
UNIT 2 HANDLING AND UTILIZATION OF SKIN, INTESTINE, GLANDS AND FALLEN ANIMAL

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2.0 OBJECTIVES

After reading this unit, you will be able to:

- state the importance of recovering hides and skins;
- describe flaying and preservation of hides/skins;
- narrate the steps of leather processing;
- list the glandular by-products obtained from slaughter of an animal;
- narrate the pharmaceutical uses of glandular by-products;
- prepare casings from intestine; and
- explain the importance of utilizing fallen animals properly.

2.1 INTRODUCTION

In this unit, we will learn about how the skin/hide is flayed and processed into a value added product –leather. Hide/skin is the external covering of the animal body comprising 4-11 per cent of the live weight of the animal and is the most valuable economically important animal by- product. Throughout human history men have utilized animal skins for its existence. Nomadic people still depend on it, for shelter, clothing and weapons and as food containers. The skins and hides are the major foreign exchange earner in the animal husbandry sector. This is probably the only by-product being fully utilized by the relatively well developed leather industry. At the slaughter house level almost all the hides and skins are collected on the same day and then sent to the tanneries. In case of non-availability of tannery in the vicinity, these are processed and preserved either by salting or curing and then sent to the tannery in lots. We will also study conversion of intestine into casings, production of many pharmaceuticals from the glands of the animals and the utilization of the fallen animals.

2.2 HIDES AND SKINS

There is hardly any commodity in the world which has such a varied and misleading nomenclature as hide and skin. A skin from a fully grown large animal is called a **hide** (weight > 30 lb) and that from a small animal (sheep, goats and pigs) is called **skin**. The term skin is also applied to that of calves. The **slunk** is the term applied to the skin of an unborn calf, which is often used for parchment, light suede or drum beats. The skin from the older calf which has not yet reached maturity is called **kip**.

Skins and hides are classified into two classes based on the source of raw material, i.e., slaughtered animals and fallen animals. In case of hides, the contribution of slaughtered animals is to the tune of 25 per cent while fallen animals contribute 75 per cent of the raw materials. In contrast, the trend in small animals is almost reverse, 80 per cent of the skins are accounted from slaughtered stock and only 20 per cent from fallen stock. Hides and skins obtained from slaughtered animals are superior to those obtained from fallen animals. To obtain good quality raw material, hides and skins are to be flayed immediately after death/slaughter. Undue delay leads to decomposition resulting in inferior quality of hides and skins. In Indian conditions, these are classified as **Oxen**, which include hides from cow, bullock, bulls, calves etc., and **Bufs** that are the hides obtained from buffaloes of any type.

2.2.1 Histological Structure of Hides and Skins

A cattle hide is mainly divided into two principal layers:

- 1) The epidermis or the outer layer.
- 2) The dermis or the inner layer.

Epidermis constitutes about 1-2 per cent of the total thickness of the skin. It mainly consists of epithelial cells. It has no blood vessels of its own, but draws nourishment from the blood and lymph of the dermis. Again, the epidermis is divided into five layers: a) Stratum corneum, b) Stratum lucidum, c) Stratum granulosum, d) Stratum spinosum, and e) Stratum basale.

During the leather making process, the epidermis, hair, sebaceous and sweat glands are removed.

Dermis or corium is the main layer of the hides and skins constituting about 98 per cent of the total thickness of skin. It is mainly composed of collagen fibres, which occur in bundles. The dermis or corium is again divided into two:

- The grain layer or the papillary layer.
- The corium proper or reticular layer.

The grain layer constitutes about 10-25 per cent of the entire thickness. The epidermal appendages like hair root, hair follicle, fat and sweat glands and the erector pili muscle remain in this layer. The grain layer determines the appearance of the finished leather. The reticular layer constitutes about 75-90 per cent of the total thickness.

2.2.2 Chemistry of Hides and Skins

The chemical composition of the skin is as follows:

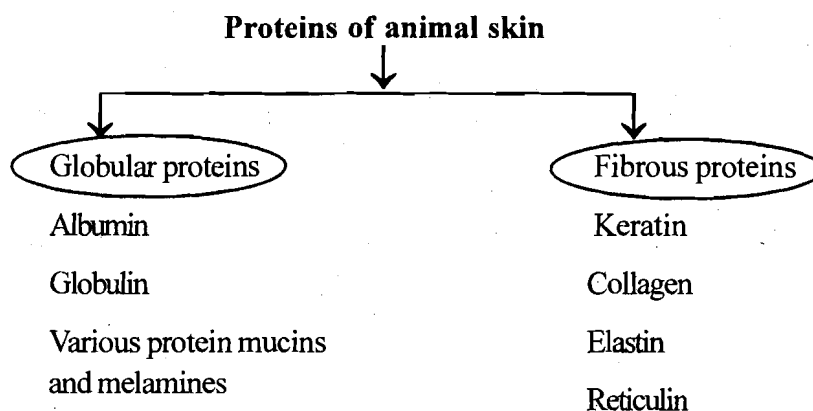
Water : 65%

Protein : 33%

Minerals : 0.5%

Fat substance : 2% (Cattle and calf), 2-10% (Goat), 5-3% (Sheep)

The fats present in the animal skin are of various types i.e., triglycerides, phospholipids, cholesterol and waxes. The minerals present in the skin are mostly phosphates, carbonates, sulphates and chlorides of sodium, potassium, magnesium and calcium. About 80 per cent of the dry matter of the skin is made up of proteins.



Except collagen, all the proteins are removed from the skin during the leather making process. Collagen combines with the tanning substances and constitutes the leather.

2.2.3 Flaying and Preservation of Hide and Skin

India is the largest producer as well as exporter of skins in the world. They are processed into leather by tanning while trimmings of the skin are used for making glue, artifacts and feed supplement. Flaying refers to the scientific removal of hide/skin from animal after slaughter or death. Defects in skin such as cuts, tear, puncture, holes, and insect damage reduce the value. Hence, the flaying must be

done by skilled butchers by following specific technique. The quality of skin also depends on the plane of nutrition and management of animals.

Production of hides and skins

Much care needs to be bestowed in the production of hides and skins from slaughtered and fallen animals. The flaying operation should be completed soon after the death of the animal. Practices of some of the following factors will help in the production of good quality raw materials i.e., skin and hide:

- 1) Animals awaiting slaughter be withheld feed and offered a good supply of potable water. The consumption of more water facilitates easy flaying of hides and skins from the subcutaneous tissue of the carcass.
- 2) Just before slaughter, the animals could be allowed to pass through a cold water shower. This minimizes the blood flow to the peripheral tissue, and so reduces the amount of blood remaining in the subcutaneous tissue. This helps in obtaining hides and skins with very low content of blood, thereby the keeping quality of hides and skins are improved. It also helps to prevent 'veiny leather' condition and the putrefactive changes in the skin.
- 3) Modern scientific flaying techniques should be adopted by employing properly trained personnel. Appropriate opening lines (ripping lines) should be made to obtain uniformly good shape of hides and skins. A hide comprises of a number of components such as ears, snouts, dew claws and other appendages, these do not make leather and interfere with proper tanning process. Hence, these parts are needed to be trimmed off.

Majority of the slaughter houses in India are maintained in unhygienic conditions. Animals are thrown on the unhygienic slaughter floor violently and are dragged on the rough floor. Such rough handling damages the grain surface of hides and skins. Further, it may be observed that after flaying the hides and skins are being thrown on the dung and urine contaminated floor. Sometimes they are trampled over the gastro-intestinal contents to increase their weight. Such practices need to be discouraged.

- 4) Animal died of natural causes is known as fallen animals and the hides and skins of such animals are known as fallen hides or fallen skins. The skin value of such animals will get deteriorated, if the time lapse is more between death and flaying of the skin. Hence, the skins from the fallen animals must be flayed immediately after the death.
- 5) After flaying, dung and other adhering contaminants of hides and skins should be washed off with cold water using a long handled brush. They are either sent to the tanneries directly or preserved by curing.

Scientific Flaying of fallen cattle and buffalo carcasses:

Flaying determines to a greater extent the value of hide. To obtain the best result it is essential.

- 1) to use special and very sharp knives with round blunt tips to prevent undesirable cuts;
- 2) to ensure proper holding of knife;

- 3) to perform perfect/correct ripping lines/cuts;
- 4) to flay as soon as possible after the death of the animal as it will be difficult to flay cold carcasses;
- 5) to ensure steady position of the carcass during flaying;
- 6) to avoid contamination with manure and blood;
- 7) to pull or beat the hide off where ever possible;
- 8) to avoid cutting/scoring of the hide;
- 9) to use flaying cradle; and
- 10) to make use of trained butchers.



Fig. 2.1: General pattern of ripping lines

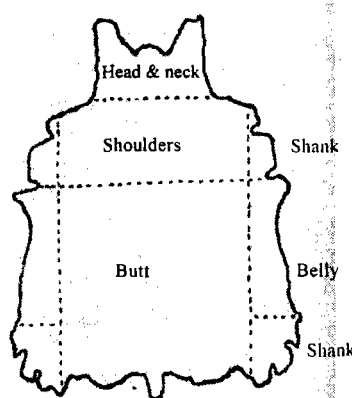


Fig. 2.2: Principal areas of a hide



Fig. 2.3: Ripping and flaying knives

Care of hides and skins

It is advisable to give a cold water showers or allow the animals to pass through cold water to remove the adhering dirt, dung and other particulate matters. Allowing the animals to pass through cold showers before stunning and slaughter will prevent 'veiny leather' condition. Immediately after flaying the skins should be opened and spread out on a concrete floor to allow it to cool down. Then the skin is washed with water thoroughly to remove dung, dirt and blood using long handled brush. Loose subcutaneous tissue, meat and fat left on the flesh side should be removed prior to curing. This process is known as fleshing. All sharp irregular flaps on the edge of the skins should be removed. The tail should be cut off. If needed all pieces below knee and hock joint should be removed. From slaughter houses skins are either send to tannery or preserved with salt or sun dried.

Methods of preservation of skin

Hides and skins contain roughly about 62 per cent moisture and 38 per cent dry matter. Because of high moisture content and the presence of proteineous material which presents a favorable medium for the growth of putrefactive bacteria resulting in the decay of the skins and hides. If proper measures are not taken to check the multiplication of bacteria, the skins will get damaged and yields inferior quality leather or even sometimes it gets totally spoiled. The first sign of spoilage or decay is loosing of hair in sporadic patches or from the entire skin. They emit bad odour. Dark patches are also seen on the flesh side (inner side) of the skin depending on the extent of damage done by the decaying process. Main purpose of preservation is to prevent putrefaction by bacteria and other physical damages such as wrinkles, insect bites before they are sent to tannery. This is being performed by sun drying and curing. The most important method for preventing spoilage is curing i.e., application of salt. This curing is performed by:

- Wet salting or green salting
- Dry salting
- Brine curing

Sun drying: A large number of skins collected from the fallen animals in rural areas are preserved by sun drying. The skins are stretched and tied to wooden/metal frame and dried in open air. Direct sunlight should be avoided as it may damage the skin and reduce the strength. The place should be well ventilated to ensure good air circulation.

Dry salting: Dry salting is used with the objective to reduce the weight of hides and skins for transport and to improve keeping quality. This is a convenient way of preventing putrefaction as salt prevents the growth of Saprophytes. Dry salting is recommended for small hide producers, village flayers and the curers residing far off places from the main hide market.

In India, dry salting is carried out mostly with *khari* salt whose chief constituent is sodium sulphate. A mixture of *khari* salt is made by dissolving 1 part of *khari* salt with 2 parts of water. In this system the skins are washed and trimmed, then dry salt is rubbed on the flesh side and the skin is stacked/stored in layers for overnight. Following salting, they are dried under sun by supporting them on a long bamboo poles. Drying is completed within 2-3 days. During hot season with temperature exceeding 115 °F (46 °C) drying is done under shade. Drying in high temperature will badly influence the quality of hides or skins. However in winter season drying may be performed under direct sun.

Sun drying may be ground drying or air drying. Ground drying is not favoured because the grain surface (outer surface) is damaged by the action of saprophytes. The damage by the saprophytes will reduce the value of the skin and hides by half.

Generally, the skins after salting are subjected to drying by fixing or tying the skins to hoops made of bamboo and rope frame. Sometimes, the skins are stuffed with straw and dried in air. Drying of hides in four sided wooden frames is a simple and desired method of dry curing or dry salting. It is beneficial to wash the hides before fixing them into wooden frames with ropes.

In this method hide is fixed length wise and subsequently the sides are evenly suspended. Care should be taken not to overstretch. While drying, the frames should be placed in slanting position preventing exposure to direct sun, which may cause the hides to shrink and crumple up. Such hides are known as 'crumpled hide' and there is deterioration of its value.

Advantages of air drying

- Air is available in plenty.
- Elimination of the hair slip and putrefaction.
- Possibilities of better grading as every cut or bruise, parasitic damage can be observed easily.
- Increased keeping quality.
- Cheaper transport as they are lighter.
- Corrosion is avoided.

Wet salting: The process is otherwise known as green salting. In this process, the freshly flayed hides and skins are spread on a sloped concave platform to facilitate cooling. Salt is then spread or sprinkled freely on the flesh side and left overnight as such. Either rock-salt or sea-salt is used for wet salting. This salt mixture may contain:

- a) 100 parts salt + 2 parts naphthalene + 2 parts Na_2CO_3
- b) 100 parts salt + 1 part naphthalene + 1 part boric acid.

Next morning, the salt is removed and a fresh layer of salt is applied in such a way that the thicker portion of the hide receives more salt than the thinner sides. Another hide is spread on the first hide with hair side (grain side) down and same procedure is repeated. The hides are left in pile until they are fully cured. Piles should be tilted and overhauled periodically to prevent development of heat inside as heat development affects the quality to a great extent.

Brine curing: Wet salting can be carried out by immersing the clean hides in a salt solution for a maximum period of 1 - 2 weeks. Brine curing can be done by making use of pots, vats or pits of 4 feet deep. Periodically more and more salt is added to maintain the saturation level of salt.

Hides absorb salt and loose moisture. This action is helpful to control the presence of unfavourable enzymes of the hides and subsequent bacterial action. Thus, the skins and hides remain in good condition. Experiences showed that brine-cured hides are superior to the hides cured by conventional wet-salting or other methods. In curing, fresh hides are washed and submerged in vats (containers) containing salt (brine) solution. The preservative action of salt can be increased by mixing about 2 - 3 per cent sodium carbonate and 1 per cent naphthalene of the salt weight. Hides are periodically turned from top to bottom after overnight soaking and allowed to cure for a period of 1-2 weeks. They are drained and packed in the layers. Hides need to be piled properly before they are lifted to the tanneries.

Advantages of brine curing

- More rapid and uniform.
- Gives greater protection when exposed to adverse conditions during storage and transportation.
- Brine curing almost eliminates salt strains during long storage.
- Do not require any washing prior to soaking back in the tannery.
- Soaking period is less considerably as compared to wet salted hides.
- Results in more fullness and brighter grain of leather.
- Can replace conveniently the conventional dry salt cure method.
- The flesh and hair sides are bright and exceptionally free from contamination by dirt without any adhering salt.

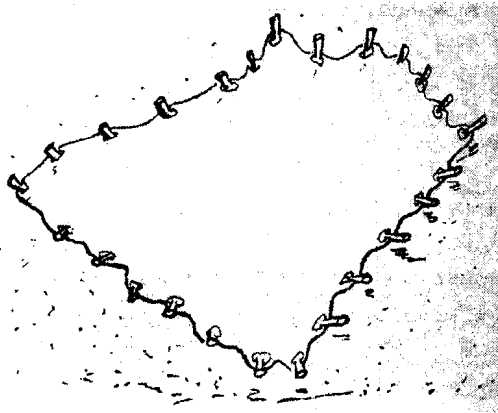


Fig. 2.4: Sun drying of cattle hides

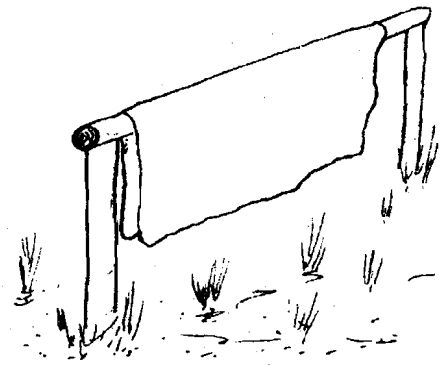


Fig. 2.5: Pole drying of hides

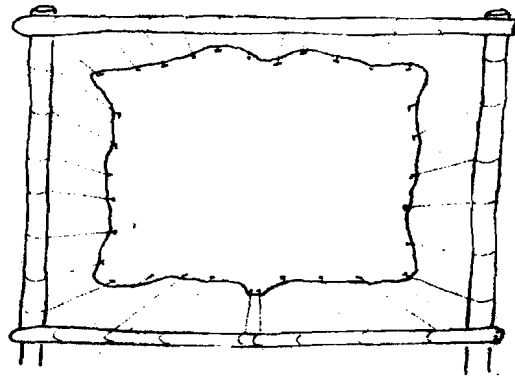


Fig. 2.6: Correct of ties for suspending dried hides

2.2.4 Defects of Hides and Skins

The defects that are most commonly observed in skins and hides are categorized in to ante mortem and post mortem defects.

I) Ante mortem defects are as follows:

- 1) Poor substrate of the skin. This may be due to genetic nature. Species variation is also reported.

- 2) Defects due to diseases;
 - i) Warbles- warble fly infection, eg. *Hypoderma bovis*, *Hypoderma lineatum*, *Hypoderma crossi*.
 - ii) Pox - cow pox, sheep pox etc..
 - iii) Mange- 1. *Sarcoptic*, 2. *Psoroptic* and 3. *Demodectic*.
- 3) Grain damage – Damage of the hides and skins on the grain side might be due to:
 - i) bacterial infection,
 - ii) thorn wire injuries,
 - iii) brand marks,
 - iv) contusions (bruises),
 - v) abrasions,
 - vi) abscesses, and
 - vii) tick damage.

II) Post mortem defects:

Defects resulted due to improper or careless handling of skins and hides during slaughter and flaying. They include bad shape, flay cuts, curing defects eg. salt burn and improper curing.

2.2.5 Processing of Hides and Skins into Leather

An animal hide or skin is converted to leather by chemical treatment and processing. This chemical procedure is known as tanning. Leather is resistant to decomposition or bacterial decay, particularly when it is wet and it has attained certain physical properties like tensile strength, flexibility, and resilience and abrasion resistance.

Steps in processing of hide and skin are as follows:

1) Fleshing

The flesh adhered to the inner side of the skin is scraped by a serrated knife. It is necessary for producing quality leather. If, this fleshing is done before curing in warmer and flexible hide, fleshing will be perfect. Moreover, a fleshed hide will allow faster penetration of salt and quicker removal of moisture.

2) Trimming

The purpose of trimming a hide is to remove parts of the hide that would have no value as leather and to give the hide a standard conformation. The parts removed from the hides by trimming include ears, snouts, lips, scrotal sac, udders, tail, head skin and uneven edges.

3) Sorting

After curing, the sorting of the hide and skin is accomplished on the basis of sex, weight and branding of the hides or skins present or not. Branding reduces the value of the hide, because that area can't be used in finished leather product. The

hides are graded into different categories based on the presence of holes, cuts, visible grain defects and the hide is sufficiently cured or not.

4) Staining and storage of hide and skin

The graded hides and skins are sprinkled with approximately 1 lb of salt to ensure against deterioration. The hides are individually folded, flesh side out and tied to form a bundle. The bundles of hides are tied with coloured ropes or may be tagged. They are then stored in storehouses. The insecticides often used include 0.2 per cent white arsenic with soda or powdered 1,4-dichlorobenzene, 0.5 per cent Lindane etc..

5) Soaking

Soaking restores, the moisture of hide or skin that was removed to control bacterial growth during curing. The soaking is done in half-round cylindrical vats where the hides and skins are placed in water, detergents/disinfectants with stirring by a paddle. It usually takes 8-20 hours.

6) Liming

Hides are immersed in vats containing saturated lime solution. This helps in separating keratinous tissues (hair and epidermal cells) and losses the hair follicles. The dehairing process is primarily chemical in nature, but mechanical dehairing equipment is also used. The most common liming agents are hydrated lime [$\text{Ca}(\text{OH})_2$] that loosens the base of hair follicle and Sodium sulfide (Na_2S) that dissolves the hairs.

7) Washing and deliming

This is done to remove alkaline dehairing chemicals. First, the limed hides and skins are washed in a jet of water, then salts such as ammonium sulphate [$(\text{NH}_4)_2\text{SO}_4$], or ammonium chloride (NH_4Cl) are added to convert the limes into soluble compounds which can easily be removed by washing.

8) Bating

This is a treatment of delimed hides with proteolytic enzymes which makes them soft and pliable. Bating is usually done with proteolytic enzymes which are mainly extracted from animal pancreas or from wood, e.g., trypsin. A combination of ammonium salts with enzyme produces the bating effect. It is generally done at 27-30°C at pH 8-9 and lasts for 8-16 hours. After bating, the hides and skins are washed to remove the digested, undesirable non-leather making substances.

9) Pickling

The skins are soaked (pickled) in a solution of sulphuric acid and salt in order to condition them for tanning. Pickling brings the skin to a uniform degree of acidity as it needs an acid pH to accept tanning material.

10) Tanning

Tanning is the conversion of hide/skin into leather without destruction of original structure. It is done by treating the conditioned hides and skins with organic, inorganic or synthetic tanning agents. Among these, vegetable tanning material and basic chromium sulphate are being commonly used.

Vegetable tanning is process, where extracts of infusion derived from tanning bearing plants or barks are used. In India, plants like avaram (*Cassia auriculata*), Babul (*Acacia Arabica*), Myrabalan (*Terminalia chebula*) are used. De-limed pelts (hide/skin) are immersed in progressively stronger tan liquors containing in pits. The pelts are moved at a fixed interval from one pit to another. The tanning particles diffuse into the pelt and impart a uniform colour. The spread of tanning is improved by the use of revolving drum and strong tanning liquor.

Chrome tanning yields soft, supple and strong leather which is permeable to air. This is most popular method of tanning. For this purpose, the chromium salts, e.g. $\text{Na}_2\text{Cr}_2\text{O}_7$, is first reacted with sugar (maltose) and H_2SO_4 which reduces the chromium salt to basic chromic sulphate. It is then added to the hide in a mixing drum. Due to this, various cross-linkages are accomplished by bonding the various chrome ions with the free carboxyl group in collagen side chain. The tanning operation requires 4-6 hours.

11) Post tanning operations

Before furnishing leather, tanned leather undergoes various operations like setting, splitting and shaving, neutralizing and dyeing, fat liquoring and stuffing, setting out, pasting, conditioning, buffing, finishing and grading. The sole leather is furnished by applying oil on grain surface and then rolling under a heavy roller.

Chrome leathers are glazed after seasoning and drying. Glazing is done by a glass cylinder clamped to the end of a moving arm. The heat generated by the friction softens the wax. The finish and a continuous plastic coat of high luster are produced on the grain surface.

After glazing and staking, leathers are smooth plated on the grain side in a specially designed press. Pleasing grain platforms are produced by boarding. Vegetable tanned leathers are given decorative pattern by embossing with hydraulic press. The disposal of chrome liquid is to be done with sufficient care owing to its toxic properties.

Check Your Progress 1

1) What do you mean by hide and skin?

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2) What are the defects in hide and skin?

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3) What are the advantages of air drying of hides and skins?

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4) What are the advantages of brine curing over conventional dry curing?

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5) Write the steps of processing of hides and skins.

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6) Define tanning and name few tanning agents.

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2.3 UTILIZATION OF GUTS AND INTESTINES

Various parts of alimentary tract of food animals viz., cattle, buffalo, sheep, goat, pig and horses after processing are used as containers for the preparation of comminuted meat products. Intestines of animals are processed into value added products such as sausage casings, surgical sutures (catguts), guts for sports rackets, musical instrument's strings. Even, they are consumed after thorough cleaning and cooking with spices. Amongst these uses, sausage casings are most profitable way of utilizing animal intestine.

Sausage casings comprises of different parts of animal body:

- Small and large intestines
- Oesophagus
- Urinary bladder
- Stomach and even rectum.

Different countries have preference to different types of sausages prepared using different types of casings.

Example

- Cocktail sausages — Weighing less than 15 grams are normally filled in casings of small (thin) diameter.
- Hotdogs — Filled in sheep and goat casing.
- Mortedella — Weighing about 10kg –filled in beef bladder.
- Bologna — Filled in beef bung, middles or rounds.
- Blood sausages — Generally, filled into processed pig stomach.

Processing of casings on scientific lines is a profitable business. One Hank (approximately 300 feet or 91.44 meters) of a good quality sheep and goat casings fetches around 8-10\$ in the international market.

Casings unit

In the organized abattoirs where large numbers of animals are slaughtered, a separate casings processing section may be provided and the casings can be processed hygienically. It is to be situated underneath the slaughter/dressing floor from which the intestines reach through chutes. Gut processing rooms should be well ventilated with ample supply of running hot and cold potable water. The gut processing room is equipped with machinery which includes a set of rollers and brushes which crushes the mucous membrane, muscles and fat and squeezes out scum/slime under constant spray of water. The temperature of the gut processing room should be well controlled to prevent decomposition and fermentation. Otherwise, the guts can be cleaned and processed on a clean floor.

2.3.1 Histology of Intestine

When viewed under microscope, intestines (from inside to outside) constitute four distinct layers, the mucosa, submucosa, muscularis externa and serosa.

Mucosa: It is the inner most layer and is called as the intestinal lumen. It is made up of large masses of epithelial cells and series of smooth muscle cells. It contains limited proportion of connective tissue cells and fibers along with lymphatic cells and randomly scattered and selected blood vessels.

Submucosa: It is the second layer from inside and is mainly composed of bundles of collagen and some elastic fibers. It is a grayish yellow coloured layer. A number of blood vessels and fat tissue are found embedded within the fibrous structure.

Muscular coat: It comprises of two layers, the longitudinal and circular made up of smooth muscle cells and fine fibers of elastin and collagen.

Serosa: It is the outer layer of intestine and is thinner. Serosa primarily composed of collagen and elastic fibers and loose connective tissue cells.

Quality casings are essentially prepared from the middle submucosa layer of intestine only. The submucosa layer is grayish-yellow or red in colour and composed of dense connective tissue network interwoven with an elastic network. The casings are, therefore, made from submucous coat only because of its fine

structure, having sufficient flexibility, elasticity and strength. Moreover, these are able to shrink and extend without cracking together with delicacy makes them suitable for sausage casings.

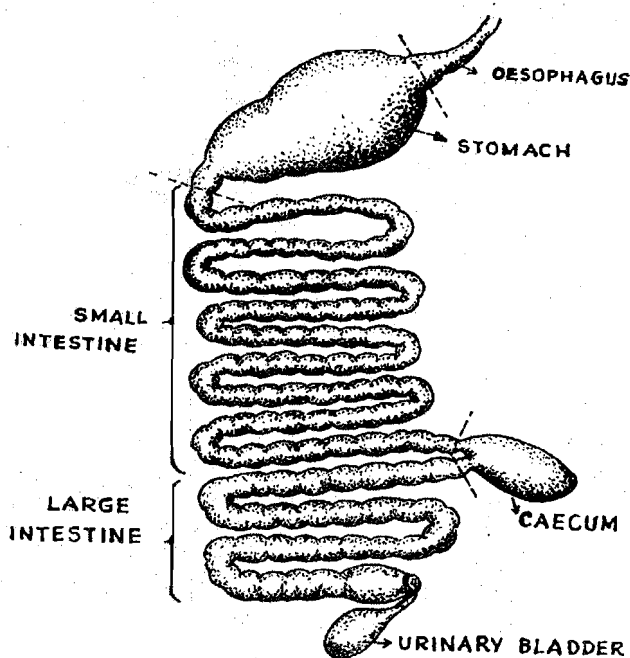


Fig. 2.7: The alimentary tract and urinary bladder



Fig. 2.8: Transverse section of small intestine of cattle showing (a) mucosa, (b) sub-mucosa, (c) circular muscle layer, (d) longitudinal muscle layer, (e) serosa

2.3.2 Processing of Casings

Bulk of the casings is produced from small intestines. Commercially, intestines of cattle, sheep, goats and pigs are used for making casings. To get good quality natural casings, following points should be considered:

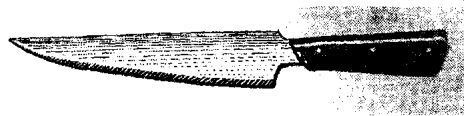
- **Healthy animals:** It is necessary to collect intestines from healthy animals which are properly slaughtered and passed both ante mortem and post mortem inspection.
- **Sound raw materials:** Raw material should be free from ulcers and damages due to infestation with parasites particularly from nodule forming parasite.

- **Sanitary handling:** They should be removed carefully and handled using sanitary precautions. Care should be taken to ensure that the casing is clean, has good colour and proper length, has no objectionable odour and is sufficiently cured.
- **Proper grading and packing:** Casings should be properly graded and packed.

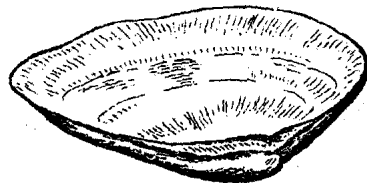
Following equipments are used for processing of casings:

- 1) **Scrapers:** It is made of hard wood or plastic and shaped like a knife. Spoon scrapers made of bone or plastic are more common.
- 2) **Gut cleaning unit:** It comprises of three vessels (casks), one each for water, chilled water and warm water. The third vessel is provided with a sliming platform. All these three vessels are arranged on a sliming table.
- 3) **Table** for grading, salting and curing of casings.
- 4) **Skeining basket:** It is used to skein the casings uniformly into hanks. It is not essential.

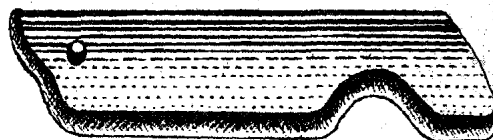
Apart from the equipment, the most essential is abundant supply of cold clean water.



A simple knife used in various operations of processing casings



Oyster shell scrapper



Bamboo scrapper

Fig. 2.9: Different scrapers for casing preparation

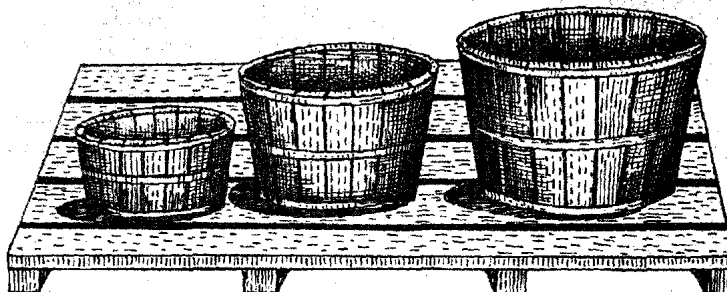


Fig. 2.10: A set of wooden tubs

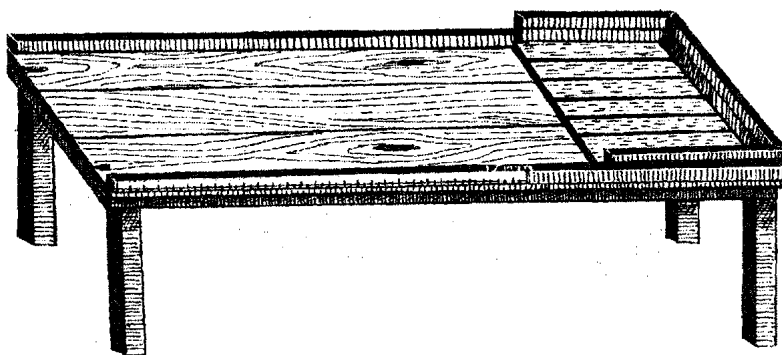


Fig. 2.11: Wooden table for grading, salting, curing and measuring casings

Steps for preparation of casings are as follows:

1) Collection of intestine

After slaughter of food animals intestines are collected from the slaughter house, cleaned of the intestinal contents and washed in clean water. They should be collected fresh and cleaned quickly to avoid decomposition by bacteria and damage to submucous layer. Fat and other adhering tissues are removed carefully.

The cleaned intestines are dipped in a solution containing 0.2 per cent sodium pyrophosphate and 1 per cent sodium chloride for one minute with constant stirring and then removed.

2) Sliming

Removal of the other layers i.e., outer serous, muscular and inner mucosal is called sliming. It is done by pulling the intestines through the gentle pressure under a small glass rod over the surface of the table, so that above stated layers are pressed out leaving behind the submucosa layer. The process is repeated till the clean white coloured casings are obtained.

3) Washing and grading

The casings are washed by infusing with water and graded according to prescribed standards such as diameter, length, colour and physical defects such as leakages, nodules, etc..

4) Curing and draining

Casings are preserved by adding salt in wooden boxes with holes underneath to drain brine formed for about 3 days and then shaken to remove excess of salt.

5) Wet and dry salting

In wet salting, the cured casings are simply placed in saturated salt solution in wooden barrels, but in dry salting, the casings are rubbed with fine grade common salt of about 40 per cent weight of the cured casings.

6) Storage and transport

Casings can be transported in plastic cover, bottles with salt or in tins/wooden boxes.

Alternate method for preparation of casing

Removal: Intact gut is removed without contaminating other parts or without being damaged by cuts.

Pulling/Runing: This is the process of separating mesentery and fat from the gut. When this is done by hand without using any instrument, is known as pulling and when knife or any instrument is used to separate then it is known as running.

Chilling: If immediate processing of gut after collection is not possible then they are stored at chilling temperature (5° - 6° C) to prevent bacterial damage.

Stripping: This is the process of removing the content of the intestine by squeezing by hand, instrument or machine. This is best done under a stream of running water to remove the intestinal content as soon as possible. A simple way of stripping is passing the gut between two fingers of one hand and pulling the same with the other hand.

Defatting: This is removal of fat from the gut. Guts from small animals are scraped while the beef guts are defatted by pulling, tearing or by using knives.

Fermenting: The intestines are immersed in warm water where enzymatic and bacterial actions loosen different layers. Thus the undesirable parts can be removed. Normally, warm water of 70° C used for 1 to 2 hours. Fermenting is generally done for sheep, goat and pig casing.

Turning: It means turning the casing inside out. It is done in case of cattle and buffalo intestines. Generally, it is done in a tank of warm water.

Sliming: This is the process of removal of mucous lining popularly known as slime. This is done by a sliming stick or a plastic knife on a sliming board.

Inspection: Casings are inspected for cleanliness, colour, odour, spots, holes and parasites etc.

Measuring: The width of the casings is measured by inflating or watering the casings.

Salting and curing: Clean, fresh salt of medium fineness should be used for salting. Casings are turned several times and rubbed by hand. During curing, the casings lose moisture and absorb salt. Thereby the keeping quality of casing is improved.

Packing: Casings are packed with brine in leak proof metal can, drums, barrels or boxes. Inner wall of the metal drums should be covered with plastic or cotton material to avoid rusting of casings.

Precautions

- 1) Casing should not be prepared in direct sun light.
- 2) Casings should never be washed in rivers or streams.
- 3) Fresh, clean salt-free from stone and sand is essential for salting.

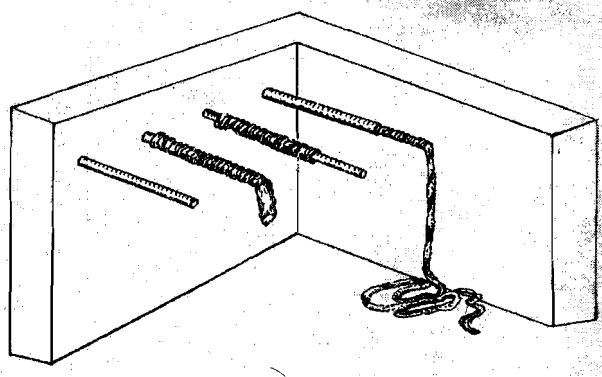


Fig. 2.12: Mode of turning beef gut inside out



Fig. 2.13: Scrapping out mucosa lining

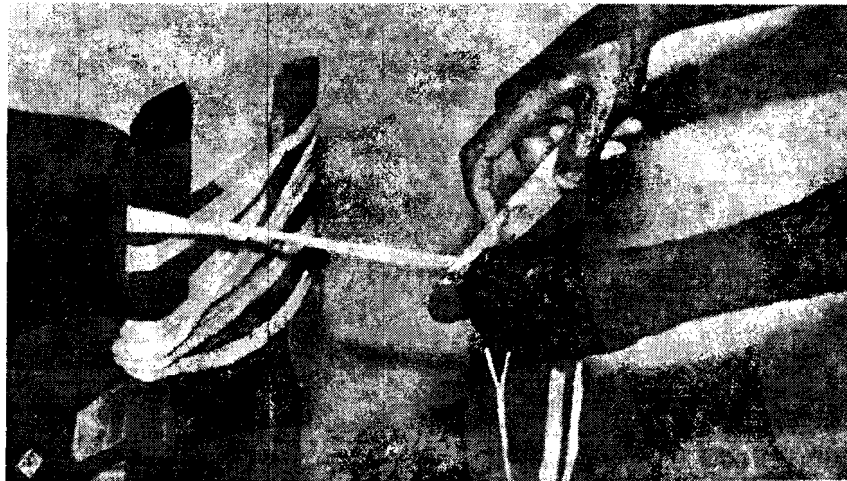


Fig. 2.14: Fating of cattle runner

2.3.3 Terminology

Commercial terms under which the casings after processing are sold differ from the anatomical names. Some of them are listed below:

- **Rounds:** casings prepared from the small intestines of cattle, sheep, goat and pigs.
- **Runners:** casings prepared from small intestines of cattle.
- **Middles:** casings prepared from large intestines of cattle and pigs.
- **Beef bung:** casings made from blind gut or caecum.
- **Hog bung:** end of the intestinal tract containing approximately 5-6 feet of intestines starting from anus.
- **Weasand:** casings prepared from oesophagus of cattle.
- **Bladder:** urinary bladder.
- **Stomach:** casings prepared from cleaned and sealed hog stomach, also called as maws.
- **Small casings:** casings prepared from small intestines of hog.

- **Chitterlings or black gut:** casings prepared from part of large intestines of hog.
- **Sheep casings:** casings prepared from small intestines of sheep.
- **Goat casings:** casings prepared from small intestines of goat.

2.4 UTILIZATION OF GLANDS AND ORGANS

Animal organs and glands are source of nutritionally attractive contents and medicine. The glands and organs include brain, heart, liver, lung, spleen, tongue, pancreas, udder, stomach, uterus, testes, thymus, kidneys, parathyroid, adrenal, ovary etc.. Some of the organs are consumed as human food and some of the organs and glands are used for medicinal and pharmaceutical purpose.

Glands (representing 0.28 per cent of animal's live weight) are important by-products of animals primarily slaughtered for meat consumption. Glandular by-products are finding increasing use in modern medicine as valuable medicinal products are being isolated from the glands. Secretion of endocrine and exocrine glands are vital for growth and proper maintenance of body mechanism. They are used for treatment of acute glandular deficiencies. Hormones isolated from glands are also used as pharmacodynamic drugs.

E.g., Insulin in shock therapy and diabetic patients.

Adrenaline in localizing anaesthetics.

Cortisones in rheumatoid arthritis.

Table 2.1: Important Glands and Organs of Value

Gland	Active principal
1) Liver	Liver extract
2) Pancreas	Insulin Pancreatin Trypsin Chymotrypsin Carboxypeptidase Lipase etc.
3) Pituitary – anterior lobe	ACTH Prolactin Growth hormone
Pituitary – posterior lobe	Oxytocin Vasopressin
Pituitary - middle lobe	MSH
4) Thyroid	Thyroxin
5) Adrenals	Adrenaline and cortisones
6) Lungs	Heparin

7) Suckling calf stomach	Rennet and pepsin
8) Gall bladder	Bile Cholic acid Cortisones Bile salts Cholesterol
9) Brain	Cholesterol
10) Blood	Serum Plasma Fibrin Haemoglobin
11) Pineal gland	Melatonin
12) Testes	Testosterone
13) Ovaries	Estradiol, progesterone, relaxin.

Insulin, pancreatin, trypsin, chymotrypsin, carboxypeptidase, lipase, rennet and pepsin are enzymes and ACTH, prolactin, oxytocin, vasopressin, MSH, Thyroxin, adrenaline, cortisones, melatonin, testosterone, estradiol, progesterone and relaxin are hormones.

These glands should be harvested within 15-30 minutes of slaughter and immediately preserved for further processing to obtain the active principles for use. The glands are collected from healthy animals and inspected properly. The active principles are rapidly lost when in contact with water or when left for prolonged periods in the open air. The best method of preserving most glands and stopping autolysis and bacterial growth is by quick freezing. Freezing should be done within one hour of collection. The glands should be cleaned and trimmed from surrounding fat and connective tissue before freezing. Then they should be put in waxed paper and transported to pharmaceutical plant after freezing. There the glands are again inspected, chopped and mixed with different solutions for extraction of active principles. In an alternative method, glands are vacuum dried, defatted and then milled to powder form and dispensed as capsules, tablets or injections.

2.5 UTILIZATION OF FALLEN ANIMALS

Fallen animals are the animals which die of various reasons such as outbreaks of diseases, malnutrition or natural calamities (flood, heat stroke, and earthquake) in villages and remote areas. About 20 million fallen animals are available in India every year. These animals are generally salvaged for hide/skin while the carcass is left for wild animals and birds. After some days bones are collected. If these dead animals are collected within few hours of death, they can be processed into meat cum bone meal by rendering. Meat cum bone meal is used as feed supplement for animals. Skin, if flayed quickly after death, fetches good price and also the intestine can be processed into casings, musical strings, catguts etc.. Casings are used in making sausages.

Utilization of fallen animals not only increases returns to the farmer but also reduces the chances of spreading diseases and environmental pollution.

Proper utilization can facilitate the establishment of carcass utilization units in the rural areas offering opportunities of some employments of the people. Besides, uses of manure, out of these animals can ensure the sustainability of soil fertility and better production of crops.

Fallen animal by-products are listed below:

- Skin/hide
- Bones
- Meat cum bone meal
- Technical fat
- Casings, Cat guts, musical strings
- Horns, hooves
- Manure (fertilizer)

Check Your Progress 2

- 1) Fill in the blanks:
 - a) Casing prepared from small intestines of cattle is known as.....
 - b) Casing prepared from oesophagus of cattle is known as
 - c) Hitterling is prepared from large intestine of
 - d) Casing prepared from large intestine of cattle and pigs is known as.....
 - e) Casings are prepared from the layer of intestine.

- 2) Write the steps of casing preparation.

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- 3) Mention few uses of animal intestine.

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4) Match column A with column B.

A	B
Pancreas	Bile
Pituitary	Insulin
Lung	Rennet
Calf stomach	Heparin
Gall bladder	Growth hormone

5) List the fallen animal by-products.

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2.6 LET US SUM UP

Utilization of fallen animals or dead animals is necessary to reduce environmental pollution and salvage hide/skin and bone of the animal for conversion into leather, bone meal, gelatin etc.. Skin fetches good price. Hence, proper flaying is necessary to avoid cuts and damages to the skin. Preservation of the hide/skin before they are taken to tannery is done by salting and air drying. The intestines of sheep/ goat, pig and cattle are used for making casings. Casings are used for making sausage, catgut, musical strings etc.. Glands and organs like brain, heart, liver, lung, spleen, tongue, pancreas, udder, stomach, uterus, testes, thymus, kidneys, parathyroid, adrenal, ovary etc., have nutritional value and these are also used for medicinal and pharmaceutical purpose.

2.7 KEY WORDS

ACTH	: Adreno Cortico Tropic Hormone is a hormone produced in the pituitary gland that stimulates the adrenal glands to release cortisol.
Bating	: Treatment of skin with enzyme during tanning operation.
Casings	: A cleaned sub mucous coat of gastro-intestinal tract of cattle, buffalo, sheep, goat, and pigs used for stuffing during preparation of meat products.
Fallen Animals	: Animal died in rural areas in scattered locations.
Heparin	: It is used as an anticoagulant.
Hog	: Pig.
Leather	: Processed and tanned skin/hide of animals; soft, pliable.

- MSH** : Melanocyte-Stimulating Hormones produced by **pituitary gland**. They stimulate the production and release of **melanin** by **melanocytes** in **skin** and **hair**.
- Skeining** : To wind something into loosely coiled yarn or thread or bundle.
- Tanning** : Process of conversion of hide into leather.
- Veiny Leather** : Poor quality leather produced from skin/hide of improperly bled animal.

2.8 SOME USEFUL BOOKS

Hui Y.H., Nip Wai—Kit, Rogers R. W. and Young O.A. (Editors). (2001). *Meat Science and Applications*. Marcel Dekker, INC., New York.

Mann. I. *Processing and Utilization of Animal By-products*. FAO agricultural Development Paper no. 75. FAO, UN.

Ockerman H.W. and Hansen C.L. (2000). *Animal By-products Processing and Utilization*. Lancaster, PA: Technomic.

Handbook of Animal Husbandry. (2002). Indian Council of Agricultural Research Publication, New Delhi.

2.9 ANSWERS TO CHECK YOUR PROGRESS

- 1) A skin from a fully grown large animal is called a hide and that from a small animal (sheep, goat and pigs) is called skin. The term skin is also applied to that of calves.
- 2) Defects of hides and skins are listed below:
 - i) Ante mortem defects:
 - Poor substrate of the skin,
 - Grain damage due to bacterial infection, thorn wire injuries, brand marks, contusions (bruises), abrasions, abscesses, tick damage, and
 - Defects due to diseases like warbles, pox, mange.
 - ii) Post mortem defects: bad shape, flay cuts, curing defects e.g., salt burn and improper curing.
- 3) Advantages of air drying:
 - Air is available in plenty.
 - Eliminates the hair slip and putrefaction.
 - Better grading possibilities as every cut or bruise, parasitic damage can be observed easily.
 - Increase keeping quality.

- Cheaper transport as they are lighter.
 - Corrosion is avoided.
- 4) Advantages of brine curing over conventional dry curing are:
- More rapid and uniform.
 - Gives greater protection when exposed to adverse conditions during storage and transportation.
 - Brine curing almost eliminates salt strains during long storage.
 - Does not require any washing prior to soaking back in the tannery.
 - Soaking period is also reduced considerably as compared to wet salted hides.
 - Results in more fullness and brighter grain of leather.
 - Can replace conveniently the conventional dry salt curing method.
 - The flesh and hair sides are bright and exceptionally free from contamination by dirt without any adhering salt.
- 5) Steps in processing of hide and skin are as follows:
- Fleshing
 - Trimming
 - Sorting
 - Staining and storage of hide and skin
 - Soaking
 - Liming
 - Washing and deliming
 - Bating
 - Pickling
 - Tanning
 - Post tanning operations like setting, splitting and shaving, neutralizing and dyeing, fat liquoring and stuffing, setting out, pasting, conditioning, buffing, finishing and grading.
- 6) Tanning is the conversion of hide/skin into leather without destruction of original structure. It is done by treating the conditioned hides and skins with organic, inorganic or synthetic tanning agents.

Vegetable tanning materials derived from plants like avaram (*Cassia auriculata*), Babul (*Acacia Arabica*), Myrabalan are used.

Chromium salt is also used for tanning.

Check Your Progress 2

1) a. Runners b. Weasand c. hog d. middle e. Submucosa

2) Steps of casing preparation are given below:

- Removal
- Pulling/Runing
- Chilling
- Stripping
- Fattening
- Fermenting
- Tuning
- Sliming
- Inspection
- Measuring
- Salting and curing
- Packing

3) Intestines of animals are processed into value added products and used as:

- sausage casings,
- surgical sutures (catguts),
- guts for sports rackets, and
- musical instrument's strings.

4) A	B
Pancreas	Insulin
Pituitary	Growth hormone
Lung	Heparin
Calf stomach	Rennet
Gall bladder	Bile

5) Fallen animal by-products are listed below:

- Skin/hide
- Bones
- Meat cum bone meal
- Technical fat
- Casings, Cat guts, musical strings
- Horns, hooves
- Manure (fertilizer)