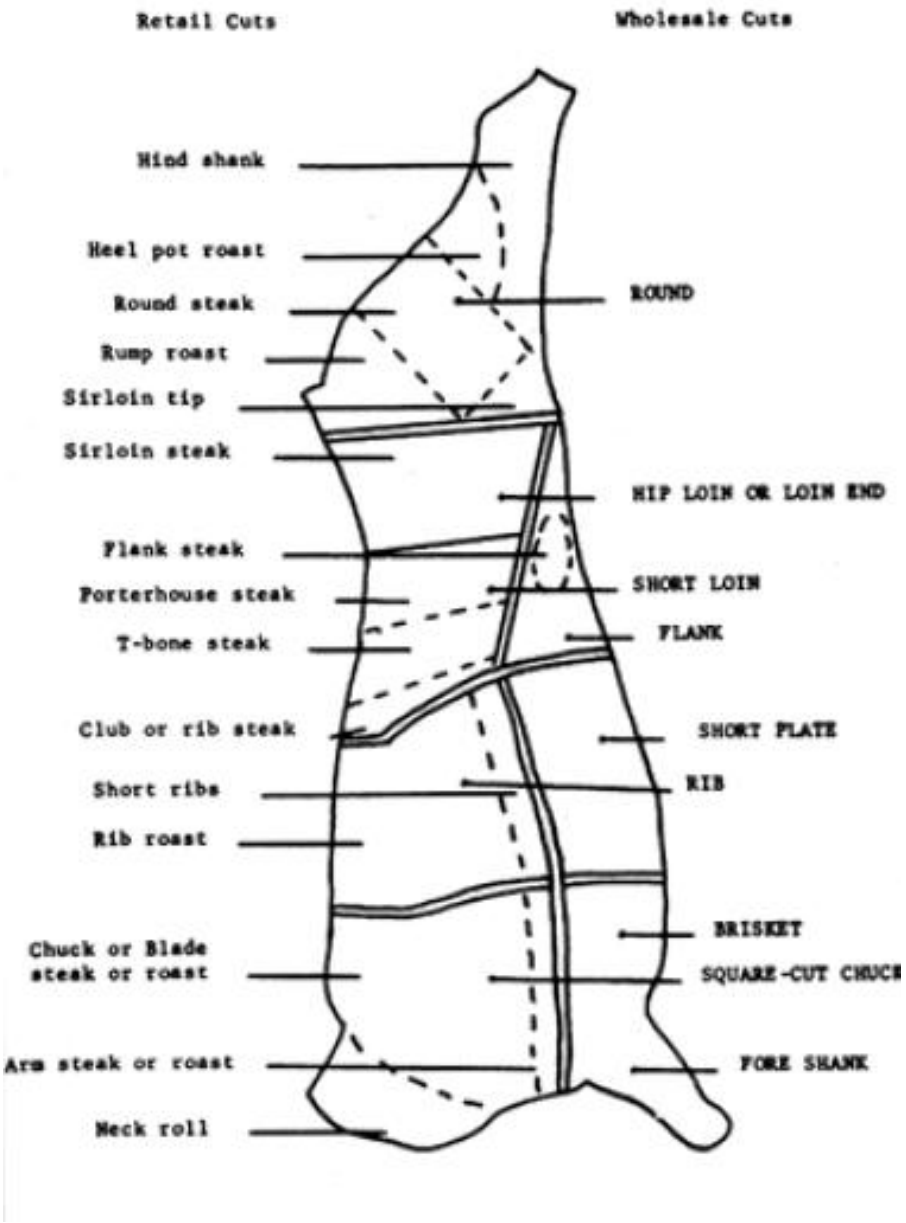

Figure 1. The beef carcass and its cuts

2.1.2. Secondary beef cuts

The secondary cutting consists in cutting the fore and hindquarters into smaller pieces according to their tenderness and their future use.

2.1.2.1. Cutting the forequarter

The first cut to make is between the fifth and sixth ribs counting from the neck back. This cut is made parallel with the ribs and produces a crosscut chuck consisting of a square cut chuck (also called chuck and blade), fore shank and brisket. Next the fore shank and brisket are removed by cutting through the first sternal cartilage (the first soft segment of the breastbone), and making the cut almost parallel with the backbone of the carcass.

- ***Foreshank*.** The foreshank is separated from the brisket by following the natural connective tissue seam between the muscles with a knife. The fore shank can then be sawn into small pieces to be used for soup stock or the lean may be removed and used for ground meat.
- ***Brisket***. The brisket, boned and made into a roll, can be used either as a pot roast or can be cured.
- ***Square-cut chuck***. This wholesale cut contains the first five ribs of the forequarter and may be sawn into steaks or roasts. Several cuts are usually made across the bottom or shank end of the chuck resulting in arm steaks or roasts. The chuck is then turned and cuts are made parallel with the ribs, resulting in blade steaks and roasts.
- ***Short plate***. The cut to divide the short plate from the rib is made 18–25 cm from the inside edge of and parallel with the chine or backbone. This division varies according to the thickness of the carcass. With a thick carcass, the cut may be made further down the ribs, and with a thin carcass nearer the spinal column.

  The plate may be used for different purposes, but it is commonly used for stews or further processing. Short ribs, which are suited for broiling, are also cut from the upper portion of the plate, usually about 5–8 cm in length. If the plate is to be used for corning, all of the ribs should be removed. If used for stews, the ribs can be left in and the plate sawn crosswise into small pieces. The plate can also be boned and the meat used for ground meat or sausage products. Before cutting the plate in any way, remove the tough membrane lining the inner portion below where the ribs join the breastbone.

- ***Rib*.** The rib cut is made up of the rear seven ribs in the forequarter. This is the most valuable piece of meat from the forequarter because it is the most tender and has the least amount of bone. It has a large bundle of muscle fibre that runs parallel to the backbone. There are several different ways to prepare the rib cut for cooking as a roast. It may also be used for steaks.

2.1.2.2. Cutting the hind quarter

Place the hindquarter on the cutting table with the inside of the carcass up because the first cut made is to remove the kidney knob from the inside of the loin. (However, loosening of meat cuts is also possible from the hanging beef side or beef quarter)

- ***Kidney knob***. Begin removing the kidney fat at the lower end and loosen it with a knife where it is attached to the loin, leaving a thin covering on the inside of the loin and being careful not to cut into the tenderloin muscle.
- ***Flank*.** Remove the flank next by cutting into the scrotum or udder, following the round muscle and cutting close enough so little of the lean meat is taken from in front of the stifle joint. Continue cutting along and below the outer portion of the line of the kidney fat, or in a straight line to leave 10 cm of the thirteenth rib in the flank. This cut may vary with the thickness of the carcass and is lowest in thick or heavy carcasses. The entire defatted flank may be used for stew or ground beef or rolled around stuffing and pot-roasted.
- ***Round***. The round and loin are divided at about the fourth sacral joint in the spinal column to almost parallel with the back end of the round, or to about 5 cm in front of the stifle joint. The aim is to cut the tip of the ball-and-socket bone in the hip joint, cutting off a piece about 2.5 cm in diameter. The round includes the rump, round cushion (consisting of knuckle piece and inside round muscle or topside), outside round muscle (also called bottom round muscle or silverside) and hind shank.

  Remove the rump by cutting just below the exposed pelvic or aitchbone. The rump usually has a large amount of bone. The most desirable piece of rump is cut from the upper portion and is composed of eye and bottom round muscles. The removal of bone and tying the rump means that it requires less oven space and is easier to carve.

  Round steak is cut in comparatively thin slices from the full round after removal of the rump. The choicest round steaks are cut from the centre section.

The remaining portion is made up of the hind shank and the piece called the heel of the round. The heel of round is used as a pot roast and is removed by cutting close to the bone and tearing away as much meat as possible from the backside. The shank can be sawn into pieces to be used for soup stock.

- ***Loin*.** The loin is usually completely sawn into steaks beginning at the large end. Sirloin steaks are cut first and the first three or four are known as wedge or round bone sirloin steaks. These are the least desirable pieces of the sirloin. The last sirloin is cut where the hip-bone is separated from the spinal column and the steak cut there is known as the hip-or pin-bone sirloin steak.

  The small portion of the loin known as the short loin is the source of T-bone steaks. This area contains the two most tender muscles in the whole carcass, namely, the loin eye muscle above the bone and the tenderloin muscle below the bone. T-bone steaks are cut to about 10 cm from the end of the short loin. This tip portion can either be used as a roast or be cut into rib steaks. Rib steak from the short loin is identified by the piece of the thirteenth rib remaining on it.

2.2. Cutting operations for pork

Halving is done immediately after the animal has been dressed and every effort should be made to saw the carcass into equal sides through the centre of the backbone. The side to be cut should be laid on the cutting table with the inside up. The primal cuts of pork are: ham, fore-end or forequarter, loin and belly.

- ***Hind foot*.** The hind foot is removed by sawing through the hock joint at a right angle to the long axis of the leg.
- ***Ham*.** The ham may be removed in several ways to make either long-cut or short-cut hams. One procedure (short-cut) is to locate the division between the second and third (or the third and fourth) sacral vertebrae and saw perpendicularly to the long axis of the ham. After the bone has been severed with the saw, the knife is used to complete the removal of the ham. The ham is further trimmed by removal of the tail bone on one side and the flank on the other side. Commonly a skinned ham is produced by removal of three-fourths of the skin and fat from the rump end . For the production of special cured dried hams the skin is left on.

In order to obtain a long-cut ham the division is made between the last two (fifth and sixth) lumbar vertebrae. The long cut is composed of a rump or chump portion and a leg portion comprising centre section and shank portion. Nowadays more processors are removing the bones thus fabricating a boneless rump (chump) and a boneless ham. The ham is commonly merchandised in smaller portions (topside, silverside, thick flank, shank).

The cutting procedure of the ham is as follows.

- Remove tail bone and aitch bone and cut the rump off.
- Peel back the rind and associated fat to expose the topside muscle on the interior side of the leg.
- Separate the topside by following the natural seam between it and the silverside (outside portion of leg) and thick flank (front position of leg).
- The topside can then be sliced into steaks. This produces between five and six lean steaks depending on the thickness and weight required by the customer.
- The next step is to remove the leg bone (femur). The thick flank (knuckle) is cut from the silverside by following the natural seam.
- Remove the kneecap (patella) and the internal fat deposits before further preparation of the thick flank, e.g. for diced pork or steaks.

- ***Forefoot***. The forefoot is removed by sawing through the junction between the foreshank and the forefoot bone at a right angle to the length of the foot. This foot contains some muscle and is therefore more desirable than the hind foot for food.
- ***Fore-end***. Considerable variation exists as to where the fore-end is removed. Generally one to three ribs are left on the pork fore-end. Locate the division between the third and fourth ribs from the head end and saw perpendicularly to the length of the backbone. The fore-end is trimmed of the hock which is cut off about halfway up the leg and about two-thirds of the skin and fat is removed from the butt or top end. Additionally the neck bone (all cervical and three thoracic vertebrae) and the jowl or cheek meat are removed. The jowl is removed by a straight cut parallel to the cut that separates the fore-end from the side just behind the site where the ear was removed. The fore-end may be divided into two cuts (spare-rib, also called blade Boston, and hand, also called arm picnic) by sawing just below the exposed lower end of the blade-bone parallel to the top of the

shoulder. The spare-rib can be sliced into steaks or used as a roast. It can easily be made into a boneless cut by removing the corner of the blade-bone.

Besides this method some other ways of cutting and boning the pork foreend exist. In order to obtain boneless cuts (shoulder and neck-end) from the fore-end the following technique is recommended.

- Seam the shoulder carefully from the rest of the side, leaving the rind and associated fat behind.
- Release the under-blade steak and remove the blade-bone (scapula) and the shoulder-bone (humerus).
- Separate the main muscle block from the smaller group. The smaller group, after trimming the fat off, can be used for dicing. The main shoulder block should be trimmed of excessive connective tissue. It can be separated further into the blade and feather muscles and the main shoulder muscle. These can then be sliced into a number of boneless steaks. The group of muscles on either side of the spinous processes of the neckbone and the two or three following segments of the backbone is called the neck-end.
- The neck-end is loosened from the backbone and after trimming off excessive rind, fat and any adhering ragged edges it can be cut into attractive steaks.

- ***Loin*.** The middle or centre section of the pork side is divided into loin and belly by a straight cut from the edge of the tenderloin muscle on the ham end through a point on the front rib tight against the protruding edge of the split backbone. The fat back (skin and excess fat) is removed from the loin so that a complete fat cover about 0.5 cm thick remains. Starting along the backbone side at the shoulder end, cut and lift the fat over the curve of the loin muscles without cutting into the lean. The loin can be roasted whole, cut into smaller roasts or cut into chops. Shoulder, rib, loin and sirloin chops are made from the loin. Chops for broiling or frying should be cut 1.3–1.9 cm thick. Thicker chops may be made and a pocket cut into them for stuffing.
- ***Belly*.** Separate the spare-ribs from the belly by cutting closely underneath the ribs beginning at the flank end. Prepare the bacon side from the belly by removing any thin or ragged pieces of lean. Turn the belly over and remove the lower edge with a straight

cut just inside of the teat line. Trim the flank edge of the belly to square the whole piece to prepare it for curing.

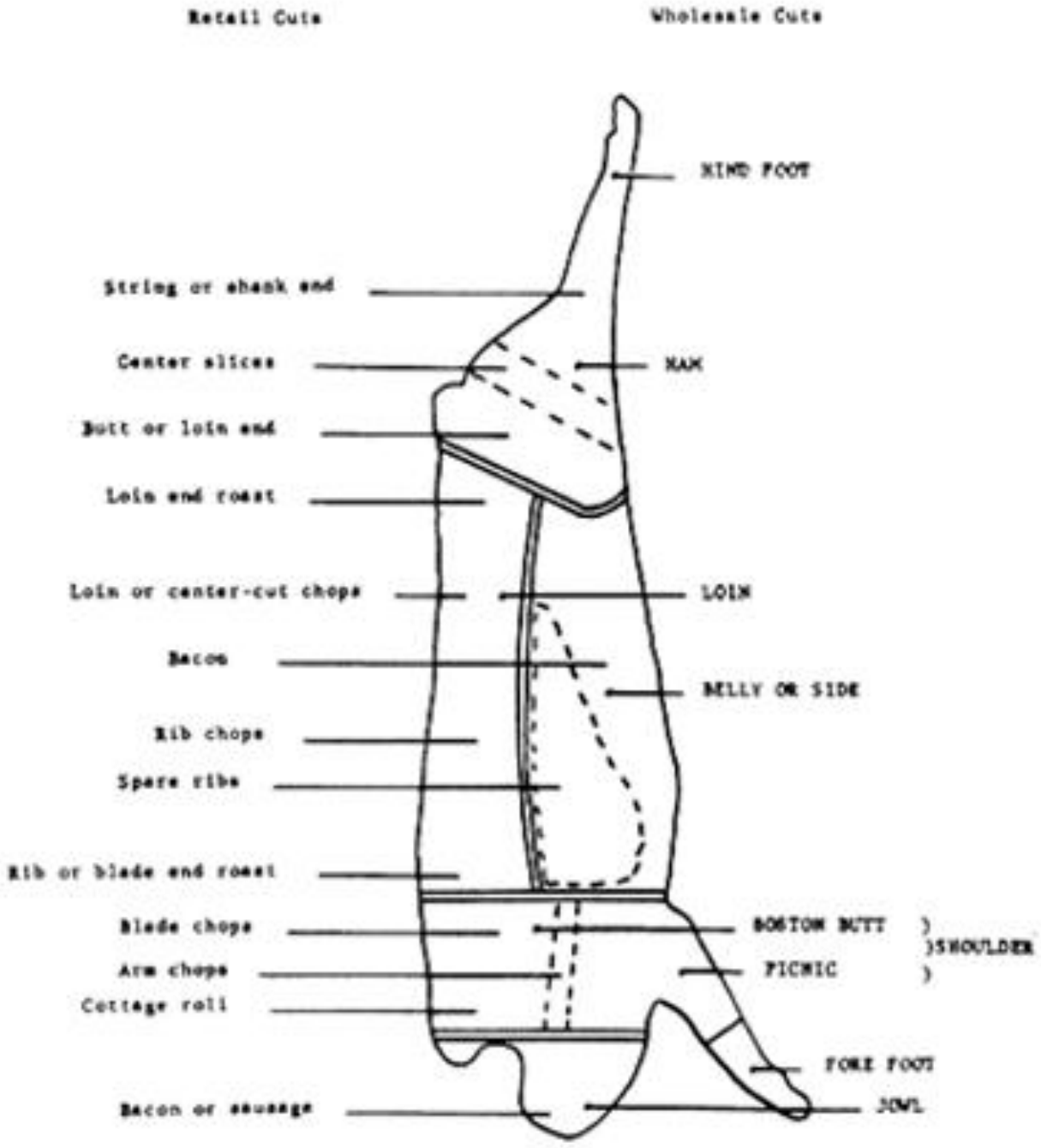

Figure 2. The pork carcass and its cuts

2.3. Cutting operations for lamb

The cutting procedure described for lamb may also be followed for the processing of deer, goats, sheep or other animal carcasses of similar size.

All lamb carcasses should be promptly chilled and kept at a low temperature (-2° to 2°C) until cut and utilized. However, do not permit lamb carcasses to freeze within a day after slaughter or the meat may toughen. Lamb carcasses can be cut into retail cuts after they have been chilled for 24 to 48 hours.

Lamb carcasses are generally not split into halves after dressing because they are not thick enough in any location to create cooling problems.

- Begin cutting the lamb carcass by removing the thin cuts, i.e. flank, breast and foreleg.
- Lay the carcass on the cutting table and mark one side from the cod or udder fat in front of the hind leg to the elbow joint.
- After removing the thin cuts from both sides, remove the kidneys, kidney fat and diaphragm.
- Next the carcass is turned over and the neck removed either in thin slices to be braised or in one piece to be added to stew or to be boned and ground.

The trimmed carcass can then be separated into four primal cuts namely the shoulder, rib, loin and legs;each with different characteristics.

- A cut between the fifth and sixth rib removes the shoulder.
- Another cut between the twelfth and thirteenth (last) rib separates the rib from the loin.
- The loin and legs are separated just in front of the hip bones by cutting through the back where the curve of the leg muscles blends into the loin.

2.3.1. Cutting the legs

The cutting procedure is described as follows:

- Split the legs through the centre of the backbone
- Trim off the flank and cod or udder fat.

- Utilize the saw and knife to remove the backbone from the leg. The leg may be further trimmed by cutting through the knee-joint which is located about halfway between where the muscles of the shank end and the muscles of the lower leg begin.
- Work the knife and cut through the joint. Several sirloin chops may be cut from the loin end of the leg. Legs may either be prepared with the bone in or the bones completely removed and the leg rolled and tied.

2.3.2. Cutting the loin

The loin is usually split through the middle of the backbone and chops are cut perpendicularly to the backbone Lamb chops are cut about 2.5 cm thick. Double or “English” chops are made from a loin that has not been split. Remove the fell or connective tissue covering before cooking chops.

2.3.3. Cutting the rib

The rib of lamb is prepared by sawing through the ribs on both sides of the backbone. The main portion of the backbone is then removed with a knife. Rib chops are easily made by cutting between the ribs. Remove the fell before cooking the chops. The breast portion may be barbecued in one piece or made into riblets by cutting between the ribs.

2.3.4. Cutting the Shoulder

After splitting through the backbone, the shoulder may be roasted as is, made into chops, or boned and rolled into a roast. Arm chops should be made first by cutting parallel to the surface where the foreleg and breast were removed.

Blade chops are made by cutting between ribs and sawing through the blade- and backbones. To prepare a boneless shoulder, first remove the ribs and backbone by cutting closely underneath the ribs, backbone and neck vertebrae. Next from the rear surface cut along the inside of the blade-bone to expose it and the arm bone. Cut along the edges of the bones and remove them. Roll the meat and tie it securely with clean twine. The boneless shoulder may also be made into a pocket roast and stuffed with ground lamb or other dressing. The edges of the pocket roast are stitched together.

Concerning the shank sections, both the fore- and hind shanks when removed can be barbecued, cut into pieces for stew or boned and the meat ground.

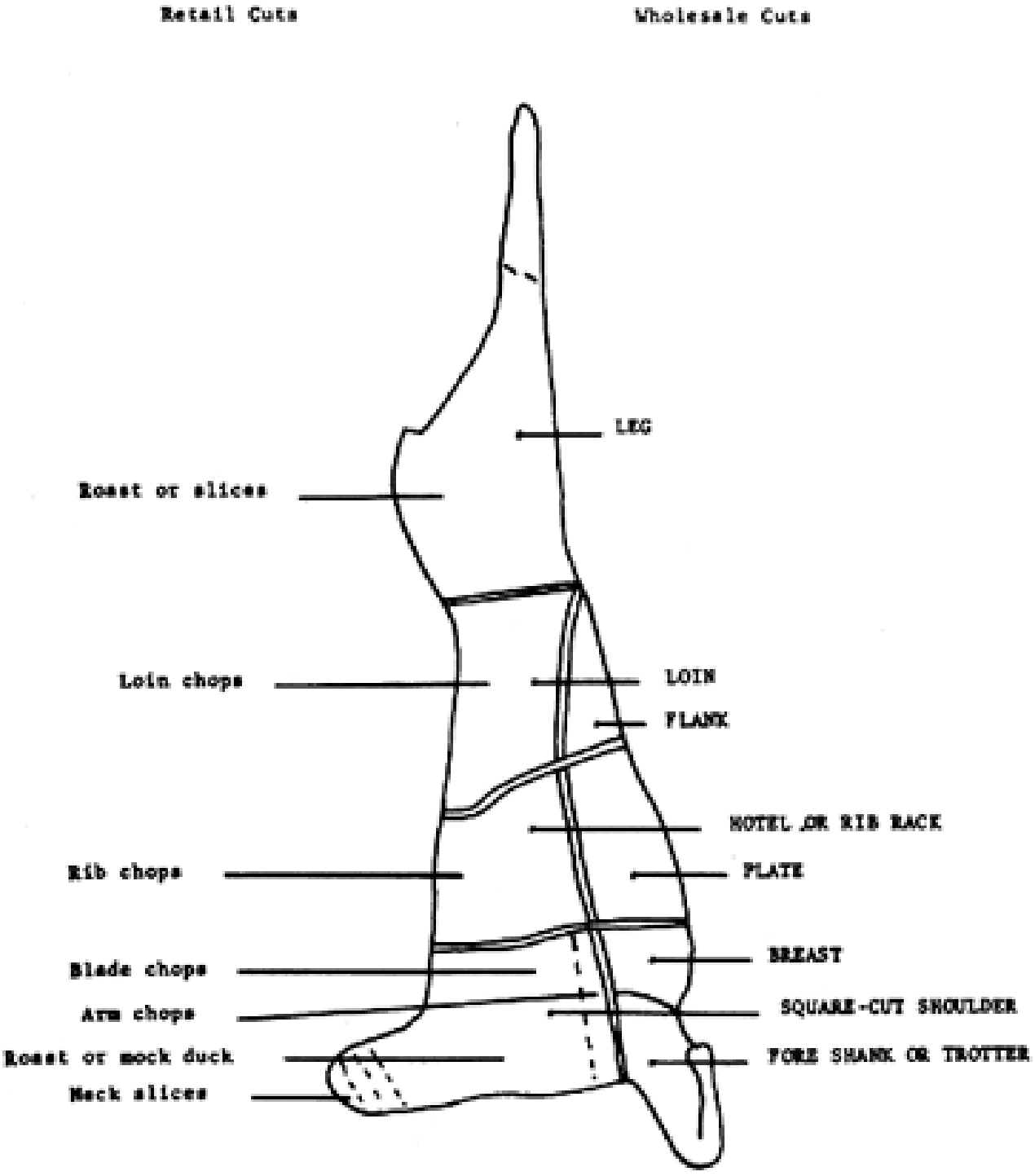

Figure 3. The lamb carcass and its cuts

Further readings

1. Food and Agriculture Organization (FAO), 1991. Guidelines for slaughtering, meat cutting and further processing. FAO Animal Production and Health Paper 91, FAO, ITALY.
2. Food and Agriculture Organization (FAO), 2004. Good practices for the meat industry, Animal production and hearth manual, Rome, ITALY.
3. Heinz, G., & Hautzinger, P. (2007). Principle of meat processing technology. In *Meat Processing Technology for Small to Medium Scale Producers* (pp. 17–43). Rome Italy: Food and Agriculture Organization.