

## Chapter 2

# FOOD ANIMALS AND TRANSPORTATION

→ The flesh of any animal which is used for food is known as meat. The food animals are those whose meat is utilised for human consumption. The great majority of animals slaughtered in all countries for human consumption consists of cattle, calves, sheep, goats, pigs (non-Muslim countries) buffaloes and camel. The rabbit and poultry is also used as a good source of meat.

The flesh of carnivorous animals such as cat and dog has been used as a protein diet in poor and labouring countries of the world. Now it is no more used as human food. The flesh of horse was used as human food but later it was stopped. The horse flesh is well established in Denmark, Belgium, Holland and Germany. The meat of pig commonly known Pork is frequently used in non-Muslim world. The meat of large ruminant is called Beef like cattle, buffalo and camel and the meat obtained from small ruminants like sheep and goats is termed Mutton. The meat is also classified as red and white meat. Meat obtained from large and small ruminants is usually called Red meat and the meat of poultry and fish is termed as White meat. DBHG

## 2.1 FOOD ANIMALS

### CATTLE AND BUFFALOES

- **Features:** ① Straight top and underlined with massive symmetrical body on short legs. ② Brisket well-forwarded, thigh full and wide to the hocks.
- **Age:** The best age for slaughter of cattle is 2½ years. The cattle and buffaloes under 18 months is not mature enough while over 3 years of age the flesh becomes coarser, dark and fibrous.



**Carcass yield:** It is also known as killing out or dressing out percentage. It is the weight of beef including the kidneys but minus the head, skin, blood, fat and viscera. The carcass yield varies with breed, feeding and age of animal. The carcass yield in cattle and buffaloes is  $\frac{4}{7}$  of its total live weight. Normally the carcass yield is 56 to 58%. The population of cattle and buffaloes in Pakistan is 18 and 21.3 million heads, respectively (E.S.P., 1997-98).

#### Classification:

**Bull:** An uncastrated male bovine ✓

**Heifer:** A female upto first calf. ✓

**Steer:** A castrated male at 6-12 months of age.

**Cow:** A female which has given one or more calves.

**Stag:** A male castrated late in life and more masculine in conformation.

#### BUFFALOES

Buffaloes beef is mostly used in India and Pakistan. The meat resembles to cattle beef in the structure, taste and colour. But this meat has coarse fibres and whitish colour connective tissue fat. Marbling is more pronounced in buffalo beef.

#### SHEEP AND GOATS

These animals serve as a dual-purpose animal and raised for milk, wool, hair and meat. Among sheep, two types are reared i.e. thin tailed and fat tailed and are comprised of seven different breeds in each class. Similarly various breeds of goats exist in Pakistan.

• **Features:** Short stocky plump legs, thick full lion, broad full back, thick fleshy ribs with a wide breast and shoulder and a short neck.

• **Age:** The best age for slaughter of sheep and goat is six months to one year.

• **Carcass yield:** A good fat sheep should yield 50% or over. A useful practical method for estimation of weight is to take 50% of animal live weight and deduct or add 1-2 kg according to the health of animal. The population of sheep in Pakistan is

31.3 million heads while goats are 48.7 million heads (E.S.P., 1997-98).

#### Classification:

**Lamb mutton:** The meat of animal slaughtered before weaning age.

**Hoggot mutton:** Meat of male sheep after culling from breeding flock.

**Ewe mutton:** Meat of female unfit for milking.

**Hogg:** The castrated male sheep at an early age i.e. 3 weeks to 3 months.

**Gimmer:** A female which has not yet born a lamb.

**Tup or Ram:** The uncastrated male.

#### CAMELS

Camels are mostly found in Somalia, Sudan, Ethiopia, Kenya, Saudi Arabia, UAE, Oman (Mid East), India and Pakistan. In these countries the meat is used as a human food. Meat of younger animals resembles the meat of cattle in its structure and taste. The taste is rather slightly saltish. Mature camel meat is deep red in colour, firm in consistency and fibres are coarser and thick. After cooking it becomes tender like the deer meat. The population of camel in Pakistan is 1.2 million heads (E.S.P., 1997-98).

#### 2.2 TRANSPORTATION

The importance of careful handling of food animals before slaughter cannot be over emphasized, because unsuitable conditions of road or rail transport frequently leads to injury. lameness and suffocation etc. This danger is greater to fat animals and is more when animals are closely loaded, the higher temperature and the longer journey. In developed countries, the transport of animals is governed by certain laws. Animals may be moved from one place to another by any of the following means.

##### 1. Driving on foot

This is a conventional method when animals are to be moved for a short distance under favourable conditions. The animals show no physical strain, provided they receive proper treatment and rest before slaughter.



## 2. Road transport

Specially built trucks are used for this purpose and should be adapted for this type of transportation. Certain rules governing this type of transport are employed. On human grounds, animals transported by trucks should not be overcrowded and tying of legs of small animals should not be permitted.

## 3. Rail transport

Special carriage wagons are in use in other countries and such wagons are specially built with feeding and watering arrangements and proper ventilation. This mode of transport is used when animals are to be moved for quite longer distances.

## 4. Sea transport

For overseas shifting and moving the animals, specially built ship vessels are used. These vessels are provided similar facilities such as rail wagons.

## 5. Air transport

As a rule, animals for slaughter are not transported by air because of heavy cost of journey. Only very precious show animals are carried by air.

Moving of animals by any of the above mentioned means will cause a change in their physical condition which affects the quality of meat. It has been estimated that a 10% weight loss does occur due to physical stress and other environmental conditions.

### 2.2.1 Rest after transport

It is very much desired that animals before slaughter must be given rest because without giving rest the animals may show a reduction in keeping quality of meat due to incomplete development of acidity of muscles and thereby early invasion of putrefactive microbes from the gastro-intestinal tract. Meat of tired animals is not satisfactory for canning, salting or sausage making. It has been observed that tired animals as well as those who got insufficient rest do not bleed well. Complete bleeding at time of slaughter is essential for increasing keeping quality of meat. It is also true that those food animals who were tired and fatigued, the organisms like *E. coli* especially are absorbed through the mucous membrane of the intestines into the blood circulation and are

distributed into the body tissue which lower the keeping quality of the meat.

The meat of fatigued animals appears dark and fiery and gives the impression that bleeding has been incomplete. This darkening of meat is partially due to a chemical change which takes place in fatigued muscles and also due to decreased oxygenation of blood haemoglobin and muscle myoglobin turning the muscle pigment dark. A minimum period of 48 hours rest is, therefore, essential before slaughtering of animals.

Fasting of animals at least 12 hours before slaughter will minimize the chance of invasion of microbes from the intestinal tract into the blood stream during digestion. Animals are offered ample supply of drinking water during rest period as it will lower the bacterial load in the intestine and will also help the easy removal of hides during the dressing of carcass.

### 2.2.2 Effects of transportation

Long journey or prolonged transportation will produce the following hazards and affect the quality of meat.

- Injuries such as bruises, fractures etc.
- Fatigue
- Loss of weight (10%)
- Starvation
- Suffocation
- Transport sickness similar to milk fever (Hypoglycemia).
- Imperfect bleeding, as tired animals do not bleed properly. The durability of meat is adversely affected due to insufficient bleeding and invasion of body tissues by intestinal microbes through general circulation. The permeability of mucous membranes of intestines is increased due to starvation and fatigue.
- The muscle haemorrhages occur more commonly in fatigued animals.



## Chapter 3

# THE SLAUGHTER HOUSE OR ABATTOIR

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The fundamental principles of hygiene as well as economic considerations demand that the slaughtering of animals for human food consumption be carried out in an establishment specially constructed for the purpose and kept under constant sanitary control. A good slaughter house should have the following provisions:

## 3.1 SITE LOCATION

The first step in planning an abattoir is to ascertain the ultimate daily kill of slaughter of animals and the proposed disposal of by products. All slaughter houses should be constructed away from human population and if possible near the livestock market and railway station. The prevailing winds should be given due consideration while selecting the site. The direction of winds should be from human habitation towards the slaughter house to avoid problem of air pollution and bad smell. The slaughter house should be constructed in a low lying area with a proper drainage facility and enough water supply. The slaughter house should have a rail linkage. Electric power should also be available. The slaughter house should be fly proof and should have sufficient roof to prevent birds. It should have enough place and facilities for disposal of waste products and be able to cater the need of handling more than required number of slaughtering animals. The following buildings must be provided.

### 1. Lairage

It consists of animal houses and pens, where the animals awaiting slaughter are kept. The following points should be observed while constructing the lairage:



- i. The animal houses should be 100-200 meters away from the slaughtering hall (butchery) building to prevent meat from absorbing objectionable odours.
- ii. The covered accommodation should be adequate and should have enclosed courtyard in front.
- iii. Watering and feeding troughs should be provided.
- iv. The animal houses should have concrete floor for better cleaning and easy disinfection. The floor should have proper slope, which should end in pucca drainament for carrying urine and faeces into a soakage pit.
- v. Shedding must be provided to facilitate rest to the animals.
- vi. Attached stores for keeping grain and fodder be provided.
- vii. A separate room for attendant is also required.

## 2. Isolation Block

This important building is actually a mini slaughter room. It consists of small lairage together with slaughter room and hanging room. It should be located near the suspected detention room and also in direct communication with the by-product department. The animals which are diseased or suspected must be lairaged apart from the healthy ones. This block must contain a small unit for treating sick animals.

## 3. Slaughter Hall

Two systems are recognized universally in abattoirs or slaughter houses and they are:

- A. French Room System or Chamber System
- B. German Hall System.

Prior to entering in any system, there is a separate animal bleeding room where animal are slaughtered and after complete bleeding the body is taken for further process of dressing and inspection.

**A. French Room System or Chamber System:** In this chamber system, the abattoir is divided into a numbers of separate rooms. This system is better and convenient for the slaughter men (butchers) where they can work easily

without any disturbance but they can smuggle or substitute diseased portion of the carcass with more confidence. In this system, the inspection is more difficult and require great number of technical staff and meat inspectors. Therefore, this system is uneconomical for abattoirs and can only be practised where the number of slaughter is small.

**B. German Hall System:** The transference of animals after antemortem examination in the lairage to slaughter hall is a matter of no difficulty if the abattoir is well designed. (The German hall system consists of a small killing room where the animals are slaughtered and bled in a chamber and then transferred to a big hall where all the flaying and dressing of the carcass including inspection is completed. Every facility like flaying apparatus, hanging pulleys to raise the large carcasses, small tables for dressing small animals, enough water supply, electricity and good drainage system must exist in German hall system. The floor of hall is paved, hard, impervious and non-slippery. The hall should be well ventilated. The prescribed hygiene rules facilitate the work in such big halls. The blood is not allowed to gain access to the gullies and drains and instead it is stored in barrels placed as garbage cans in the hall.

## 4. Hanging Room

Adjacent to the hall, this place is specified for hanging the carcasses vertically as it has been raised for flaying. The hanging of carcass facilitates its setting and inspection.

## 5. Cooling Hall (Chilling)

Next to hanging hall, this block is situated consisting of a big hall. The temperature of this hall may be kept and maintained between 30-40°F. The hung carcasses after inspection are transferred to this hall for chilling and setting of carcass. They remain good for about a fortnight without deterioration. Cooling increases the tenderness of the meat.



### 6. Guttery or Tripery

This is a separate unit of the slaughter house and consists of engine room, gut scrapping room, tripe room, stores and product plant unit. This is close to the slaughter hall. In abattoirs large slaughter houses a large number of tripes (intestines) are cleared. Tables are provided for each work and the garbage stored in garbage cans in shape of stomach and intestinal ingesta. This place should be well ventilated. Sufficient water and drainage facilities are provided. The gut cleaning is carried on smooth top tables. At the end of the table, water tanks for immersion of gut should be provided. The blood should be collected in separate barrels specially provided for this.

### 7. Hides and Skin Store

This store should have a sufficient space and size and be capable of storing three or four days material. Proper sanitation and cleanliness be observed daily.

### 8. Condemnation Cell

This is a room where condemned carcasses or portions/organ can be stored. It should be near incinerator of the slaughter house and also a facility of steam digester is provided. The key for this room must always be kept under the custody of the incharge slaughter house and always be kept under lock and key.

### 9. Incinerator

This facility is an essential one for even large or small slaughter houses. The condemned carcasses are treated and useful material is obtained. The rest of the material is burnt to ashes for sanitary disposal of carcasses.

### 10. Laboratory

A good small laboratory is provided in such establishment which can cater the need of diagnosing the suspected meat through carrying various tests and pathological examinations to complete the investigations.

### 11. Bath Rooms and Canteen Shop

The toilets and both rooms are provided in the establishment for the workers. Canteen for refreshment is an other facility deemed to be necessary for slaughter houses.

### 12. Offices

This building is provided near the exit of the slaughter house where offices of chief meat inspector and other technical staff officers are located. This building should be close to the laboratory and have all the facilities of an office.

A layout plan of a slaughter house situated in Pakistan at Sinala, Islamabad is given in Fig.1.

### 3.2 SLAUGHTER HOUSE SANITATION

In a good abattoir, hygiene will go a long way in the production of clean and wholesome meat. Without a proper sanitation even the most modern and ideal slaughter house will turn into a filth house and will become a public health hazard. Haphazard measures will always fail to meet the sanitation requirements. To ensure proper sanitation, a system of cleaning should be laid down and rigidly followed. Slaughter house hygiene can be divided into the following:

a. Personal hygiene. All persons working in the slaughter house handling meat should be regularly examined for any evidence of contagious disease and they should be protected against cholera, small pox and typhoid etc. They should not have long nails or hairs and their hands should be free from boils, infected sores, cuts and skin diseases. The workers must be free from tuberculosis. They must wash hands with soap before handling meat and must wear clean clothes or working dress.

b. Equipments. Proper equipment should be provided and sterilized before bringing them to use.

c. Good ventilation. Drainage and lighting etc. arrangements be provided.

d. FLY proofing. The slaughtering and hanging halls must be perfectly roofed. Special care to avoid rodents' presence in the slaughter house will enhance sanitation and efficiency of the slaughter house.



**LEGENDS**

1. Administration building
2. Janitors lodge
3. Sewage treatment plant
4. Dining room
5. Slaughter house with cold storage
6. Garage laundry and auxiliary workshop
7. Transformer station
8. Boiler house
9. Stable for cattle and sheep
10. Cattle boxes
11. Sheep boxes
12. Scale
13. Slaughter house for processing of sick animals
14. Quarantine ward
15. Garbage compound for dung

Fig. 1. Layout Plan Of Sihala Slaughter House, Islamabad

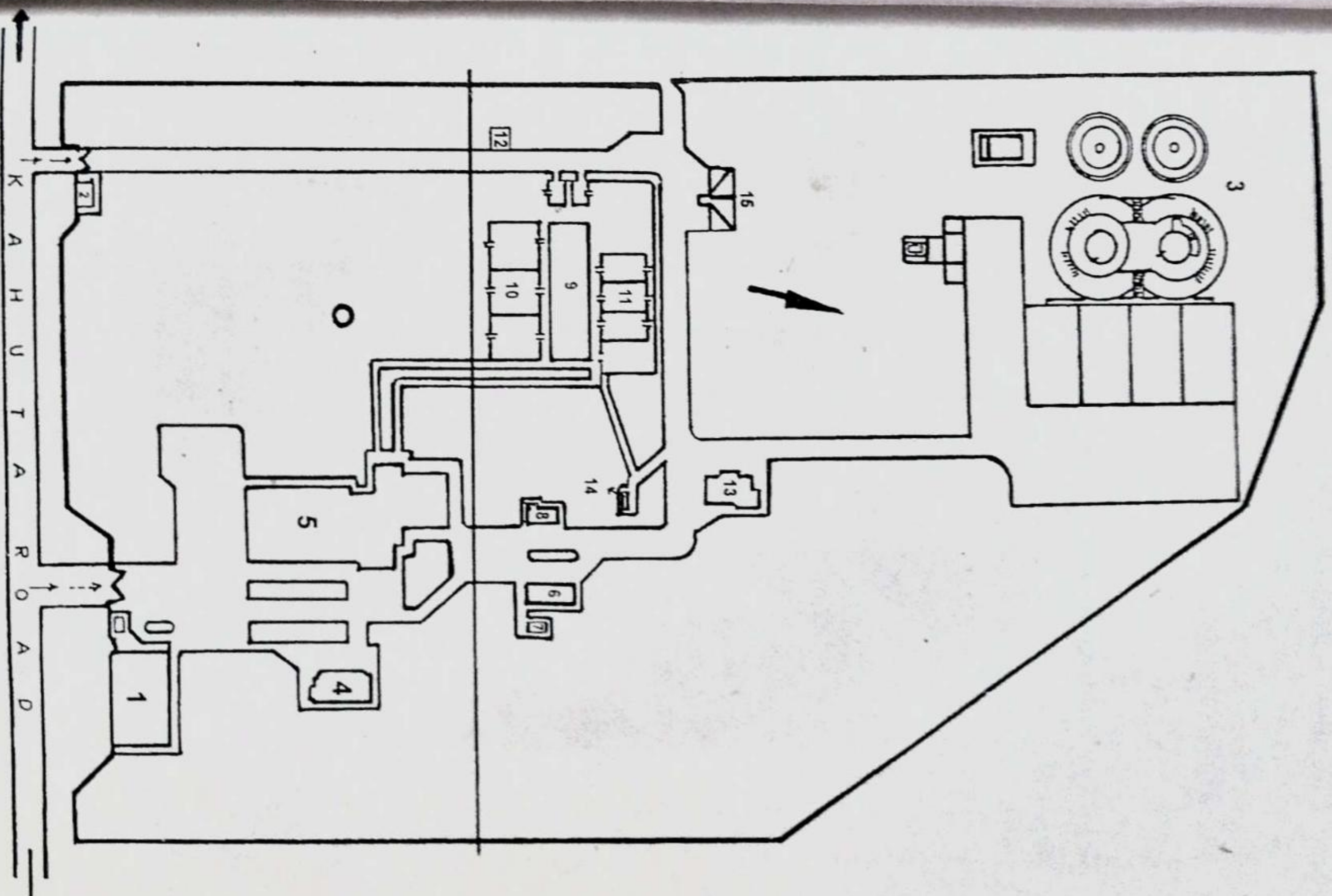


Fig. 1. Layout Plan Of Sihala Slaughter House, Islamabad



e. Cleaning and disinfection. The slaughter house should be cleaned in a routine system under which daily and weekly routine be made. The equipment, tables, walls and floors must be thoroughly cleaned and disinfected to avoid any contamination of meat.

### 3.2.1 Contamination of slaughter house

1. In Pakistan, the greatest health hazard is contamination and the diseases of animals in meat industry. Hence animal diseases do not pose a serious threat to health but on the other hand the contamination of meat is so common and wide spread moisture & temp is good for microbes that hardly any carcass can be without any contamination & growth so polluted. Very little attention is paid in elementary cleanliness & repair and maintenance of slaughter houses or to the principle of hygiene. The sanitary fittings, sterilization of instruments & disposal of offals and enough supply of water are generally contaminated & be changed ignored.

2. Meat being a nourishing food for human as well as for microbes which in a matter of few hours render unwholesome. The temperature and moisture conditions of the country are most suitable for the growth of bacteria and their multiplication which soon convert the meat into deadly poisonous.
3. Initial bacterial load determines the durability or keeping quality of meat. Cleaner the meat, the more durable it is.
4. The meat once contaminated can not be rendered clean. The only way to get rid of contamination is to cut and throw away the contaminated part.
5. Contamination can not be safeguarded through cooking as it has no effect on thermostable bacteria and their toxins.
6. The spoilage of meat can be retarded by production of clean meat and protecting it from contamination till it is consumed.
7. The contamination can be seized by avoiding moisture of meat and cooling it which will render the meat dry. The dry film produced on meat surface acts as a barrier against deeper contamination.

### 3.2.2 Sources of contamination

1. Dirty hands, nails, boils, cuts on skin and dirty clothing are the source of contamination. Inflation of carcass by diseased person is yet another source of contamination.
2. Faulty Techniques: Do not legate the food pipe (intestine) before starting skinning of the animal. Skinning with the help of dirty feet, holding knife in mouth, using unsterilized equipment, puncturing urinary bladder, stomach or intestine, washing the carcass with dirty water and skinning on ground also induce contamination.
3. Faulty conveyance: The meat should not be carried from slaughter house to market in bath tubs and buckets in an open cart. The contamination from dust in the way must be avoided.
4. Flies. These are major health hazards and common source of meat contamination. Prevent the access of flies to meat at all stages of its processing, storage, transportation and on sale points.
5. Animals. The contamination from animal organs, secretions and discharges should be avoided.
6. Pathological agents. Specific bacteria, viruses, parasites, molds and fungi are main source of contamination.
7. Poor management in slaughter house by not making arrangements of good hygiene provisions and not following the approved procedures of slaughter.

### Suggested Readings

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# ANIMAL INSPECTION AND SLAUGHTERING

## 4.1 ANTEMORTEM INSPECTION

The animal slaughter Act 1965 of Pakistan provides in its clauses 56 to 59 the inspection of animals before slaughter in order to ascertain whether each animal intended for slaughter is in a satisfactory state of health and not within the category of useful animal as defined in the act.

Antemortem inspection means the professional examination of animals for fitness for food, or otherwise, of animals tendered for slaughter. This examination should take place as close to the time of slaughter as possible so that no time is given to a disease to develop and render the meat unwholesome. Meat inspection system is based on double inspection system i.e., before and after slaughter of animals. This system greatly enhances the value of meat inspection. The antemortem examination enables to detect diseases during the life of the animal. It provides an opportunity to diagnose those diseases which do not leave sufficient changes after death. Without this examination, the animals will be slaughtered and unwholesome meat will be produced. Hence the antemortem inspection of animals is most desirable practice of great value.

Furthermore, the flesh of animals slaughtered is influenced by the presence of certain drugs (antibiotics) residues. This can be checked by Swab Test On Premises (STOP). It is a simple but highly accurate test for the detection of antibiotic residues in animal tissues. This test reduces the holding time of many retained carcasses, reduce the time spent in packing and mailing specimens, and results in decreased mailing and laboratory costs. When injection lesions are found, the carcass is to be retained and appropriate samples sent to the laboratory for analysis. It often takes several days or more to receive the laboratory results. A high

percentage of carcasses with visible injection lesions do not have detectable antibiotic residues in the tissues, meaning that after the time-consuming and expensive process packing and mailing samples and a long holding period, the carcass is likely to be released.

With this test, the tissue may be tested in the slaughtering plant (on premises) and the results obtained less than 24 hours after slaughter. If the STOP results are negative, the carcass may be released immediately with a high degree of assurance that the tissues are free of antibiotic residues. Only STOP positive cases need to be submitted to the laboratory for confirmation and assay to determine the disposition.

STOP is a biological test for the presence of inhibitors (antibiotics) in animal tissue. It is based on the principle that if the tissue contains an antibiotic residue, fluid from the tissue will inhibit the growth of a sensitive organism on a bacterial culture plate. Experience has shown that the kidney is the most likely organ to contain antibiotic residues, so kidney tissue is used for this test. The accuracy of STOP has not been determined when used to test other tissues. Cotton swabs saturated with kidney tissue fluid from the suspected carcass are placed on an agar gel culture plate. The agar gel plate has been pre-seeded with a special stain of *Bacillus subtilis* bacteria that is highly sensitive to all the common antibiotics. (Note: *Bacillus subtilis* is a harmless organism found in nature and is not dangerous to animal or human health). The swabs and plates are incubated for 16 to 18 hours to allow the growth of the organism. Then the plates are examined for zones of inhibited growth around the swabs.

### 4.1.1 Objectives

1. To prevent the introduction and spread of contagious diseases amongst the reserved stocks of already passed animals awaiting slaughter.
2. To prevent the slaughter of fatigued, diseased or otherwise unfit animals.
3. To safeguard the health of consumer against communicable diseases and consumption of unwholesome meat.



4. To detect the diseased conditions which do not leave much of disease signs after slaughter e.g. septic conditions.
5. To avoid unnecessary condemnation of carcasses after slaughter.
6. To eliminate the entry in the slaughter house of dying emergent slaughtered animals.

#### 4.1.2 Procedure of inspections

*a. Weekly inspection:* Animals should be presented for inspection once in a week of usually reserved stock for seven days. Each animal is inspected from disease standpoint and should see that animal is bright and active. It is not lame and there is no purulent discharge from nostrils. There is no foul smell or blood stained diarrhoea. The animal is not in the stage of advanced pregnancy. There is no septic condition and the hair coat is not dull. The animal is neither emaciated nor hide bound. There is no fever. Such above-mentioned conditions render to declare the animal rejected.

*b. Daily inspection:* Animals are examined from the already passed animals they are and branded with a word 'P' on the near hind hoof and kept separately till slaughtered. They are supplied ample water and not any thing to eat. The animals that escape slaughter should again be produced next day for inspection.

### 4.2 SLAUGHTERING METHODS

#### 4.2.1 Essentials in the slaughtering

- a. The death of the animal is brought suddenly in order to avoid unnecessary pain. This method should be as human as possible.
- b. The bleeding should be complete because complete bleeding increases the keeping quality of meat. The total blood in the body is 8% of its total body weight.
- c. The flesh of animals incompletely bled is dark in colour.
- d. Exhausted animals do not completely bleed well while slaughtering.

- e. It is undesirable that animals awaiting slaughter should view the slaughtering process.

There are two methods of slaughtering:

1. Islamic (Halal) slaughtering without stunning.
2. Un-Islamic where slaughtering act is performed after stunning.

#### 1. Islamic method

This is a religious method and practised in all Muslim countries of the world. In this method, the animal is casted, its neck is slashed transversely at the throat with a razor sharp knife and the main vessels (common carotid artery) of the neck is severed while reciting 'Takbeer'. This method is called 'Halal'. All other methods of slaughter render the meat 'Haram' because of not reciting Takbeer.

#### Advantages of halal method:

1. It is ordered by Allah Almighty
2. It is question of faith and religion
3. It is human and almost painless to the animal, if the knife is sharp. The cutting of the carotid causes instantaneous anaemia of brain and the animal is rendered incapable of feeling any pain or discomfort.
4. In this method neither medulla oblongata is served nor damaged by breaking or twisting neck. The heart keeps on working till the last available ounce of blood.
5. Complete bleeding is achieved which increase the keeping quality of meat.
6. No back bleeding takes place.

#### Stunning and halal method

For large animals, a slight modification of the Islamic method is recommended. Stunning preferably with electric should proceed the act of slaughtering to avoid forcibly casting the animal on floor. Electric method is better than any other method of stunning.



## 2. Un-Islamic methods ✓

There are several un-Islamic methods of killing animals. Some important methods are given below:

1. Shooting in head ✓
2. Decapitation or chopping head off (*Jhatka*) ✓
3. Breaking the neck by twisting it. ✓
4. Sticking. ✓
5. Stabbing in heart. ✓

### 4.2.2 Stunning of animals

In all advanced and developed countries like UK, USA, Canada, Australia and all European countries where many of cattle are range and difficult to approach and handle. To overcome this problem many devices of controlling the animals are adopted.

#### Advantages of stunning: ✓

- i. Animal is relieved of pain. ✓
- ii. No need of tying the animal or casting it on floor, so extra labour is avoided.
- iii. It facilitates and expedites the work of slaughter.
- iv. Maximum bleeding is obtained as stunning is said to promote the increase in blood pressure and rate of heart beat which lasts for a minimum time. So animal is required to be bled soon after stunning. The animal should be allowed to bleed for five minutes or even longer.

## A. MECHANICAL STUNNING

### 1. The Pistol (Captive bolt) method ✓

It is one of the most generally used instruments for stunning the food animals both large and small. It is more rapid, reliable and certain equipment are already provided, so it is held firmly at the right point of the head. The operation of this appliance is simple. After being loaded with blank cartridge, the pistol is placed at the shooting point without too great pressure and upon pulling the trigger, the steel bolt which is  $\frac{7}{8}$  inch (9 mm) in diameter, pierces the skull, enter the brain and then recoils. The shooting point is the

middle of the forehead. Cartridges of various sizes are used according to the type of the animal to be stunned. A stronger charge is required for cattle and other large animals. This instrument is available as a pistol type in different makes like Cash, Schenker and Temple etc.

#### Causes of failure of Captive bolt

- i. Use of damp cartridge. ✓
- ii. Lack of grease on the bolt of appliance ✓
- iii. Using low strength charge e.g. sheep cartridge on cattle and vice versa.
- iv. Not using the bolt at proper place of brain. ✓

### 2. Free bullet guns ✓

These are used for stunning the larger animals. The user of this instrument must be skilled and the gun should be held firmly at the correct shooting point and aimed at proper angle. The bullet after piercing the skull enter in brain and acts in the way of pithing process. The different trade guns like GREENER and R.S.P.C.A are available.

## B. CHEMICAL STUNNING ✓

### Use of Carbon dioxide ✓

It is usually practised in Europe where range boars (pigs) are difficult to handle. It is an oval tunnel type and can handle upto 240 bacon pigs per hour. The pigs are admitted to this tunnel singly into an endless conveyor belt divided into 10 compartments and the belt transports each pig through the lower part of the apparatus. The part of tunnel contains a mixture of 65% carbon dioxide in atmospheric air and on the exposure to the gas for 15 seconds, the pigs become rapidly anaesthetized and after emerging are completely unconscious for  $1\frac{1}{2}$  to 3 minutes during which they are bled.



**Advantages**

- i. The carcass stunned through gas system bleed 75% better than those which are non-stunned.
- ii. The pH of flesh of pigs is lower than those which are non-stunned (acidic pH).
- iii. No splashing in carcass occur.

**C. ELECTRICAL STUNNING**

This method has been used in Europe for many years. Different kinds of apparatus are used and their efficacy depends mainly on their practical results. If the stunning is to be effective the current must pass through the brain and the electrodes must be placed accurately on the head of animal.

The apparatus consists of a pair of stainless steel tongs with handles 8-12 inch in length which by flex wire conveys the current through a transformer to the animal. The purpose of the transformer is to reduce the high voltage to the requisite low voltage of 60-70 volts suitable for stunning pigs, sheep and calves. For large cattle 160 volts current is applied for 30 seconds.

**Advantages**

- i. Economy of operation because of low voltage current is required.
- ii. No damage to brain or to carcass occurs.
- iii. More efficient bleeding is achieved.
- iv. Carcass is obtained with out splashing.
- v. No risk is involved for operator because of low voltage.

**D. PITHING**

After stunning sometime cattle are pithed before bleeding. This is done by inserting a long thin rod into the aperture (hole) made in the skull by the bolt of the pistol. The rod destroys the medulla oblongata. The purpose of pithing is to enable the slaughterman to proceed more rapidly and with safety for dressing the carcass. The pithing rod should not be of greater length than 24 inches and it longer than that will destroy the roots of great splanchnic nerve which is the main vasoconstrictor of abdominal cavity and

resultantly bleed vessels of liver, kidneys and intestine will be congested and the enlargement of spleen will occur. Perfect bleeding will not occur.

**4.2.3 Factors affecting bleeding**

- i. When bleeding of animal is not done immediately after stunning.
- ii. Bleeding is retarded in all infections which affect the action of heart, lungs and muscles.
- iii. Animals suffering from febrile conditions or indigestion will not bleed properly.

**Signs of good bleeding**

- i. All arteries and large and medium veins are empty.
- ii. Dryness of muscles.
- iii. Dryness of parenchymatous organs.
- iv. In a well bled animal only a few drops of blood can be squeezed out of freshly cut surface and traces of blood can be found in smallest veins.

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## SKINNING AND DRESSING OF CARCASS

### 5.1 SKINNING

Just after the completion of the process of bleeding, the dressing of the carcass takes place. In cattle, goat, sheep and horses, the skin is removed and this process is called flaying. The following instructions are adopted:

1. The butchers (slaughterman) should wear clean overalls or rubber aprons, their hands should be cleaned and nails are pared. The premises must be clean. The knives should have steel handles.
2. The skin of the animal (carcass) should not distended by blowing air by mouth.
3. While skinning, the knives should not be placed on floor or even in the skin of the animal or held by mouth.
4. Before skinning is started and hanging up of the carcass, the oesophagus is tied up with a piece of string or knotted to prevent back flow of ingesta and contamination of the carcass.
5. While skinning, the hairside, the skin should not be allowed to come in contact with the skinned part (flesh).
6. Skinning should be done away from the walls or posts.
7. Skinning should not be done with the help of feet.

After bleeding, the carcass is turned on its back and the skin cut along the middle of the abdomen from the root of the neck to the pubis is made. The skin is striped off as far as possible towards the backbone. While skinning, the inspector should obtain the view of the subcutaneous tissues for any of the bruising or parasitic invasion and the superficial lymph glands, as the glands are sometime removed with the skin. The body is then lung up and the rest of skin is removed.

### 5.2 WASHING AND INFLATION

#### 5.2.1 Washing

The washing of small and large carcass is a usual practice in a slaughter house as it aids in removing hair, wool and dirt during the process of skinning. This is done by cold water but sometime a spray at about 300 lbs per square inch pressure heated to 95°F is applied. Warm water is claimed in reducing surface bacterial contamination and results in a better appearance of carcass.

#### 5.2.2 Inflation of carcass

This is very old practice and believed to facilitate the removal of skin and thus avoid deleterious cutting. An incision is made on the fore shanks and on the belly of large animals just posterior to the sternum, air is pumped into these incisions. The carcass of veal, mutton lamb and goats can be dressed satisfactorily without inflation. The inflation is now forbidden in USA and Germany as the carcasses are regarded contaminated. Inflation may be done either by subcutaneous inflation or inflation of the lungs.

##### i. Subcutaneous inflation

In subcutaneous inflation, the carcass of the sheep and calves are inflated by making a puncture into the skin and blowing air into it. This results into subcutaneous emphysema which renders skinning easier and gives carcass a better plumply look. The carcass crackles when pressed with the finger. There is nothing objectionable to this practice if the process is carried out with the help of blowers or bellows. For this purpose a mechanical technique called "Master flaying" is now a days in practice at big slaughter houses. Inflation by mouth by butchers (slaughtermen) is prohibited as some of them may be suffering from tuberculosis or any other respiratory infection and are liable to transmit the disease.

##### ii. Inflation of the lungs

This is done to make the lungs look larger and more appetizing. The inflation in this case by mouth should also not be permitted.



## SKINNING AND DRESSING OF CARCASS

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### 5.2.3 Dressing

The dressing of the carcass consists of process of flaying (skinning) and opening the cavities of the carcass for inspection. After superficial inspection of the surface of carcass by looking any bruise or parasitic invasion, the abdominal cavity is opened by cut from the sternum to the pubis exposing the peritoneal cavity. Stomach and intestine which are removed along with the mesenteric glands, at this stage notice should be taken of any sign of ascites and peritonitis. The liver is removed separately along with lung and the heart. These organs constitute so called Slings or Fluck. The breast bones are also cut in the middle exposing the lung pleura and heart which are removed at a time. The carcass is then raised by hind quarter and suspended in upright position. The limbs are divided at the knee and hock joint. Head which has been already removed from the neck is hung by muzzle. Dressing is then completed by splitting the carcass into two halves down to the middle of the back bone. The postmortem inspection is conducted by looking the internal side of the carcass for any untoward signs. When the carcass is set, it is divided into various joints or meat cuts like neck, brisket, shoulder, back, loin, leg and feet and flanks. The carcass should be examined in the day light, because jaundice and other changes in colour may be overlooked in artificial light.

### 5.3 RIGOR MORTIS

The rigor mortis is a permanent contraction of all the skeletal muscles after death beginning in the muscles of head and neck and appearing gradually over the whole of the body. It is accompanied by stiffening of the joints and rise of temperature by 3°F. This state of stiffening after death is called rigor mortis.

The muscles are soft when the animal is slaughtered. After death a chemico-physical series of highly complicated changes take place in the body which end up in stiffening or rigor mortis. The basis of rigor mortis is the muscle protein "actomyosin" which is a complex of actin and myosin. The precise manner in which myosin and actin molecules react to cause contraction is not known. But it is believed that contraction is caused by sliding of the chain of actin molecules with the chain of myosin molecules. No break down of actomyosin into its component parts actin and

myosin takes place, instead the changes which occur in the meat after death favour the process. The sequence of changes is as under:

- i. Immediately after death of animal, nucleotide adenosine triphosphate (ATP) is broken down to ADP by enzyme ATPase of myosin. This forms the onset of rigor mortis.
  - ii. Because of the presence of oxygen in the tissues on account of recent death, the regeneration of ATP continues for sometime, hence no stiffening is seen in the initial time after death.
  - iii. The interruption of blood circulation through the muscle now reduces the ability of muscle to maintain aerobic oxidation of lactic acid and removal of CO<sub>2</sub>.
  - iv. Anaerobic metabolism takes over and accumulation of lactic acid concentration is seen at the height of rigor mortis which is almost ten times more than in the living condition of the animal. In living conditions, the muscle is alkaline or neutral but it turns acidic in 3-6 hours after death.
  - v. Concentration of lactic acid reduces the pH of muscle from 7 to 5.6 to 5.3.
  - vi. The decrease in pH retards anaerobic metabolism because the enzymes involved are no longer at their optimum pH for activity.
  - vii. Because of the residual metabolism of the muscle, the concentration of ATP continues decreasing and leading to gradual hardening of the muscle until it becomes quiet stiff and dull in appearance.
- The meat in early rigor mortis, if cooked, is found tough, but if it is kept in a cooler condition for a few days, it will gradually begin to soften again. This period is called "AGEING". Autolysis appears to play a major role in softening the meat. Lactic acid also tenderizes meat by converting collagen to gelatin. The duration of rigor mortis is extremely variable. It starts appearing in 7-12 hours and reaches to its peak in 20-24 hours and then starts declining gradually. The earlier it appears, the sooner it passes away and vice versa. The development of rigor mortis is influenced by the following conditions:



- i. **Muscular activity:** Any exertion before slaughter depletes the glycogen contents of the meat thus affecting the onset of rigor mortis. The appearance of rigor mortis is inversely related to the glycogen content of the muscles. The lesser is the glycogen, the quicker and shorter the rigor mortis. Hence there will be no or even lesser the rigor mortis in fatigued or exhausted animals.
- ii. **High atmospheric temperature:** The onset of rigor mortis is accelerated by high atmospheric temperature and retarded by low temperature.
- iii. **Health condition:** Rigor mortis does not properly develop in sick and debilitated animals. It may be absent or minimal present in the carcass of animals that have suffered from severe febrile conditions, septic infections and emaciation.

### 5.3.1 Importance of rigor mortis

Great importance must be attached to rigor mortis in meat inspection because it is a criterion for judging the quality of meat. Lack of rigor mortis means that the animal was suffering from one or the more of the following conditions/diseases:

Fatigue, exhaustion, debility, emaciation, febrile disease, debilitating disease, septicemia or toxemia. A carcass showing lack of rigor mortis due to fatigue may be passed but do not pass carcass that fail to set otherwise. Their meat may contain harmful bacteria or toxins and may cause meat poisoning.

The development of acid during rigor mortis retards the growth and multiplication of putrefactive bacteria. Hence it enhances the durability or the keeping quality of the meat. Lack of rigor mortis is an indicative of poor keeping quality of meat.

The development of rigor mortis (acid) tenderizes the meat by converting collagen to gelatin. It also improves the flavour of the meat too. Full rigor mortis signifies healthy and good quality meat. The very early rigor mortis is an indication for the onset of putrefaction process.

## 5.4 THE LYMPH NODES

The importance and functions of lymph nodes are as under:

- i. **Act as sieves:** No lymph can enter into the circulation without passing through at least one lymph node.
- ii. **Purify lymph:** The lymph nodes purify lymph before it enters into the circulation by arresting bacteria, viruses and even pigments from it.
- iii. **Act as sentinels:** The lymph nodes are sentinels (guard) of body because they arrest invading microbes. In this way, they either prevent or at least delay the generalization of disease through dissemination or infection by blood.
- iv. **Facilitate meat inspection:** Since every part or organ of the carcass is provided with a lymph node which alone may be inspected to judge the wholesomeness or the part concerned instead of searching the entire carcass or organ.
- v. **Diagnostic aid:** The lymph nodes first pick up the infection, so they form a valuable guide for diagnosis in meat inspection. Their examination is of considerable importance in meat inspection. Changes in their size, consistency and colour provide valuable guide lines for the detection of the various diseases.

### 5.4.1 Types of lymph nodes

- i. **Visceral lymph nodes:** They receive lymph from the viscera e.g., hepatic, renal, bronchial and mesenteric lymph nodes.
- ii. **Body lymph nodes:** They receive lymph from muscles, joints and bones. e.g., popliteal, prefemoral and prescapular lymph nodes.
- iii. **Mixed lymph nodes:** They receive lymph from viscera and also from muscles e.g. internal iliac, superficial inguinal, ischiatic, anterior mediastinal and posterior mediastinal etc.

### 5.4.2 Important lymph nodes

The following lymph nodes of sheep and goats are inspected in routine meat inspection.

- i. **Prescapular:** This node is situated just in front of the point of the shoulder. It drains head, neck, shoulder and forelimb.



- ii. **Prefemoral (precrural).** It lies in the fold of flank in front of stifle joint. It drains skin, prepuce and superficial muscles.
- iii. **Popliteal.** It lies deep in the middle of the thigh and drains the lower part of the leg and foot.

The following lymph nodes are examined in cattle for tuberculosis:

- **Left bronchial.** It is situated close to the left bronchus and is partly covered by the aorta. It drains the lungs. If T.B. is found in the left bronchial lymph node, then other lymph nodes such as **retropharyngeal** and **mediastinal** are also examined.
- If there are no T.B. lesions in the head or in its nodes and lesions are found in **prescapular node**, then they are indicative of haemorrhagic spread of the disease.

The following table outlines the cut (Joints) together with the bones and lymph nodes associated with them:

1. **Head.** It contains the submaxillary, parotid and retropharyngeal lymph nodes.
2. **Clod (Neck)** contains the cervical vertebrae and the middle cervical group of lymph nodes.
3. **Sticking (loaf)** contains the prescapular lymph nodes
4. **Back ribs (Thick chine)** contain the first five dorsal vertebrae upper part of the first five ribs and the scapula together with the costo-cervical and intercostal lymph nodes.
5. **Fore ribs (Thin chine)** contain the 6-9th dorsal vertebrae with corresponding ribs and intercostal lymph nodes.
6. **Top ribs (Thick rib)** contain part of the first five ribs with the prepectoral and axillary lymph nodes. The main prepectoral node, however, is likely to be removed by the butcher in the trimming of this joint.
7. **Flat ribs (Thin ribs)** contain part of the 6-9th ribs.
8. **Brisket** contains the greater part of the sternum with its costal cartilages and the presteral and suprasternal lymph nodes.
9. **Plate** contains the posterior portion of the sternum and its xiphoid cartilage and the presteral and suprasternal lymph nodes.

10. **Sirloin** contains the last three or four dorsal vertebra with their ribs. All five lumbar vertebrae and the lumbar and the renal lymph node.
11. **Rump (Steak piece)** contains the sacrum and the shaft of the ilium with the deep inguinal, external iliac, internal iliac and sacral lymph nodes.
12. **Rump and Shell bone (Izal and Rump)** contains the ischium and pubis and ischiatic lymph nodes.
13. **Round.** This meat cut is divided into an inner topside and outer silver side. The topside contains the superficial inguinal lymph node in the male and supramammary lymph nodes in female. The silver side contains the femur and popliteal nodes.
14. **Thick Flank** contains the patella and part of the precrural lymph node.
15. **Thin Flank** contains portion of the last three or four ribs and part of the prescapular lymph node.

#### 5.4.3 Haemolymph nodes

These are pea sized deep red and black round or oval masses of lymphoid tissue without any afferent or efferent lymphatics. They are supplied by arteries which break up in their substance and discharge blood into the tissue spaces. Thus, they resemble spleen and are sometimes called accessory spleen and contain numerous white blood cells and disintegrating red blood cells. These are numerous in ox and sheep but are absent in horse. In ox, they are more common along aorta and subcutaneous fat. In sheep, they are commonest in sublumber fat. They are more common and large size in anaemic and debilitated animals.

#### Suggested Readings

- Gracey, J.F., 1981. *Thornton's Meat Hygiene*. 7<sup>th</sup> Ed. Baillere Tindall, London.
- Herenda, D.C., and D. A. Franco, 1991. *Food Animal Pathology and Meat Hygiene*. Mosby Year Book, Inc. 11830 Westline Industrial Drive, St. Louis, MO 63143 USA.
- Lawrie, R.A., 1991. *Meat Science*. 5<sup>th</sup> Ed. Pergamon Press Inc, New York, U.S.A.
- Wilson, A., 1991. *Practical Meat Inspection*. 5<sup>th</sup> Ed. Oxford Blackwell Scientific Publications, London.



## Chapter 6

## POSTMORTEM EXAMINATION AND CERTIFICATION

According to the Livestock Slaughter Control Act, 1963, it prohibits the slaughter of useful animals and to regulate the slaughter of other animals in Pakistan. The Clause 60 and 61 of the Act deals with the examination of carcasses and viscera of the slaughtered animals, where in all the carcasses should be examined for any evidence of bruising, haemorrhage and discoloration whether local or general dropsy (oedema) and swellings, deformities of bones or joints or swelling or other abnormality in the musculature.

The serous membranes (pleura and peritoneum) should be examined in every case. Neither they should be removed nor any evidence of disease be modified or obliterated by washing, rubbing, stripping or in any other manner before examination. After the carcass is split, the sternum, ribs, vertebrae and spinal cord shall be examined. An incision shall be made on each quarter in the musculature near the shoulder joint and near the pubic bone, without mutilating the carcass for detection of cysts (cysticercus).

All viscera shall be examined before or at the time when they are removed from the carcass or in such circumstances as will ensure the identification of the carcass from which they are removed. Every organ and the associated lymph glands shall be examined visually and by palpation. When any abnormal condition is observed, the nature and significance of which can not be determined by such examination, the organ or gland shall be incised and the incision shall be made in such a way to avoid soiling and contamination or unnecessarily depreciating the value of any part of the carcass or other organs that may be passed fit for human consumption. An efficient examination of the lymph gland shall be made by multiple incisions into their substance.

### 6.1 POSTMORTEM EXAMINATION

#### i. Head

The head including the surface and substance of the tongue which should be loosened but not detached before examination, the palate or roof of the mouth and lymph glands of the throat (Retropharyngeal, submaxillary and parotid) shall be examined visually and by palpation. The cheek muscles shall be examined on both sides by a line or incision parallel to the branches of the lower jaw. In case of calves, lymph glands of head shall only be cut in cases of suspicion.

#### ii. Stomach and intestines

The outer and when necessary the inner surfaces of stomach and intestines shall be examined. The surface and substance of the spleen will also be examined together with the glands of the stomach, bowel (gastrosplenic and mesenteric) and web (omentum). The spleen shall be cut where necessary for the examination of substances (pulp).

#### iii. Liver

The surfaces and substance of liver shall be examined. The associated lymph glands (hepatic) shall also be examined and the bile ducts be incised where necessary. In case of calves, the cutting of bile ducts may be omitted.

#### iv. Urogenital system

The renal and adrenal lymph glands of kidneys shall be examined before removal of the kidneys. Therefore the kidneys shall be exposed and the surface is examined. If necessary the kidneys shall be split by incision and the substance is examined. The inner and outer surface of uterus and the substance of ovaries shall be examined. Where necessary the uterus shall be cut transversely and longitudinally through the both horns. Similarly the urinary bladder be examined and only be cut if it happens to be diseased. In reporting upon lesions, special attention be paid to whether the lesions affect the peritoneal surface or the organ itself.

#### v. Thoracic cavity

The contents of the cavity shall be examined before the various organs are separated from each other and the examinations be conducted.



**vi. Lungs**

The lungs shall be examined visually and by palpating and unless obviously diseased shall be incised at the base. The associated lymph glands (bronchial and mediastinal) shall also be examined and unless obviously diseased shall be incised. In reporting upon lesions, distinction shall be made between lesions affecting the pleura and those affecting the lung parenchyma.

**vii. Heart**

The heart sac (pericardium) shall be opened and the heart examined and if necessary incised. In reporting lesions, distinction shall be made between lesions of pericardium, myocardium and endocardium.

**viii. Udder and testicles**

The udder shall be examined by observation and palpation. Incisions shall be made at the base of the teats and also into any indurated region in the substance of glands and the associated lymph glands (supra mammary) shall also be incised. Similarly the testicles are examined and suprainguinal lymph glands are observed.

**ix. Lymph glands**

The following lymph glands must be examined as a matter of routine.

1. Retropharyngeal
2. Bronchial and mediastinal
3. Hepatic
4. Mesenteric

**x. Other organs**

The serous membranes (lining) of the chest, abdomen, pleura and peritonium shall be examined in every case.

The detailed examination of an organ is based on consideration of the following points.

1. Important normal characters of an organ.
2. Pathological conditions present.
3. Size of the organ.
4. Colour and consistency

5. Uniformity of the organ.
6. Character of the blood from cut surface.
7. Character of the lymphatics of the part.

**6.2 MEAT CERTIFICATION**

All organs and meat should be marked after inspection by the inspector himself. Only sound meat is stamped as this avoids any possibility of smuggling of unfit or unwholesome meat by butchers. To enforce and regularize the sale of stamped meat, it is advisable to organize frequent surprise raids on the butchers and meat shops in consultation with the local law enforcement authorities. Numerous frauds and imitations to conceal the unlawful slaughter are evolved by interested butchers which should always be looked for during these raids. A special check should always be carried on meatless days to detect any sale of unlawful meat in these days.

**Suggested Readings**

- Gracey, J.F., 1981. *Thornton's Meat Hygiene*. 7<sup>th</sup> Ed. Bailliere Tindall, London.
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