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ENHANCED VALUE ADDITION AND STRENGTHENING VALUE CHAINS IN THE GREATER BAHR EL GHAZAL REGION, SOUTH SUDAN

TRAINING MANUAL ON IMPROVED PRODUCTION AND PRESERVATION TECHNIQUES OF HIDES AND SKINS



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FORWARD

Livestock is widely known as part of the identity of South Sudan. It is not only an important economic asset but also a socio-cultural component of the majority of the population. Great Bahr el Ghazal represents over 46 % of the livestock population of the country. Hides and skins being one of the important segments of the value chain, UNIDO together with GIZ has planned to capitalize on this and work closely for better utilization of hides and skins in the GBEG region. GIZ will be upgrading basic infrastructure of the four identified slaughter houses in the GBEG region where as UNIDO will improve capacity of the butchers, flayers and other stakeholders involved in the hide and skin value chain to produce and market better quality hides and skins.

It is in this regard therefore, UNIDO has decided to train the various stakeholders who are involved in the hides and skins value chains. This training manual is one of the deliverables of the training exercise that will be conducted in the states of Northern Bahr El Ghazal (NbG), Western Bahr el Ghazal WbG), Lakes and Warrap, where the project is being implemented.

The overall objective set for the global action by EU is to contribute to the improvement of food security and income of the population of the target beneficiaries in the Greater Bahr El Ghazal region of South Sudan with the specific purpose of improved food security and income for rural small holders in consideration of the axial role and the important potential of small holders to boost the rural economy and reach a sustainable food security level in the country. Under the Result /Output 3 of The EU global action, the overall objective of UNIDO action is to contribute to improved food security and income of the rural communities in the Great Bahr el Ghazal by enhancing value addition and strengthening identified five value chains.

Thus, the content in this training manual has been packaged in line with one of the project goals; to train the local butchers and flayers on improved flaying techniques. In addition, the manual also contains content that is useful in the training of actors involved in the value chain on improved preservation techniques of hides and skins. The main objective of this training manual is to equip participants with knowledge and practical skills on different aspects of animal husbandry, stunning, animal killing, bleeding, ripping, flaying and processing of hides and skins. By the end of the training the trainees are expected to acquire the following skills:

- i. A sound knowledge of basic principles of hygiene and sanitation during the production and processing of hides and skins.
- ii. Improved knowledge and technical skills on production of good quality hides and skins.
- iii. Improved knowledge and technical skills on different aspects of preservation and processing of hides and skins.
- iv. Knowledge on grading and storage of hides and skins.
- v. Improved understanding on marketing channels and benefits of collective marketing.

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ABBREVIATIONS AND ACRONYMS

A/M	Antemortem
ABPs	Animal by-products
ALLPRO	ASAL Based Livestock and Rural Livelihoods Support Project
ASALs	Arid and Semi-Arid Lands
BOD	Biochemical oxygen demand
BSE	Bovine Spongiform Encephalopathy
COD	Chemical oxygen demand
D/A	Documents against acceptance
D/P	Documents against payment
ECF	East Coast Fever
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
GIZ	German International Corporation Agency
kg	Kilogram
pH	Hydrogen potential
RVF	Rift Valley Fever
SO ₂	Sulphur (IV) Oxide (Sulphur dioxide)
SOPs	Standard Operating Procedures
TN	Total nitrogen
TOC	Total organic carbon
TP	Total phosphates
TSE	Transmissible Spongiform Encephalopathy
TSS	Total suspended solids
UNIDO	United Nations Industrial Development Organization
WHO	World Health Organisation

INTRODUCTION TO THE MANUAL

Background Review

The project under which this training manual is developed aims to train the pastoralists (including butchers and flayers) in Great Bahr el Ghazal region of South Sudan on improved animal husbandry, pest and disease control as well as slaughterhouse operations - particularly flaying techniques and sanitation and hygiene. In addition, the actors involved in the value chain will be trained on improved preservation, storage, transportation, sorting, selection and marketing techniques of hides and skins.

This manual comprises nine modules. **Module One** reviews livestock husbandry techniques required to improve and maintain quality of hides and skin leading to better incomes. It spells out the role of pastoralists, extension agents and other players involved in livestock production as the foundation of the hides, skins and leather industry.

Module Two looks at Environmental Sanitation and Personal Hygiene with emphasis on approaches and methods followed in order to ensure hygiene, sanitation, waste management and quality of hides and skins during slaughter. The module also outlines the recommended procedure for slaughterhouse sanitation and maintenance as well as personnel hygiene and safety during slaughterhouse operations. In addition, effects and prevention of food poisoning during meat handling are discussed.

Module Three offers insights on the importance of protecting the environment from pollution and contamination by both slaughterhouse and hides and skins effluent and solid wastes. It also highlights the risks involved in slaughterhouse and hides and skins waste mismanagement. This is meant to develop right attitude of hides and skins dealers and butchers towards right disposal of such wastes.

Module Four highlights the various approaches and methods of maintaining the quality of hides and skins both before and during slaughter. The module also gives details on how to prepare livestock for slaughter, right procedures in slaughtering and flaying techniques.

Module Five gives an account of the different curing methods of hides and skins for value addition. Curing aims at preserving the hides and skins in preparation for the tanning process. In cases where tanning facilities are available within six hours of slaughter, then curing can be skipped.

Module Six details the various approaches and risks of inappropriate transportation and storage of hides and skins as well as how proper sorting, selection, and storage of cured material may assist in retaining their value.

Module Seven outlines marketing networks for hides and skins and how the quality of production affects the market both locally and internationally. The module also stresses the need for the establishment of hides and skins stakeholders' associations.

Module Eight summarizes the methodology of conducting training sessions for adult learners. It also covers what needs to be done by the facilitators while preparing for the training sessions and also during the trainings.

Module Nine describes the different types of tools and equipment that are normally used in slaughterhouse operations, and how to use them appropriately.

Training objective

The main objective of the training programme is to equip participants with knowledge and practical skills on different aspects of animal husbandry, stunning, animal killing, bleeding, ripping, flaying, curing, sorting, selection and marketing of hides and skins as well as sanitation and hygiene in the slaughterhouse.

Expected outcome

By the end of the training the trainees are expected to acquire the following skills:

- A sound knowledge of basic principles of hygiene and sanitation during the production and preservation of hides and skins.
- Improved knowledge and technical skills on the production of good quality hides and skins.
- Improved knowledge and technical skills on different aspects of preservation and processing of hides and skins.
- Knowledge on grading and storage of hides and skins.
- Improved understanding on marketing channels and benefits of collective marketing.

Target groups

- Slaughterhouse workers such as cleaners and supervisors
- Butchers/Meat vendors/retailers
- Flayers
- Hides and skins traders and processors
- Livestock traders

MODULE 1: ROLE OF LIVESTOCK HUSBANDRY IN QUALITY OF HIDES AND SKINS

1.1 Module 1 Outcome and Objectives

Table 1.1 presents the module outcome and objectives.

Table 1.1: Module 1 Outcome and Objectives

Module Outcome, Objectives and Duration:	
<p>Outcome: By the end of the module the participants and facilitators will share and understand the role of livestock husbandry techniques in improving hides and skins quality.</p>	
<p>Objectives: To develop participant skills and competence on how to select and keep large animal breeds for better sized, heavier and thick hides and skins leading to better income. Also, the participants will have acquired knowledge and skills on how to maintain adequate stable feeding by conserving pasture and fodder, prevent occurrence and spread of diseases, deworm to improve livestock growth, treat sick animals immediately they show signs of diseases, branding for identification to be done on recommended and less important areas of animal body, and proper management of livestock grazing areas to reduce damage to hides and skins.</p>	
<p>Duration: 2.0 hours</p>	
Topic	
Role of Livestock Husbandry Techniques in Improving Hides and Skins Quality	
Tasks/Activities	
<ul style="list-style-type: none"> i. Discussion on importance of selection and keeping of large animal breeds for better sized, heavier and thick hides and skins leading to better income ii. Feeds and feeding iii. Physical care iv. Pest and disease control v. Traditional branding/modern branding methods vi. Management of livestock grazing areas vii. Recommended practice while livestock are in transit 	
Teaching Aids	
<ul style="list-style-type: none"> i. Posters ii. Diagrams iii. Photos iv. Flipcharts v. Note books vi. Exposure to livestock farms/ commercial feeds and nutrient fodder 	

1.2 Recommended Husbandry Practices

Improvement of hides and skins quality at farm level entails controlling defects on the live animal that may occur due to poor animal husbandry practices. These practices include breeding, feeding, physical care, pest and disease control, management of grazing areas and lastly good practice in transporting the animals to the market. In general, large, healthy animals will translate to better quality hides and skins.

The following management practices are recommended since they impact positively on production of hides and skins.

1.2.1 Breeding

Recommended breeding practices entails the following:

- ❖ Selecting and keeping large animal breeds for better sized, heavier and thick hides and skins leading to better income e.g. Sahiwal, Galla goat, Dorpers, Camels, Ostrich and Donkeys.
- ❖ Incorporating bulls and bucks selection and Artificial Insemination for breed improvement.

1.2.2 Feeds and Feeding

The recommended feeds and feeding practices are as outlined below:

- ❖ Feed livestock with high –nutrient fodder, mineral supplements and commercial feeds where applicable.
- ❖ Maintain adequate and stable feeding by conserving pastures and fodder.

1.2.3 Physical Care

In order to get quality hides and skins from the livestock, avoid external or internal damage on animals when ploughing, pulling carts and carrying loads to reduce defects on the hides and skins.

1.2.4 Pest and Disease Control

Pests and diseases negatively affect the quality of hides and skins. Tick bites and mange scratches may render skins unfit for commercial applications. Emaciation or weakness of the livestock due to diseases make the skin weak and of poor substance. The skin of a sick animal therefore has less value. Besides, sick animals can infect other healthy animals. It is therefore important for the livestock farmer to:

- ❖ Prevent occurrence and spread of diseases
- ❖ Deworm to improve livestock growth.
- ❖ Treat sick animals immediately they show signs of diseases.
- ❖ Observe and adhere to quarantine notices, which arise from diseases that directly affect hides and skins e.g. lumpy skin disease, Mange, ringworms, tick bites, ECF, and anthrax among others.

1.2.5 Traditional Branding

Branding is used by livestock farmers as a proof of ownership. Normally, many farmers use red hot iron to brand their animals. This however, burns the hide making it less useful for leather manufacturing. Appropriate hot iron branding which does not damage the hide should be done on the less important areas of the animal body such as the neck, legs, ears hump and the masks. Figure 1.1 shows the recommended areas where hot iron branding may be done and these include masks, in between the horns, behind

the ears, lower forelimbs, lower hind limbs and the hump. The grey shaded overlay represents the prime part of the body which should be avoided when branding to ensure quality hide for leather production.

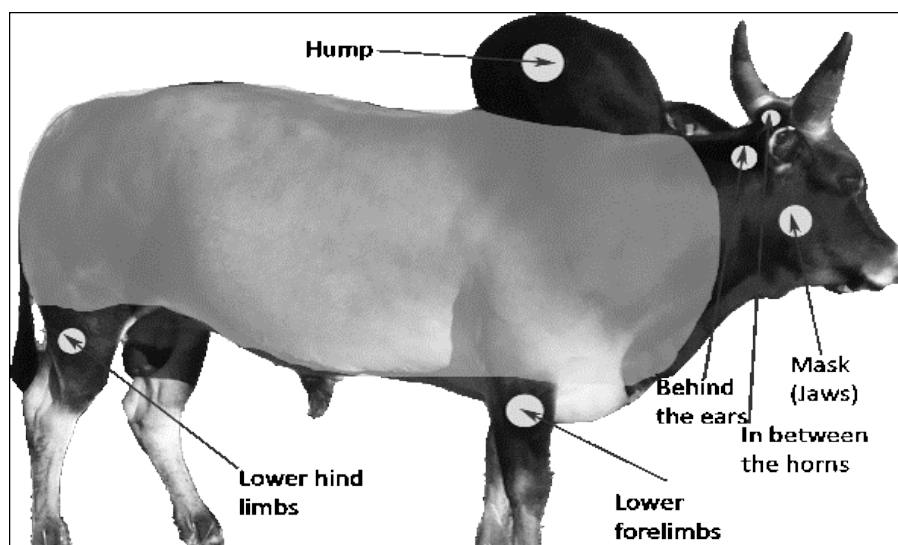


Figure 1.1: Recommended parts for hot-iron branding of cattle

1.2.6 Management of livestock grazing areas.

Proper management of livestock grazing areas can reduce damage to hides and skins. Livestock grazing fields or enclosures should be kept free from sharp objects that may scratch or tear skin. Important practices to observe in grazing areas include:

- i. Clearing thorny bushes around the grazing areas and near *cattle boma*¹ where livestock frequent.
- ii. Fencing using plain wires instead of barbed ones where applicable.
- iii. Avoiding sharp and protruding objects like nails and timber especially in handling yards.
- iv. Dehorning and trimming sharp animals' horns.
- v. Separating male animals that are likely to fight.

1.2.7 Transporting Livestock

Recommended practices for livestock in transit include but not limited to:

- i. Spreading sand or saw dust on the floor of the truck bed before loading livestock onto trucks. This avoids injury by reducing slipping of animals which may cause damage to hides and skins from the injuries.
- ii. Avoiding overloading by observing the recommended carrying capacities for common trucks as presented in Table 1.2.
- iii. Avoiding transporting of livestock on trailers and semi-trailers because they take long to reach destination and hence straining the livestock.
- iv. Loading and offloading livestock at appropriate places/ramps to avoid injury.

¹ Cattle boma- - livestock enclosure

Table 1.2: Different Modes of transporting hides and skins

Vehicle Type	Load Capacity	No. of sheep and goats	No. of cattle/ donkeys	No. of camels
Pick-up trucks	1 ton / No Decker	10-15	2	NA
	With decker	20-25	NA	NA
Canter	3-4 ton / No decker (high sided body)	30-40	5-6	1
	With Decker	50-60	NA	NA
Lorry	6-wheeler / No decker	100-120	17-20	4
	With Decker	150-200	NA	NA
	10-wheeler / No Decker	120-150	20-22	4-6
	10-wheeler with Decker	200-250	NA	NA

MODULE 2: ENVIRONMENTAL SANITATION AND HYGIENE

1.3 Module 2 Outcome and Objectives

Table 2.1 presents the module outcome and objectives.

Table 2.1: Module 2 Outcome and Objectives

Module Outcome, Objectives and Duration:	
Outcome:	By the end of the module the participants and facilitators will share and understand approaches and methods for ensuring hygiene, sanitation, waste management and quality of hides and skins during slaughter.
Objective:	To develop participant skills and competence on how to prepare livestock for slaughter, right procedures in slaughtering and flaying carcass.
Duration:	1.5 hours
Topic	
Personal safety hygiene & Slaughterhouse/slaughter place hygiene	
Tasks/Activities	
i.	Discussion on importance of hygiene and risk of meat contamination.
ii.	Meat borne diseases
iii.	Communicable diseases through meat handling.
iv.	Direct observation and addressing observed challenges.
v.	Participants experience with food poisoning.
vi.	Questions and answers
vii.	Trainer's presentation verbal and illustrations presentation/demonstrations.
viii.	Role played by slaughterhouse protective gear
Teaching Aids	
❖	Posters
❖	Diagrams
❖	Photos
❖	Flipcharts
❖	Note books
❖	Slaughterhouse / slaughter place exposure
❖	Protective clothing such as plastic aprons (washable and water proof), light coloured (preferably white) dust coats or overalls, rubber gum boots and white caps/hair covering;
❖	Cleaning equipment such as hose pipes, hard blooms, soft blooms, scrappers, buckets/pails, wheel barrows, hand brushes, detergents and Magadi soda

1.4 Environmental Sanitation

Sanitation is the act or process of providing adequately, hygienic conditions to ensure a safe, sound, wholesome product fit for human consumption and covers hygienic precautions regarding personal hygiene, process hygiene and cleaning and disinfection. Sanitation may also signify disinfection.

Slaughterhouse cleaners are expected to disinfect and sanitize the building in which animals are killed for consumption. Given the nature of the bodily fluids being spilled inside such buildings, the cleaners must adhere to strict guidelines that clean not only dirt and grime, but kill and dispose of germs, fungal agents and mould. The job keeps the new cuts microbe-free and keeps meat consumers from falling ill. The sanitation process ensures the conditions within the house result in a product people can eat. Environmental sanitation in a slaughterhouse comprises process hygiene, cleaning, disinfection and location.

1.4.1 Process Hygiene

One of the primary functions of a slaughterhouse cleaner is to sterilize the equipment in between uses. This includes hooks, countertops, knives and cutting tools, grinders and other meat processing equipment. To effectively clean these apparatus, the worker must dismantle the machinery and disinfect each piece individually, using cleaning agents such as bleach and vinegar (making sure to thoroughly rinse and dry), high heat, and abrasive sponges and brushes. Slaughterhouse cleaners might also be responsible for the disposal of hazardous fluids coming from the carcasses. They must trap grease and fat, separate the blood and screen the solid wastes. Cleaners will also be expected to take care of pest control, meaning rodents, bugs and birds.

1.4.2 Cleaning

Slaughterhouse cleaners must remove all trace of fats and proteins from equipment and holding stations in between shipments. They clean these leftovers using high water pressure, heat and intense detergents. They must know which types of cleaning agents to use on each mess. These include sodium-based detergents, which lower the surface tensions, wiping the grime away; ionic surface agents, which break down the chemical makeup of the waste; sequestering agents, which bind calcium, preventing hard water build-up; and acids, which break down stubborn waste materials. Slaughterhouse cleaners often use large machinery to clean wide surface areas, which increases pressure and the strength of cleaning agents. For smaller equipment that must be cleaned by hand, they must use gentler agents to keep themselves safe.

1.4.3 Disinfection

Cleaning goes further than removing the visible fat, protein and dirt off the machinery. Slaughterhouse cleaners must completely disinfect all areas where meat will be processed, creating a sterilized environment in between shipments. The first step to this in-depth cleaning is usually a high-heat steam treatment. Most microbes cannot survive in high temperatures. This method can be followed up with any of several different compound cleaners, including chlorine treatments, ammonium agents or a mix of hydrogen peroxide and acetic acid.

Table 2.2: Key Terminologies used in slaughterhouse hygiene

Term	Brief explanation
Carcass	The part of animal body that is used for meat
Composting	A controlled process involving microbial degradation
Dissolved Air floatation	Separation of low density contaminant from water using minute air Bubbles attached to individual particles to increase the buoyancy of the particle
Evisceration	The process of removing inner organs of the body, particularly organs of thorax and abdomen such as the intestine, heart, lung, liver, kidneys, etc.
Hygiene	The science of health and its preservation
Incineration	It is a controlled combustion process in which the waste is burnt and converted into gases and a residual containing little or no combustible material
Lairage	Facility of slaughterhouse where animals are delivered and rested prior to slaughtering
Lard	Processed pig fat, processing is done by boiling raw fat material
Offal	Part of the animal that remains after the carcasses have been removed
Rendering	Facility for processing by-product from slaughterhouse and meat processing units into animal feed, bone meal etc.
Rumen	The first stomach of ruminants like cow, buffalo, and goat sheep which ruminates
Slaughter House	The building, premises or place which is used for slaughtering of animals

1.4.4 Location

The slaughterhouses should be located outside or on the periphery of a city or town and shall be away from an airport. Care should, however, be taken to see that these are easily accessible to the patrons and do not adversely affect the transport of meat to the market place. Main services such as portable water, electricity and proper hygienic waste disposal facilities are a prerequisite and should be taken care of.

1.5 Recommended Procedure for Sanitation

The appropriate procedure for sanitation in the slaughterhouse should ensure that:

- i. The outer part of the skin or hide does not contact the carcass side.
- ii. There is no puncturing of the viscera organs during dressing and evisceration
- iii. Evisceration is done within the shortest time possible
- iv. The rough offal's are emptied into their designated receptacles such as a wheelbarrow
- v. The inedible dirty parts of the animal like hooves, skin, hide and un skinned heads are immediately removed from the dressing areas into sorting rooms
- vi. The flaying knife is sterilized every time it pierces the skin, hides, and cuts an abscess or a lymph node.

- vii. There is a hand washing basin with hot water for use in the bleeding, skinning and evisceration areas
- viii. Have only leg operated hand washing taps
- ix. The facilities and equipment are cleaned before, during and after operations
- x. The exterior doors open outwards
- xi. The drainages are working and cleaned continuously during work
- xii. Drainages flow from clean to dirty areas of operation
- xiii. There is use of approved detergents, disinfectants and sterilizers for cleaning such as *methylated* spirit or Chlorine solutions.

1.6 Personnel Hygiene and Safety

Cleaning a slaughterhouse means the workers must also keep themselves germ-free. They should wash their hands before their shifts begin, after each specific disinfecting job, after eating or smoking, and after using the bathroom. Any bacteria on the hands of the workers will be transferred to the food being processed. The workers' uniforms must be clean, and they should change into the outfits onsite, just before beginning their shifts, to keep the contaminants normally found on clothing away from the meat. Uniforms should be washed after each shift. Workers should not wear jewellery, as microorganisms can live in the crevices of the metal. Hair coverings and gloves are a must when cleaning the house, and any worker who is ill should call out for the day.

As shown in Figure 2.1, slaughterhouse workers must observe the following guidelines while working in the slaughterhouse:

- ❖ Wear clean, approved and adequate protective clothing.
- ❖ Should not store items in their pockets
- ❖ Should not change in operation areas
- ❖ Should not keep personal clothes in the operation areas
- ❖ Wear hair restraints (hair net, hat, cap or head band, beard restraints, and clothing that cover body hair) to prevent hair from falling on meat
- ❖ Change their apron whenever it becomes dirty.
- ❖ Be encouraged to cover their mouths when coughing and their nose when sneezing.
- ❖ Routinely be checked for medical fitness (every six months).
- ❖ Tell the supervisor if they are sick.
- ❖ Should tell a supervisor if they are diagnosed with any food borne illness.
- ❖ Should not wear false fingernails (artificial nails) or fingernail polish.
- ❖ Must not sneeze or cough near meat. If an employee experiences persistent sneezing or coughing, they must not work in meat areas.

- ❖ Avoid wearing jewellery while working in the operation/facility. Employees must not wear jewellery on their arms or hands, except wedding bands.
- ❖ Should not eat food, drink, chew, or smoke while in the work area.
- ❖ Use a disposable towel to wipe sweat
- ❖ Wash their hands every time they visit toilets, blow nose, exit from work areas or touch uncovered parts of their bodies
- ❖ Keep their bodies clean by washing before work and keeping nails cut.



Figure 2.1: Best personal hygiene practices for workers (above);

Source; Kioko, P. (Training manual for FAO Somalia meat draft report, 2013)

On the other hand, the slaughterhouse workers must not do the following while in the slaughterhouse:

- ❖ Unguarded coughing and sneezing
- ❖ Spitting on hands to enable firm grip of an axe
- ❖ Licking of fingers to pick up items e.g. papers
- ❖ Blowing paper bags to open them
- ❖ Blowing or wiping of nose using bare hands
- ❖ Brushing of teeth in the slaughterhouse
- ❖ Placing meat, knives, sharpening steel in the gumboots

1.7 Meat Borne Diseases (Food poisoning)

Meat borne diseases are caused by biological, chemical and physical hazards. Biological hazards are the most serious and commonest. The biological hazards are attributed to pathogens (bacteria, viruses, parasites or fungi).

Pathogenic microorganisms cause food poisoning in two ways: through **infection** and/or **intoxication**. Food poisoning as a result of infection is caused by the ingestion of food containing live bacteria which grow and establish themselves in the human intestinal tract. On the other hand, food poisoning as a result of intoxication is caused by ingesting food containing toxins formed by bacteria which resulted from the bacterial growth in the food item. Live microorganisms do not have to be consumed for food poisoning to occur. For a foodborne illness (poisoning) to occur, the following conditions must be present:

- ❖ The microorganism or its toxins must be present in food.
- ❖ The food must be suitable for the microorganism to grow.
- ❖ The temperature must be suitable for the microorganism to grow.
- ❖ Enough time must be given for the microorganism to grow (and to produce a toxin).
- ❖ The food must be eaten.

1.7.1 Impacts of Meat Borne Diseases (Food poisoning)

Food poisoning has adverse socio-economic impacts on the communities. However, the full impacts of food borne illness on the social and economic fabric of many nations are unknown and very hard to assess or estimate due to lack of efficient food control systems, poor surveillance and under reporting. Meat has been implicated in many human disease outbreaks such as Brucellosis, RVF, Anthrax, BSE and Cholera among others. The mortality rate attributed to food poisoning in sub-Saharan Africa is estimated at 700,000 per year for all ages of the population (WHO, 2012).

Food borne diseases go unnoticed in many countries unless there is a massive outbreak like Mad cow disease, Bird flu, RVF and Cholera. The economic costs can be estimated by considering the number of work hours lost, medical and healthcare costs and deaths associated with a food borne disease. Food borne diseases disrupts the social lives of a country through such economic losses.

1.7.2 Prevention of Food Poisoning

The way to prevent meat borne infection is to reduce the possibility of contamination at Production (Slaughtering), Packaging, Transportation, Retail (vending) and Preparation. This is possible through use of Best hygiene practices for meat during the whole production and marketing processes. The following guidelines must be observed at appropriate stages in the meat value chain to prevent food poisoning.

Table 2.3: Guidelines for prevention of food poisoning

Guideline	Activities
Keeping bacteria, viruses, and parasites from spreading	<ul style="list-style-type: none"> ❖ Sick employees (workers) must be quarantined or kept away from handling meat ❖ Meat handlers must wash hands and use clean gloves ❖ Employees with open cuts and wounds must not handle meat

Guideline	Activities
	<ul style="list-style-type: none"> ❖ Employees must not touch their faces and mouths with their hands while handling meat ❖ Proper disposal of hygienic items (i.e., toilet paper, paper towels) ❖ Employees must wash their hands after using the toilets ❖ Meat handling must be done on sanitized surfaces and utensils ❖ Rotten meat parts must be disposed of away from fresh meat, surfaces or equipment used for meat handling.
Maintaining slaughterhouses	<ul style="list-style-type: none"> ❖ All slaughterhouses (abattoirs) must meet the same animal welfare standards. If you operate a slaughterhouse you must have detailed instructions for each type of operation your staff carry out involving animals. These instructions are known as standard operating procedures (SOPs).
Establishment design, facilities and equipment	<ul style="list-style-type: none"> ❖ Materials and design features for the premises and equipment must be suitable for the meat production operations ❖ Adequate facilities such as water, ventilation, drainage, lighting, changing areas and toilets must be provided, designed, installed, maintained and controlled. ❖ Appropriate changes must be made to the process(s) that may give rise to cross contamination of meat products. ❖ The premises must be maintained on regular basis to facilitate effective cleaning and disinfection. ❖ Documented programmes for effective and appropriate maintenance and sanitation must be in place. ❖ Monitoring of the effectiveness of maintenance and sanitation must be included as a basic component of meat hygiene programmes. ❖ Separation of clean and dirty operation areas must be observed ❖ All drainages and floor surfaces must be properly sited ❖ The wash out water drainage flows must be designed and constructed to flow from clean towards dirty areas. ❖ A condemnation meat receptacle should have lock and key and labeled "CONDEMNED MEAT" ❖ An equipment sterilization three-point facility must be provided at the bleeding, dressing, evisceration and splitting areas ❖ There must be three sets of plastic handle knives for severing the neck, putting the dressing lines and actual flaying of the animals. ❖ Equipment must be easy to clean and non-corrosive, sufficiently cleaned, disinfected and sterilized at the right temperature of potable water (i.e. safe to drink).

MODULE 3: WASTE DISPOSAL AND ENVIRONMENTAL CONSERVATION

1.1 Module 3 Outcome and Objectives

Table 3.1 presents the module outcome and objectives.

Table 3.1: Module 3 Outcome and Objectives

Module Outcome, Objectives and Duration:	
Outcome: By the end of the module the participants and facilitators will share and understand the importance of protecting the environment from pollution and contamination by hides and skins effluent and solid wastes	
Objective: To develop right attitude of hides and skins handlers and butchers/flayers towards right disposal of hides and skins effluent and solid wastes	
Duration: 1.5 hours	
Topic 1	
How hides and skins can pollute the environment	
Tasks/Activities	
i.	Participants experience with hides and skin waste, knowledge, attitude, practice and behavior of hides and skins handlers and butchers/flayers with regard to environmental pollution and conservation.
ii.	Trainer's verbal and illustrative presentation on hides and skins pollution and standard practice for environmental protection and conservation.
Teaching Aids	
<ul style="list-style-type: none"> ❖ Flipchart and stand ❖ Posters ❖ Diagram ❖ Notebooks 	
Topic 2	
How to dispose of hides and skins and slaughter waste	
Tasks/Activities	
i.	Participants experience with hides and skins waste disposal.
ii.	Trainer's verbal and illustrative presentation on hides and skins waste disposal
Teaching Aids	
<ul style="list-style-type: none"> ❖ Flipchart and stand ❖ Posters ❖ Diagram ❖ Notebooks 	
Topic 3	
Factors to consider in environmental conservation	
Tasks/Activities	
i.	Participants experience with hides and skins factors to consider in environmental conservation
ii.	Trainer's verbal and illustrative presentation on environmental conservation

Teaching Aids

- ❖ Flipchart and stand
- ❖ Posters
- ❖ Diagram
- ❖ Notebooks

1.2 Definition of Waste

Waste is “the unwanted remains, residues or by products which are no longer wanted by the owner”. Waste is assumed to be valueless to the owner.

Slaughterhouse and Hides and Skins wastes are associated with discharge of highly organic matter. These wastes if directly disposed of in the land create aesthetically objectionable Public Health and Environmental pollution.

Composition of Slaughterhouse and Hides and Skins waste.

- i. Blood
- ii. Rumen ingesta
- iii. Horns
- iv. Hooves
- v. Bones
- vi. Hides and Skins fleshings
- vii. Hide and skins splits and trimmings
- viii. Condemned meat
- ix. Gall bladder
- x. Foetus etc.

1.3 Characteristics of Slaughterhouse waste

Slaughterhouse effluents are considered detrimental worldwide due to their complex composition of fats, proteins, and fibres, as well as the presence of organics, nutrients, pathogenic and non-pathogenic microorganisms, detergents and disinfectants used for cleaning activities, and pharmaceuticals for veterinary purposes. Therefore, the treatment and disposal of wastewater from slaughterhouses and meat processing plants are an economic and public health necessity. Table 3.2 attempts to summarize the typical characteristics of the slaughterhouse effluents. The features and common ranges of such effluents are listed as Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Organic Carbon (TOC), Total Suspended Solids (TSS), Total Nitrogen (TN), Total phosphates (TP) and pH.

Table 3.2: Typical characteristics of the slaughterhouse effluents

Parameter	Range	Average
BOD (mg/L)	610-4635	1209
Ca (mg/L)	32-316	67
COD (mg/L)	1250-15900	4221

Parameter	Range	Average
K (mg/L)	0.01-100	90
Na (mg/L)	62-833	621
Pb (mg/L)	0.21-34	4
TN (mg/L)	50-841	427
TOC (mg/L)	100-1200	546
TP (mg/L)	25-200	50
TSS (mg/L)	300-2800	1164
pH	4.90-8.10	6.95

(Source: *Journal of Geoscience and Environment Protection*, 2016, 4, 175-186 Published Online April 2016 in SciRes. <http://www.scirp.org/journal/gep>
<http://dx.doi.org/10.4236/gep.2016.44021>)

1.4 Categories of Slaughterhouse Wastes

1.4.1 Category 1 (for disposal only)

Category 1 constitutes a very high-risk material (animals suspected or confirmed as being infected by a TSE, animals killed in the context of TSE controls, Specified Risk Material). This category also includes animals other than farmed and wild animals (e.g. pets, zoo animals and circus animals) and experimental animals.

Category 1 Animal By-Products (ABPs) must be disposed of by incineration or rendering. They can also be used as fuel for combustion at an approved combustion plant; or, sending them for burial at an authorized landfill, if they are international catering waste (i.e. if the vessel transporting the waste travels outside the EU, even if you stocked up for the entire journey in the EU).

1.4.2 Category 2 (not for animal consumption)

These include other high-risk material for example:

- i. Condemned meat
- ii. Fallen stock
- iii. Manure or digestive track contents (excluding excrement from wild, zoo, pet and experimental animals unless there is a known risk)
- iv. Animal by-products presenting a risk of contamination with other animal diseases (e.g. animals which are killed in the context of disease control measures).
- v. Animal by-products containing residues of certain veterinary drugs and contaminants that exceed permitted levels
- vi. Animal materials collected when treating wastewater from slaughterhouses.

Permissible disposal routes for Category 2 materials include incineration and rendering. Unprocessed Category 2 material cannot go to landfill. However, some Category 2 ABPs may be recycled for uses other than feeds after appropriate treatment (e.g. biogas, composting – subject to other legislative control, etc.).

1.4.3 Category 3 (for human consumption)

These represent the lowest risk category. It consists of animal products that are highly putrescent and can be hazardous; contains 80% biodegradable material and a mixture of blood, ingesta, bones, Horns fleshings, splits and trimmings. It constitutes a significant portion of the waste that can be recycled or reused for economic production. Examples include:

- i. Raw meat that has passed meat inspection
- ii. Parts of animals (e.g. hides, skin horns etc.), slaughtered in a slaughterhouse, that did not show clinical signs of disease that is communicable to humans or animals blood from animals other than ruminants where ante-mortem inspection showed them to be fit for human consumption
- iii. Raw milk from animals that did not show clinical signs of disease that is communicable to humans or animals
- iv. Shells, hatchery by-products and cracked egg by-products from animals that did not show clinical signs of disease that is communicable to humans or animals, catering waste.

Category 3 waste should not be disposed of carelessly due to risk of microbiological and gross organic pollution. It cannot be taken to landfill, but can be disposed of via a number of routes such as incineration, rendering, composting (subject to other legislative control) or anaerobic digestion, or be used in an approved pet food or technical plant in some cases.

1.5 Disposal of Slaughterhouse Waste

1.5.1 Rendering

Rendering is a heating process for meat industry waste products through which fats are separated from water and protein residues for the production of edible lards and dried protein residues. Commonly it includes the production of a range of products of meat meal, meat-cum-bone meal, bone meal and fat from animal tissues. It does not include processes where no fat is recovered.

There are basically two different rendering processes:

- i. High temperature rendering which involves cooking or steam application. Five methods of high temperature rendering include simple cooking; open pan rendering; kettle rendering; wet rendering; and dry rendering.
- ii. Low temperature rendering (at around 80°C). This process requires finely ground material and temperatures slightly above the fat melting point. It results in a better-quality lard. The rendering at low temperatures is a highly-sophisticated process requiring large throughputs and trained personnel. For many developing countries, the system is not suitable.

1.5.2 Handling of viscera, paunch and intestines

Viscera can be recovered as edible products (e.g. heart, liver). They can also be separated for inedible rendering or processing (e.g. lungs).

The paunch contents, 'paunch manure' (partially digested feed), is estimated to range from 27 to 40 kg. The paunch can be handled in four ways:

- i. **Total dumping.** All of the paunch contents is flushed away into the sewer.
- ii. **Wet dumping.** The paunch contents are washed out and the wet slurry is screened on the presence of gross solids, which are subsequently removed.
- iii. **Dry dumping.** The paunch contents are dumped for subsequent rendering or for disposal as solid waste without needless water flushing.
- iv. **Whole paunch handling.** The entire paunch may be removed, intact, for rendering or for disposal as solid waste.

Intestines may be rendered directly, or hashed and washed prior to rendering. For the processing of intestines de-sliming prior to thorough washing is necessary.

1.6 Risks of Slaughterhouse Waste Mismanagement

As much of this waste can possibly be recycled and the recycling process can sometimes be fast, high proportions of the waste remains unattended to in the environment of the slaughterhouse due to the high costs involved in their processing. This then poses great public health risks. Metal screens trap solids like skin trimmings, hair, bones and hooves. Grease traps capture fat. Outside slaughterhouses enormous containers hold all these leftovers until tankers come to take them away. In most countries, this type of waste has to be heat-treated and sanitized to make sure it poses no danger to human or animal health. Only then can it be disposed of in municipal sewers, in incineration plants or, if possible, made into 'value-added' products, including feed for animals.

Fat is made into tallow and used as a lubricant in steel rolling. In the cosmetic industry tallow is a key ingredient in lipstick and eye make-up. Blood and bones are rendered into blood and bone meal for fertilizer. Hides and skins trimmings can be processed into office glue after decontamination.

The major risks involved in slaughterhouse and hides and skins waste mismanagement include, but not limited to the following scenarios:

- i. When scattered on the ground, may contaminate food. Pathogens, which grow in decomposing wastes, may cause infectious diseases.
- ii. It attracts and provides food for vectors, pests (rats), scavengers (Marabou stalk birds), and other vermin.
- iii. It can result in spread of communicable diseases. Slaughterhouse and Hides and Skins wastes affect the well-being of communities

- iv. It results in unsightly and smelly dirty neighbourhood.
- v. Community gets unsecured or end up leaving the area
- vi. It reduces business as people eat less in hotels etc.

1.7 Handling Condemned Materials from Slaughterhouse

Handling of condemned material carcasses, portions thereof or any edible products in an abattoir, which cannot be passed for human or animal consumption, must be:

- i. Portioned and placed in a theft proof container which has been clearly marked "CONDEMNED", in letters not less than 10 cm high, or conspicuously marked with a stamp bearing the word "CONDEMNED", using green ink;
- ii. Kept in a holding area or a room or dedicated chiller provided for the purpose, except if removed on a continuous basis; and
- iii. Removed from the abattoir at the end of the working day or be secured in a dedicated chiller or freezer at an air temperature of not more than minus 2 °C.

No person may remove a carcass, part thereof or any edible product which has been detained or condemned from an abattoir, except with the permission of a registered inspector who is a veterinarian and subject to such conditions as he or she may impose. The abattoir owner is responsible for complying with the legal requirements or conditions relating to the safeguarding and disposal of any carcass, part thereof or any edible product which cannot be passed for human or animal consumption.

1.7.1 Disposal of condemned material

Any condemned material must be disposed of by:

- i. Total incineration;
- ii. Denaturing and burial of condemned material at a secure site, approved by the local veterinary officer and local government, by –
- iii. Slashing and then spraying with, or immersion in, an obnoxious colorant approved for the purpose; and
- iv. Burial and immediate covering to a depth of at least 60 cm and not less than 100 m from the abattoir, providing such material may not deleteriously affect the hygiene of the abattoir; or
- v. Processing at a registered sterilizing plant.

1.7.2 Requirements for sterilizing plants for condemned materials

The following stipulates the requirements for sterilizing plants for condemned materials:

- i. A sterilizing plant must comply with the general requirements for premises, structures and equipment set out in the relevant regulations, which apply with the necessary changes.
- ii. The premises of a sterilizing plant must be fenced and secured so as to prevent the entry of unauthorized persons, vehicles and animals, and must include- Unclean areas, comprising the rooms in which material is received, stored or prepared for sterilizing as well as the entrance to the sterilising apparatus; and Clean areas, comprising the rooms in which the sterilized material is dried, milled or otherwise prepared, packed, stored or dispatched.
- iii. A solid wall must separate the unclean and clean areas, and there may be no direct contact between these areas.

For the unclean area, it is required that:

- i. Material of animal origin may only be received in the unclean area of a sterilizing plant and no such material may be removed from this area otherwise than through the operations of the sterilizing equipment.
- ii. Foot-baths with disinfectants must be provided at all exits, as well as a wheel bath for vehicles at the unclean receiving area.
- iii. The floors, walls and equipment of the unclean area of a sterilizing plant must be sanitized daily after the cessation of operations.
- iv. Workers employed in the unclean area must –
- v. Wear distinctively marked overalls and rubber boots;
- vi. Wash their hands and disinfect their boots before leaving the unclean area; and
- vii. Change from their soiled protective clothing and footwear and clean themselves with soap and water before leaving the premises.
- viii. A person who has entered the unclean area may not enter the clean area or any area where any edible products are handled in the abattoir unless he or she has cleaned and changed as required by relevant laws.

1.7.3 Vehicles for condemned material

The requirements for vehicles used for condemned materials provides that:

- i. A vehicle used for the transport of condemned material may not be used for any other purpose, but after cleaning and disinfection the vehicle may be used for the transport of inedible material.
- ii. A vehicle may only be used for the transport of condemned material if the –Load space is lockable, theft proof and sealable; internal surface is leak proof and constructed of durable material; and Floor is provided at its lowest point with a drain pipe capable of being securely closed by a screw valve.

- iii. The load space of a vehicle used for transporting material to a sterilizing plant must be cleaned and disinfected to the satisfaction of a registered inspector at the end of each delivery, at a place specially constructed for the purpose.

1.8 Effect of Slaughterhouse Wastes on the Environment.

Slaughterhouse wastes affect the environment in various ways including:

- i. Polluting air with pathogenic germs of the waste.
- ii. Polluting water bodies including rivers and springs.
- iii. Blocking waterways and drainage system in towns resulting in stagnant smelly water.

1.9 Summary of Management of Slaughterhouse Waste

1.9.1 Solid wastes

- i. Solid wastes could be temporarily stored in holding sheds (manure shades and temporary dumping sites for hides and skins trimmings and fleshings) before transfer to disposal sites
- ii. Solid wastes generated must be removed daily in proper designed carts, wheelbarrows or collection vehicles.
- iii. Spillage during transport should be avoided.
- iv. The chosen waste collection method should transport the waste to disposal at minimal costs.

1.9.2 Liquid Waste/Effluent

The liquid waste should be washed away by safe potable and constant supply of fresh water at adequate pressure throughout the premises of slaughtering. The wastewater from slaughterhouse is heavy in pollution and, therefore, it should not be allowed to mix with the municipal drainage system without pre-treatment as shown in Figure 3.1. Figure 3.2 shows well designed slaughter house (smooth and slanting floor) to allow ease of drainage of slaughterhouse effluents. It is important to ensure the following:

- i. All liquid wastes must be screened before discharge to remove solid waste materials.
- ii. The waste must be treated before discharge into the environment.
- iii. The waste treatment system must be cost effective and efficient



Figure 3.1: Poor separation of liquid and solid wastes from slaughterhouse

(Source; Okumu. O 2012, workshop draft report on environmental management in hides and skins curing premises)



Figure 3.2: Slaughtering facility with a slanting floor and slot drainage

(Source; <http://www.slotdrainsystems.com/abattoirs-slaughterhouse-drainage>)

MODULE 4: SLAUGHTERING TECHNIQUES

1.10 Module 4 Outcome and Objectives

Table 4.1 presents the module outcome and objectives.

Table 4.1: Module 4 Outcome and Objectives

Module Outcome, Objectives and Duration:
Outcome: By the end of the module the participants and facilitators will share and understand approaches and methods of maintaining the quality of hides and skins both before and during slaughter
Objective: To develop participant skills and competence on how to prepare livestock for slaughter, right procedures in slaughtering and flaying techniques
Duration: 1.5 hours
Topic 1
Resting slaughter animal
Tasks/Activities
<ul style="list-style-type: none"> i. Participants experience sharing and peer reviews. ii. Trainers Probing questions on the practice of slaughtering. iii. Participants' narrations on their practice and experiences. iv. Trainer's verbal and illustrative presentations on resting slaughter animals' principles and procedures. v. Questions and answer sessions. vi. Practical on slaughtering procedures.
Teaching Aids
<ul style="list-style-type: none"> ❖ Posters ❖ Diagrams ❖ Photos ❖ Flipcharts ❖ Note books ❖ Slaughterhouse/ slaughter place exposure
Topic 2
Stunning before slaughter
Tasks/Activities
<ul style="list-style-type: none"> i. Refers 1 and 2 above ii. Participants' narrations on their practice and experiences on stunning animals before slaughtering (humane slaughter). iii. Trainer's verbal and illustrative presentations on stunning slaughter animals, principles and procedures involved in preparing the animals for slaughter iv. Questions and answer sessions. v. Practical on pre-slaughtering procedures.
Teaching Aids
<ul style="list-style-type: none"> ❖ Tools and other Implements used for restraining animals to facilitate humane slaughter
Topic 3
Slaughtering

Tasks/Activities

- i. Refers 1 and 2 above
- ii. Participants' narrations on their practice and experiences in actual slaughtering
- iii. Trainer's verbal and illustrative presentations on slaughtering principles and procedures.
- iv. Questions and answer sessions.
- v. Practical on slaughtering procedures.

Teaching Aids

- ❖ Tools and other Implements used for different slaughterhouse operations

Topic 4

Bleeding

Tasks/Activities

- i. Refers 1 and 2 above
- ii. Participants' narrations on their practice and experiences on carcass bleeding after slitting the throat.
- iii. Trainer's verbal and illustrative presentations on right bleeding methods, principles and procedures.
- iv. Questions and answer sessions.
- v. Practical on bleeding procedures.

Teaching Aids

- ❖ Tools and other Implements used for bleeding

Topic 5

Ripping

Tasks/Activities

- i. Refers 1 and 2 above
- ii. Participant's narrations on their practice and experiences on making the correct ripping lines before flaying.
- iii. Trainer's verbal and illustrative presentations on ripping principles and procedures.
- iv. Questions and answer sessions.
- v. Practical on how to make the correct ripping lines.

Teaching Aids

- ❖ Tools and other Implements used for ripping

Topic 6

Flaying

Tasks/Activities

- i. Refers 1 and 2 above
- ii. Participants' narrations on their practice and experiences on flaying techniques.
- iii. Trainer's verbal and illustrative presentations on flaying principles and procedures.
- iv. Questions and answer sessions.
- v. Practical on hides and skins flaying procedures for both large and small animals.

Teaching Aids

- ❖ Tools and other Implements used for flaying

1.11 Appropriate Pre-slaughter and Slaughter Techniques

1.11.1 Best practices for Pre-slaughter animals

During pre-slaughter, one must ensure that:

- i. Animals presented for slaughter should be sufficiently clean
- ii. Animals should not be stressed during transportation to the slaughterhouse. The mode of transport should be comfortable and means such as motorbikes as shown in Figure 4.1 or bicycles are not recommended.
- iii. Animals be allowed enough rest, Figure 4.2 (24 hours) before slaughter to improve quality of meat and hides and skins
- iv. The animals should be given a good drink of water for cooling them down and facilitating the loosening of the attachment between the hide/skin and the flesh for ease of flaying
- v. The conditions of holding of animals presented for slaughter should minimize cross-contamination and facilitate efficient slaughter and dressing.
- vi. Slaughter animals should be subjected to ante-mortem inspection.
- vii. Ante-mortem inspection should be scientific- and non-risk-based
- viii. Ante-mortem should take into account all relevant information from the level of primary production
- ix. Relevant information from primary production where available and results of ante-mortem inspection should be utilized in process control.
- x. Relevant information from ante-mortem inspection should be analysed and returned to the primary producer as appropriate.



Figure 4.1: Bad animal transportation pre-slaughter

(Source; Kioko, P. Training manual for FAO Somalia meat draft report, 2013)



Figure 4.2: Good animal rest pre-slaughter

(Source; Kioko, P. Training manual for FAO Somalia meat draft report, 2013)

1.11.2 Recommended Slaughter techniques/practices

a) Restraining animals

You must restrain an animal before you stun or kill it. The equipment for restraining animals must:

- i. Be in good working order
- ii. Allow you to stun or kill an animal effectively
- iii. Prevent injury or cuts to animals
- iv. Minimize struggling and vocalization
- v. Minimize the time an animal is restrained.

You must only put animals into restraining equipment, including head restraints, when you're ready to stun or kill the animal.

b) Stunning pens for cattle

You must use a stunning pen or restraining pen for adult cattle, including bovine animals such as buffalo and bison. You must only use restraining equipment in the way described in the manufacturer's instructions. Stunning pens and restraining boxes must:

- i. Be in good working order
- ii. Only accommodate one animal at a time
- iii. Prevent any large movements forwards, backwards or sideways
- iv. Allow complete access to an animal's forehead.

c) Stunning cattle with a pneumatic captive bolt

If you use pneumatic captive bolts you must have a restraining device in any new stunning pens and restraining boxes. Additionally, you must:

- i. Restrict an animal's head from moving both up and down, and side to side
- ii. Allow the release of an animal's head immediately after stunning.

1.11.3 Reasons for humane slaughter

- i. To comply with animal welfare requirements
- ii. To prevent needless suffering;
- iii. It results in safer and better working conditions for persons engaged in slaughtering operations;
- iv. It brings about improvement of products and economies in slaughtering operations; and
- v. To produce other benefits for producers, processors, and consumers that tend to expedite an orderly flow of livestock and livestock products in interstate and foreign commerce.

1.11.4 Equipment used for stunning and correct stunning position

The commonly used equipment is the captive stunning bolt Figure 4.3. A captive bolt stunning gun kills the animal and reduces it instantly unconscious without causing pain. The correct position for stunning small stock is shown in Figure 4.4 while stunning for large stock (bovines) is shown in Figure 4.5. Figure 4.6 shows stunning in progress.



Figure 4.3: Cash special captive bolt stunner gun

(Source; Accles & Shelvoke UK, <https://www.walltonsic.com>)

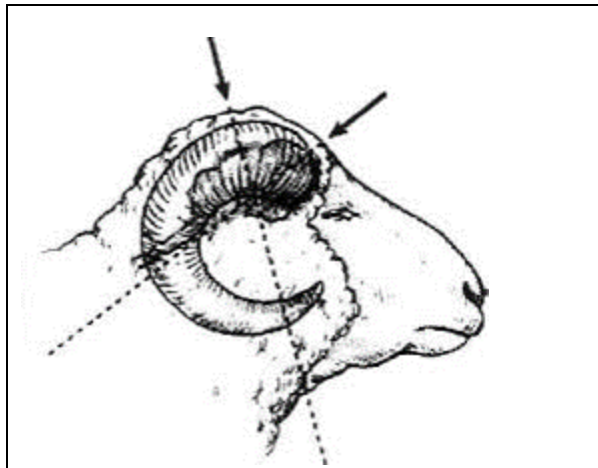


Figure 4.4: Sheep or goat captive bolt position

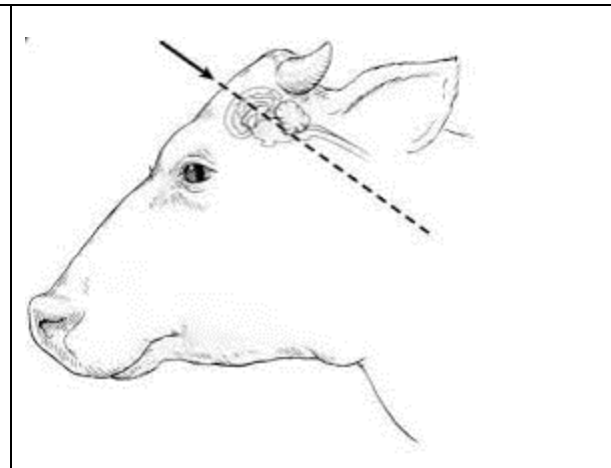


Figure 4.5: Cattle captive bolt position

(Yami, 2009)



Figure 4.6: Stunner in the correct position

Source: <http://bit.ly/2vscNPs>

1.12 Best Bleeding and Flaying Practices

1.12.1 Bleeding

The objectives of bleeding are to kill the animal with minimal damage to the carcass and to remove quickly as much blood as possible as blood is an ideal medium for the growth of bacteria. Sticking, severing the major arteries of the neck, should immediately follow stunning. Care must be taken not to puncture the chest cavity or it will fill with blood. Immediately following stunning the animal is hoisted by one leg and stuck. For sheep, the sticking point is in the side of the neck, the gash cut severing all the major blood vessels in a single movement (closer to the head) as shown in Figure 4.7. The sticking point for pigs is in the centre of the neck just in front of the breastbone as shown in Figure 4.8.

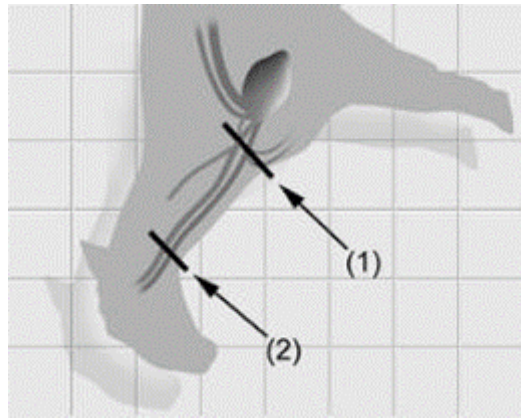


Figure 4.7: Sticking point for the sheep

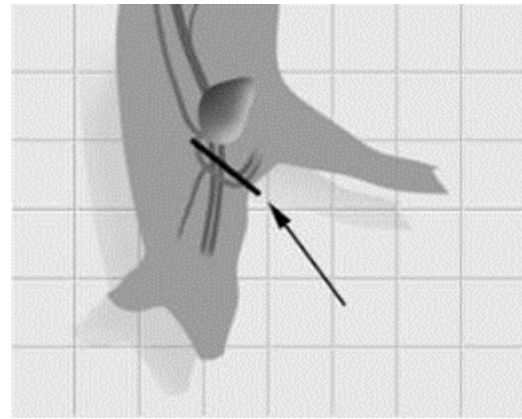


Figure 4.8: Sticking point for the pig

Source:

The procedure for best practices in both bleeding and flaying should follow the following steps:

- i. Sterilize the cutting knife in water at 82°C
- ii. Bleed on a clean tilting surface or hanging position
- iii. Slaughter/Flay on cradles or tables or hanging rail/suspension
- iv. Remove head and after skinning wash it
- v. Ensure equipment that touch the skin does not contact the meat.
- vi. Do not leave any hair or skin pieces on the meat
- vii. Use clean hooks, knives and protective clothes.
- viii. Do not leave the carcass to bleed while lying flat (horizontally) on the ground, Figure 4.9
- ix. Hoist the carcass upside down on rails to ensure complete bleeding as shown in Figure 4.10.



Figure 4.9: Poor bleeding practice

Source: <http://bit.ly/2wB6XAY>



Figure 4.10: Best Bleeding practise

(Source; Kioko, P. *Training manual for FAO Somalia meat draft report*, 2013)

1.12.2 Flaying

Flaying is the removal of skin from the carcass. Generally, an attempt is made to keep the removed portion of skin intact and with very few holes or no holes at all. An animal may be flayed in preparation for human consumption, or for its hide or fur; this is more commonly called skinning and improper slaughtering and flaying practices cause damage to hides and skins. The type of flaying equipment also plays a major role in the production of good quality hides and skins. Most slaughter facilities in the pastoral areas and even in urban areas use hand flaying and as a result, flay cuts, scores and gouges are a common feature on hides and skins. It's observed that hides and skins from homesteads are of much lower quality because of the number of gouges and holes in the hides and skins. In more organized slaughterhouses, hides and skins quality is taken into consideration by minimizing holes and gouges. Flay cuts, scores or gouges in hides and skins are caused by the careless use of the knife or by the use of unsuitable knives. Flay cuts constitute the most serious mechanical defects on hides and skins. Lack of proper tools like the rounded flaying knives, lack of flaying skills and carelessness lead to loss of quality or outright rejection of raw hides and skins.

1.12.2.1 Flaying in Rural Setup

Livestock in a country are either slaughtered at homesteads, village slaughter slabs or at urban slaughterhouses. Slaughterhouses and Abattoirs have fairly good basic facilities that if properly used can add value to the hides and skins. Ideal slaughtering always brings out best value and grades of hides and skins. Poor flaying causes holes and cuts on the hides and skins, which consequently fetch lower prices because of the poor quality, and also results in higher rejection by tanneries. Figures 4.11 and 4.12 illustrate the best bleeding and flaying techniques in rural areas.



Figure 4.11: Best Bleeding techniques in rural areas



Figure 4.12: Tree flaying in rural areas

(Source; Mwundu, J. Conference paper on best practices in flaying techniques, 2016)

During flaying the recommended sequence of events for both large and small stock are as shown in Figure 4.13 while Figure 4.14 shows the sequence for slaughtering specifically for small stock such as sheep where the skin can be pulled by hand after slitting the throat.

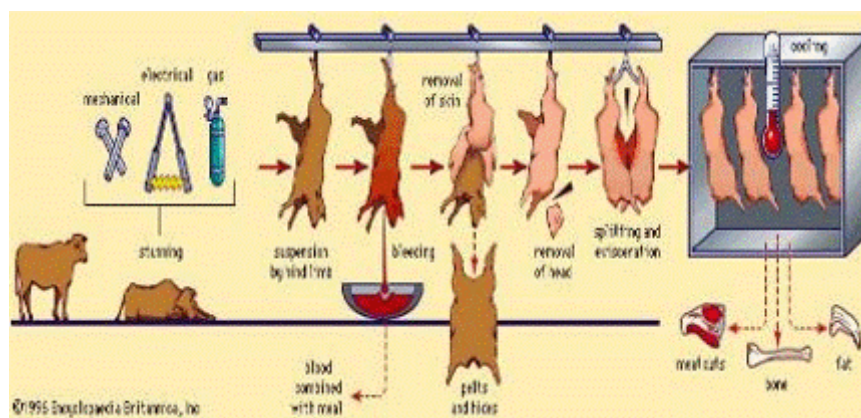


Figure 4.13 Flaying sequence operations.

(Source; Slaughtering procedures, Tanzania Meat Processing Company)

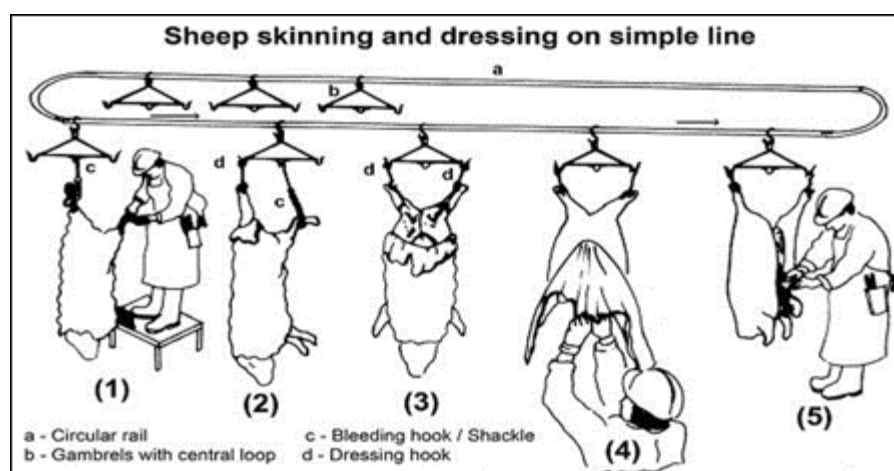


Figure 4.14: Sheep skinning by pulling method

(Ockerman & Hansen, 1999)

To improve and maintain quality of hides and skins at homesteads;

- i. Blow or pull out skins or use proper flaying knives to avoid damaging the hides and skins
- ii. Animals to be slaughtered must be kept in good structures near the slaughter point.
- iii. Animals must be kept away from blood and slaughtered carcasses to avoid the animal turning violent.
- iv. Restraining and bleeding of animals being slaughtered should be properly done on smooth and slanting floor.
- v. Proper ripping lines should be followed for better hides and skins shape.
- vi. The removal of hides and skins should be done immediately (when the carcass is still warm) to avoid cooling of the carcass for easier flaying.
- vii. Proper and recommended tools must be made available and used for the intended purpose.
- viii. Grading of green (wet) hides and skins should be done to give correct value of the hides and skins produced immediately after flaying.
- ix. The green hides and skins should be cooled by washing with cold water. Curing process should start within six hours after slaughtering to prevent the onset of autolysis (first signs of cell breakdown due to self-digestion of the cells once body metabolism stops after the animal's death).
- x. Preservation of green hides and skins for the first six hours should be done using easily available preservation materials e.g. immersing in a container filled with cold water for a period of not more than 6 hours waiting proper curing.

1.12.2.2 Evisceration and splitting

a) Skinning

When skinning the carcass, the operator of a slaughtering or processing facility should ensure that

- i. The oesophagus is prodded and tied before evisceration or skinning to prevent escape of rumen contents and carcass-viscera contamination;
- ii. Feet are removed before the carcass is otherwise cut;
- iii. Skinning is performed using either a bed system or an on-the-rail system;
- iv. Except for sticking the carcass to bleed it and starting the skinning, the skin is cut from inside outward to prevent carcass contamination with cut hair or dirt;
- v. The hair side of the hide is carefully rolled or reflected away from the carcass during skinning to prevent contamination to the flesh and muscle from the hide; if an on-the-rail system is used, skinning must begin with hind shank and proceed downward;
- vi. Exposed meat does not contact floors, walls, or equipment when the carcass is moved;

- vii. Floors, walls, and equipment in the skinning area are kept clean and, if contaminated by gut or faecal material, the floor, wall, or equipment is washed immediately and sanitized using care not to splash a carcass or processed meat;
- viii. The hide is pulled down or the carcass pulled up to prevent hair contamination if a mechanical hide puller is used;
- ix. Lactating udders are removed to prevent soilage of carcasses, facilities, or equipment; however, if an area of a carcass is contaminated from lactating udders, the contaminated portion of the carcass must be trimmed immediately; contaminated facilities or equipment must be washed and sanitized immediately;
- x. The penis is removed to prevent carcass contamination due to urine spillage; if a bed system is used, the penis shall be removed while the carcass is at half-hoist;
- xi. The brisket is opened to facilitate removal of thoracic viscera;
- xii. The bung is dropped as a final part of rumping;
- xiii. The perineal skin is pulled laterally over the anus leaving the sphincter intact;
- xiv. The cut around the bung and into the pelvic cavity is done with a clean knife; and
- xv. The rectum is tied to include the bladder's neck and to prevent urine and faecal leakage before evisceration.

b) Eviscerating

When eviscerating the carcass, the operator of a slaughtering or processing facility should ensure that:

- i. Before carcass opening, contaminants are trimmed from the midline area of the front of the carcass before opening the abdominal cavity; opening the abdominal cavity may not result in carcass or viscera contamination;
- ii. To minimize contamination, viscera removal is performed to pull or cut free abdominal viscera from the carcass without cutting or breaking the stomach or intestine; and
- iii. Urinary bladder removal is performed without urine spillage on the carcass, viscera, or equipment.

c) Splitting the carcass

When splitting the carcass, the operator of a slaughtering or processing facility should ensure that:

- i. Bruises, insect larvae, and other contamination are removed from the midline area of the back before splitting to prevent spreading contamination; and
- ii. The neck and fore shanks do not contact the floor.

d) Other procedures

When trimming the carcass, the operator of a slaughtering or processing facility should ensure that large blood clots and bruised tissue are removed. The operator of a slaughtering facility shall ensure that all carcasses are washed to remove hair, dirt, and other contaminants so that the contaminant does not contact other carcasses; and should be done from the top downward to eliminate possible contamination to clean areas of the carcass. The carcasses must be spaced to facilitate rapid chilling.

Additionally, ensure that evisceration is done into a receptacle such as a wheelbarrow or conveyor belt from suspension position (Figure 4.15 and splitting is done with right equipment such as an axe, splitting saw in a hanging position (Figure 4.16).



Figure 4.15: Best evisceration technique



Figure 4.16: Best Splitting Practice with axe

(Source; Kioko, P. *Training manual for FAO Somalia meat draft report*, 2013)

1.12.3 Flaying of large animals

After the throat, has been cut and the bleeding is over the carcass is put on the floor on its back wedged on both sides by wooden blocks against which the carcass rests. The flayer then makes a straight slit along the centre starting from the underlap down the throat, breast, belly and finishing at the tail. Then a cross slit is made at the breast right down to the joints of the forelegs. A similar cross slit is made at the lower part of the abdomen down to the joints of the hind legs. Then the hide is peeled off by hand, cutting the white membrane with a knife on the underside of the hide at places where it sticks so fast that it cannot be removed by pulling hard by hand or fisting.

If ripping is done as described above and shown in Figure 4.17 the hide will be of perfect square pattern and symmetrical on its two sides. If the flaying knife is carefully handled flaying damages are avoided.

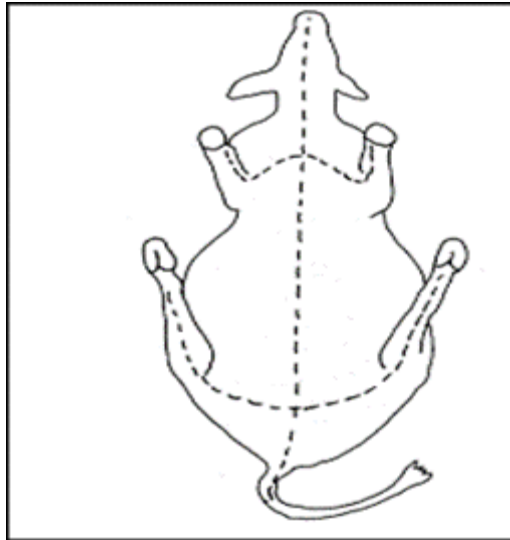


Figure 4.17: Correct line for ripping hide with ordinary knife before starting flaying

(Source: Sarkar, Theory and Practice of Leather Manufacture, 1985, page 32)

1.12.4 Flaying of small animals (goat and sheep)

Goat and sheepskins are often flayed without much use of a knife after slitting. The skins are loosened by thrusting with the fists. In some cases, the skin is drawn off without even slitting it down the belly, as shown in Figure 4.18. Such skins are called "Cased" skins which do not contain any butcher cuts. The skin usually sticks at the chest and at this place it is separated by using the knife. The skins are slit along the belly and opened out at the time of curing and preservation. Figure 4.19 shows best flaying technique for cattle hides by placing the carcass on cradle instead of bare ground.



Figure 4.18: Best Flaying technique by pulling skin



Figure 4.19: Best Flaying technique on cradle

(Source; Kioko, P. (Training manual for FAO Somalia meat draft report, 2013)

1.12.5 Vertical and horizontal flaying

Whatever the method used, hand flaying or hand assisted machine flaying, there is a choice whether to perform the operation, or part of it, with the carcass lying on the ground, or with the carcass hanging vertically from a hook or rail.

Evidence and logic show that when a carcass is lying on the floor of a slaughterhouse or slaughter slab, Figure 4.20; the quality of the flaying is lower than when the flaying operation is executed on a hanging carcass, Figure 4.21. The flaying job on a hanging carcass is done easier, faster and with less fatigue. The fringe benefit of working on a hanging carcass is also improved hygiene and better food safety to the benefit of public health.



Figure 4.20: Bad Flaying Technique



Figure 4.21: Best Flaying Technique

(Kioko, P. (Training manual for FAO Somalia meat draft report, 2013)

1.13 Meat Inspection

1.13.1 Antemortem inspection

Antemortem inspection should be carried out in adequate lighting where the animals can be observed both collectively and individually at rest and in motion. The general behaviour of animals should be observed, as well as their nutritional status, cleanliness, signs of diseases and abnormalities. Some of the abnormalities which are checked on antemortem examination include: respiration, behaviour, gait, posture, structure and conformation, discharges or protrusions from body openings, colour and odour

Abnormalities in respiration commonly refer to frequency of respiration. If the breathing pattern is different from normal the animal should be segregated as a suspect. Abnormalities in behaviour are manifested by one or more of the following signs:

- i. Walking in circles or show an abnormal gait or posture
- ii. Pushing its head against a wall
- iii. Charging at various objects and acting aggressively
- iv. Showing a dull and anxious expression in the eyes

An abnormal gait in an animal is associated with pain in the legs, chest or abdomen or is an indication of nervous disease. Abnormal posture in an animal is observed as tucked up abdomen or the animal may stand with an extended head and stretched out feet. The animal may also be laying and have its head turned along its side. When it is unable to rise, it is often called a "downer". Downer animals should be handled with caution in order to prevent further suffering. Abnormalities in structure (conformation) are manifested by:

- i. Swellings (abscesses) seen commonly in swine
- ii. Enlarged joints
- iii. Umbilical swelling (hernia or omphalophlebitis)

- iv. Enlarged sensitive udder indicative of mastitis
- v. Enlarged jaw ("lumpy jaw")
- vi. Bloated abdomen.

Examples of abnormal discharges or protrusions from the body are:

- i. Discharges from the nose, excessive saliva from the mouth, afterbirth
- ii. Protruding from the vulva, intestine
- iii. Protruding from the rectum (prolapsed rectum) or uterus
- iv. Protruding from the vagina (prolapsed uterus)
- v. Growths on the eye and bloody diarrhoea.

Abnormal colour such as black areas on horses and swine, red areas on light coloured skin (inflammation), dark blue areas on the skin or udder (gangrene). An abnormal odour is difficult to detect on routine antemortem (A/M) examination. The odour of an abscess, a medicinal odour, stinkweed odour or an acetone odour of ketosis may be observed.

Since many abattoirs in developing countries have no accommodation station or yards for animals, Inspector's antemortem judgement must be performed at the admission of slaughter animals.

1.13.2 Post mortem inspection

Routine post-mortem examination of a carcass should be carried out as soon as possible after the completion of dressing in order to detect any abnormalities so that products only conditionally fit for human consumption are not passed as food. All organs and carcass portions should be kept together and correlated for inspection before they are removed from the slaughter floor.

Post mortem inspection should provide necessary information for the scientific evaluation of pathological lesions pertinent to the wholesomeness of meat. Professional and technical knowledge must be fully utilized by:

- i. Viewing, incision, palpation and olfaction techniques.
- ii. Classifying the lesions into one of two major categories - acute or chronic.
- iii. Establishing whether the condition is localized or generalized, and the extent of systemic changes in other organs or tissues.
- iv. Determining the significance of primary and systemic pathological lesions and their relevance to major organs and systems, particularly the liver, kidneys, heart, spleen and lymphatic system.
- v. Coordinating all the components of antemortem and post-mortem findings to make a final diagnosis.
- vi. Submitting the samples to the laboratory for diagnostic support, if abattoir has holding and refrigeration facilities for carcasses under detention.

1.13.3 Carcass judgement

1.13.3.1 *Trimming or condemnation*

Trimming or condemning carcass is carried out when:

- i. Any portion of a carcass or a carcass that is abnormal or diseased.
- ii. Any portion of a carcass or a carcass affected with a condition that may present a hazard to human health.
- iii. Any portion of a carcass or a carcass that may be repulsive to the consumer.

1.13.3.2 *Localized versus generalized conditions*

It is important to differentiate between a localized and a generalized condition in the judgement of an animal carcass. In a localized condition, a lesion is restricted by the animal defence mechanisms to a certain area or organ. Systemic changes associated with a localized condition may also occur. Example: jaundice caused by liver infection or toxæmia following pyometra (abscess in the uterus).

In a generalized condition, the animal's defence mechanisms are unable to stop the spread of the disease process by way of the circulatory or lymphatic systems. The lymph nodes of the carcass should be examined if pathological lesions are generalized. Some of the signs of a generalized disease are:

- i. Generalized inflammation of lymph nodes including the lymph nodes of the head, viscera and/or the lymph nodes of the carcass
- ii. Inflammation of joints
- iii. Lesions in different organs including liver, spleen kidneys and heart
- iv. The presence of multiple abscesses in different portions of the carcass including the spine of ruminants

Generalized lesions usually require more severe judgement than localized lesions. It is worth to note the following:

- i. Ante mortem judgments are correlated with post mortem inspection.
- ii. Slaughtering process is supervised by a competent meat inspector in white uniform and butcher's knife, Figure 4.22
- iii. All meat portions and carcasses are inspected by the meat inspector everyday
- iv. Enough light, either natural or artificial
- v. There are tight and lockable condemned meat receptacles.
- vi. There is a lockable detention room for detained meat.
- vii. Condemned meat and organs is disposed of under his/her supervision in a deep (30 feet) pit with permanent lock or into an incinerator
- viii. All animals for slaughter are accompanied by information from primary producers
- ix. Passed meat for human consumption bears an inspection mark or lot number.



Figure 4.22 Best meat inspection technique with butcher's knife and right white uniform (above)

(Source; Kioko, P. Training manual for FAO Somalia meat draft report, 2013)

1.14 Meat Transport and Hygiene

Suggestions for Safe Meat Transport include:

- i. Make sure the meat carrying compartment of the vehicle is capable of maintaining the required temperature of the meat during the journey. Refrigeration units should be serviced regularly.
- ii. Cold air loss is one of the main causes of rising product temperature. The usual culprits are doors open too long, seals (check and replace), poor closure (repair damaged hinges and seals), cracked floors and ceilings (repair), draining holes (plug them until needed).
- iii. Clean out and air dry the truck daily. You wouldn't put tonight's lamb roast on yesterday's dirty dinner plates. The same goes for raw meat.
- iv. Make sure caps and clothing are clean and that you understand the benefits of personal hygiene. Drivers should wash their hands before loading and after delivery. You're always under the scrutiny of the general public.
- v. Closing the truck doors as much as possible and plastic curtains (regularly cleaned) help reduce cold air loss. The refrigeration compartment should be pre-chilled prior to loading.
- vi. Donkey carts and open containers, Figure 4.23 are not recommended.
- vii. Separate areas and containers for transportation of raw edible meat; red offal's and rough offal's.
- viii. The meat carrier or container design and construction material is non-corrosive, permanent and easy to wash and disinfect, Figure 4.24.
- ix. Containers or carriers are checked and cleaned by owner before loading of meat.
- x. Carriers or containers are fitted with cooling system.

- xi. Meat consignment is accompanied by a certificate of approval from inspecting official in the slaughterhouse to destination
- xii. Meat loaders and handlers have medical certification approval
- xiii. Meat loaders wear full body covering protective clothes during work.



Figure 4.23: Bad meat transport technique on donkey carts covered by dirty cartons



Figure 4.24: Best meat transport technique in a non-corrosive meat container and clean loader

(Source; Kioko, P. Training manual for FAO Somalia meat draft report, 2013)

MODULE 5: CURING AND PRESERVATION OF HIDES AND SKINS

1.15 Module 5 Outcome and Objectives

Table 5.1 presents the module outcome and objectives.

Table 5.1: Module 5 Outcome and Objectives

Module Outcome, Objectives and Duration:
Outcome: By the end of the training the participants will have developed competency in approaches on curing and preservation of hides and skins
Objective: To enhance participants learning on competency and skills of curing and preservation of hides and skins
Duration: 6 hours
Topic 1
Hides and skins curing;
Tasks/Activities
i. Probing participants experience with different curing methods for hides and skins.
ii. Questions and answers
Teaching Aids
❖ Flipcharts
❖ Marker pans
❖ Notebooks
❖ Hides and Skins samples (green, chilled, wet salted, dry salted, brined and air dried)
Topic 2
Hides and skins records in the curing premises
Tasks/Activities
i. Trainer's verbal and illustration presentation on keeping hides and skins records.
ii. Questions and answers
Teaching Aids
❖ Flipcharts
❖ Marker pans
❖ Notebooks
❖ Ledger books

1.16 Preservation of Hides and Skins for Value Addition

In case tanning facilities are available nearby, the green hides and skins can be processed directly without curing. This should however be done within six hours. However, if tanning is only possible after the six hours have elapsed, then curing is necessary immediately in order to preserve the quality of the green hides and skins, and prepare them for tanning process.

Curing is the process of preserving hides and skins for longer periods in order to maintain their quality and prepare them for the tanning process. The most common methods of curing are, Air drying and salting.

1.16.1 Curing by drying

Hides and skins among the pastoralist communities are commonly cured by drying. Two methods of drying are commonly practiced, namely;

- i. Frame drying (referred to as suspension drying in Kenya), and
- ii. Sun drying (not recommended)

Frame drying (referred to as "suspension drying" in Kenya): - In frame drying the hides are stretched out by tying them to a rectangular wooden frame. Usually the hides are stretched out more lengthwise than breadthwise. The stretched hides are dried out under shade in specifically designed drying premises (bandas) so that drying takes place in a good current of air circulation. The hides are kept under a shed to avoid exposure to the hot sun which will cause rapid drying on the flesh and grain surfaces forming a hard crust and thus prevent drying of the internal layers of the hides. Too much heat can also lead to gelatinization of the collagen fibres. Furthermore, too rapid drying causes damage due to the outer layers becoming horny and the inner layers glutinous due to excess moisture remaining in the interior of the hides. The hides are thus putrefied at different places which appear as blisters after soaking and liming. The blisters are caused due to putrefaction of the inner layers of the hides. Besides forming blisters rapid drying under hot sun coagulates the albumins in the hide and makes them insoluble. Although drying at higher temperature does not coagulate collagen fibres but it makes them resistant to water absorption. Hides which have been dried out in the hot sun are soaked back with great difficulty. Whether or not a hide has been dried under the hot sun can be ascertained from the colour of the flesh. Slow drying under protection from the direct rays of sun and in a good current of air circulation keeps the hides softer and the flesh side whitish in colour. Rapid drying under hot sun makes the flesh side yellowish in colour. The frame dried hides are known in the trade as 'framed hides' or suspension dried hides and are regarded to be better than the sun-dried hides.

1.16.1.1 *Ground drying*

Sometimes fallen stock in the remote rural villages are dried by pegging them on the ground (ground drying) as shown in Figure 5.1 below. Small slits are made at convenient distances all-round the edges. Pointed pegs are inserted through the slits and the pegs are hammered down to the ground. Being pegged all round, the hides dry out in the stretched condition.



Figure 5.1: Drying of hides by ground dry method, which is not recommended

(Source: Hides and skins manual for the arid and semi-arid lands of Kenya, 2007)

The degree of drying or the amount of moisture remaining in the dried hides depends on the amount of relative humidity in the air at the time of drying. If the relative humidity is more the amount of moisture left in the hide is greater. Sun dried hides contain about 10% moisture. Sun dried hides or flints are relatively slow to absorb water. The difficulty which is usually met with such class of hides is the non-uniformity of soaking.

1.16.1.2 Suspension air drying

This involves suspending the green hide and skin on a frame in order to dry. It requires proper washing, fleshing and trimming prior to symmetrically suspending the hide or skin on a suspension drying frame in a drying shade (Banda). The Banda is usually constructed on a North- south orientation so that wind blows through if from the East- West directions. A 10 square feet size wood or pole frame is prepared. This can take 1 hide or 4 skins as shown below (Figure 5.2).



Figure 5.2: Drying of hides by suspension method

(Source: Hides and skins manual for the arid and semi-arid lands of Kenya, 2007)

The frames should be 1 foot from the ground (to allow air flow, sweeping or washing of the floor) and spaced 1 foot apart (to allow air flow, allow easier access by the Banda

man). To avoid putrefaction, the suspended hide /skin should never touch the poles of the frame. The steps followed in suspension air drying include:

- i. Wash the hides or skins with cold water to cool and remove soil, dirt, dung and blood.
- ii. Then using a flaying knife, remove flesh and fat that were left on the hides and skins.
- iii. Perforate the skins/hide at the edges for suspending on the frame as shown Figure 5.2 (above) and Figure 5.3 (below).
- iv. Drying should not be less than 5 days for a skin and not less than 7 days for a hide. After this period, the dry and cured materials can be sold or stored.

1.16.2 Salting method

Salting involves applying white coarse industrial salt on green hides and skins in order to preserve them and still retain some reasonable amount of water. Even though the processing method is similar, it results in two different products. There are two types of salting methods depending on where the hides and skins are;

1.16.2.1 Drying salting Method

In hot and dry areas that are far from the tanneries like Northern Kenya, or South Sudan, the salted hides and skins in most cases end up drying before 21 days are over. This results with dry salted hides and skins. They are folded, stored, and transported to markets at a convenient time. These products are lighter and easier to transport. The prices offered are different from the Air -dried and wet salted ones due to difference in water content.

The danger of putrefaction during drying of hides can be greatly reduced by salting before proceeding with drying. Material of better quality is produced and the tanner has much less difficulty in soaking this back to normal water content.

Dry-salting of a hide or skin is carried out by placing the stock flesh-up on a flat surface and applying salt on the flesh side (about 60% to 70% of green weight), taking care to rub salt in, particularly at the edges. The hide or skin is then folded flesh-to-flesh along the backbone and rolled into a bundle. The treated stock is left for 72 hours before opening, excess salt is shaken off and the material dried by hanging over a beam about 8 to 10 cm in diameter to avoid sharp folding of the hide. Beam direction is usually East West to avoid direct exposure of the hide surface to the sun. The neck and the backbone are placed along the beam and the material is turned over several times on the second day. Dry-salted goods are light in weight, can be kept indefinitely in good storage conditions (between 2 and 3 years), are immune to insect attack and are relatively easy to soak back.

1.16.2.2 Wet salting method

Wet-salting of hides is usually carried out in areas where the quantity of hides handled is fairly large. In this case, a quantity of antiseptic is added to the curing salt used. Sodium

chloride in the pure state is not a perfect curing agent since it allows halophilic (or "salt-tolerant") organisms to develop. These are responsible for the appearance of "red heat" or "purple heat" on hides cured with salt alone. These colorations on hides are due to the production of coloured pigments by these salt-tolerant bacterial types. For good curing, the action of sodium chloride should be reinforced by adding substances with disinfecting properties. Powder mixtures of salt with boric acid, sodium carbonate, naphthalene, sodium bisulfite, sodium fluoride, sodium silicofluoride, and zinc chloride have been found effective for this purpose. In a typical case, 1 % w/w boric acid and 1 % w/w naphthalene based on salt weight are used in the mix.

The preservation of hides and skins by wet-salting process consists of sufficiently dehydrating the fresh hides and skins in order to prevent the development of bacteria causing putrefaction, and sorting them in a pile in such a way that the pickling brine resulting from the dehydration can be easily drained off. Dehydration by wet-salting is carried out by means of a homogeneous mixture of salt and chemicals to which antiseptic products have been added to avoid development of defects of microbial origin such as red spots, hairslip and run fresh etc. Before salting, the hides and skins should be carefully washed in cold water. After cleaning and draining of the hides or skins, salting should be started as soon as possible (in case of slaughtered animals, not later than 5-6 hours after the animal has been flayed).

The curing procedure for wet salting is summarized below:

- i. Wash green hides and skins and spread flesh side up, on a slanting stand in a well-ventilated protected shade. The area should be free from vermin and insects e.g. dogs, rats, beetles and ants.
- ii. Apply coarse industrial salt sufficiently on the flesh side of the washed skin (2kilos per skin) or for hides (6kilos per hide). In hot areas shuffling of the salted stacked hides and skins is recommended to avoid red heat.
- iii. Stack the salted hides and skins 1.5 metres high (as shown in Figure 5.3) The stacked materials will be fully cured after three weeks (21days). After this period the cured materials can be sold or stored as described in chapter 6 (Module.VI).

However, defects are still likely to appear during this processing. The following should be avoided.

- i. Careless cooling: cool hides by washing in cold water, storing under shade especially in hot areas.
- ii. Uneven and / or poor salting - spread salt uniformly.
- iii. Pilling too high above 1.5 metres.
- iv. Using dirty or unsuitable salt.
- v. Salting green hides and skins before they have sufficiently cooled.



Figure 5.3: A pile of wet salted hides

(Source: Hides and skins manual for the arid and semi-arid lands of Kenya, 2007)

1.16.3 Brining of hides

Brine curing involves submerging the freshly-flayed hides in a saturated brine solution (minimum 33% salt solution). The hides are then subjected to constant slow agitation in the saturated brine for a period of up to 24 hours, either in a specially designed raceway system or in a solution of brine in a rotating drum. This method promotes more rapid penetration of salt than in the static wet-salting methods described above since brine is already present when the hides are introduced. The solution contacts both sides of the hide uniformly although penetration is more rapid from the flesh-side: the mechanical agitation also promotes more rapid penetration of brine.

Dry-drum salting is a variation on drum-brine curing in which the washed and drained green hides are drummed directly with a quantity of dry curing salt plus antiseptic (approximately 30 % w/w on green weight) in the absence of any added water. Brine formation takes place on the surface of the hides and slow rotation of the load promotes rapid penetration of salt in the form of brine, particularly during the initial stages of curing. The vessel used may be of the conventional wooden tannery-drum type or one of the modern stainless-steel, inclined hide processors which resemble the familiar concrete mixer. In either case, following initial agitated treatment, it is recommended that the hides be bundled or stacked with antiseptic-treated "safety" salt to complete the cure. Used brine can be reused several times after boiling, filtering and allowing it to settle out. There are number of advantages which can be claimed for brine curing of hides:

- i. Brine curing requires only a day in contrast to the wet-salting method requiring a minimum of 5-7 days, and up to a maximum of 21 days.
- ii. Brine curing can be done on concrete or wooden vats or in rotating wooden drums if mechanization is preferred.
- iii. Cost of curing can be significantly reduced if a process of regeneration and purification of the brine is followed.

- iv. Bactericidal additives to the curing agent which are essential for tropical climate can be applied more uniformly to the hides.

1.16.4 Improved practical method of preserving hides and skins

Hides and skins, if not well preserved, are of very little economic and commercial value. Because of this neglect, hides and skins produced in this region, go to waste. The most common method of preserving hides and skins in Semi-Arid and Arid areas (ASALs) is open air-drying that includes frame drying for hides only and triple wire drying for skins only. Other rudimentary and unrecommended methods that are still practiced by some livestock farmers, butchers and hide and skins buyers are ground-drying, pole-drying, roof-drying, and wall-drying. However, these methods do not result into properly seasoned stock that is acceptable to international markets. That is partly why the current earning from hides and skins is very low, particularly in the ASALs.

1.16.4.1 Improved Salting

The method described herein is an improved practical method of preserving hides and skins using salt. Whether you are using wet or dry salting method, the following activities are important:

a) Preparation:

- ❖ Removal of fats (Defatting);
- ❖ Removal of excess/ loose meat found on the stocks (Defleshing).
- ❖ Washing the stock using scrubbing brush to remove dirt and any other contamination (see the image on Washing the raw stock in Figure 5.4)
- ❖ Weighing the hide (not skin);

On the weight of the hide, 30%/ 1/3 of Magadi salt (calculated based on raw hide weight) is evenly sprinkled throughout the flesh-surface. In case of small stock (skins), 2 kg of Industrial sodium chloride salt (or 3 handfuls) is evenly sprinkled throughout the flesh side. On average, we will need five handfuls of salt for large size skins. Bundle the stock with flesh side in. First beginning with the side edges (see the image on Bundling hide after wet-salting in Figure 5.4). It is now ready for sale or storage. The hides and skins will be protected up to 6 months from bacterial infection.

With dry salting, the salt required is 60-70% of the green weight of the hide, or 6 tupelo mug full. Folding is done only once along the back-bone line with the flesh side out (see the detailed description of both wet-salting and dry-salting in section 5.2 (a) and (b)). In this type of dry-salting method, salt reduces moisture content to an extremely safe level of 20 - 30%.

b) Advantages

- ❖ Produces higher quality leather when tanned;
- ❖ It is market-demand oriented, especially for the European Union markets;
- ❖ Uses very little amount of water in soaking during tannery processing;
- ❖ In many cases salt is provided almost free of charge by the exporters or tanners;
- ❖ Livestock farmers and buyers get better incentives for their hides and skins.

c) Potential benefits

With the above explanation that clearly states the ease of preserving hides and skins using salt as well as the assured markets from the European Union, and indeed, other international markets; the hides and skins dealers will definitely benefit. A good hide or skin starts from the farm. It is therefore essential that the farmer keeps his animals healthy. Similarly, the hides and skins buyers would earn more money from the improved practical method of preservation using salt, as indicated in Figure 5.4.

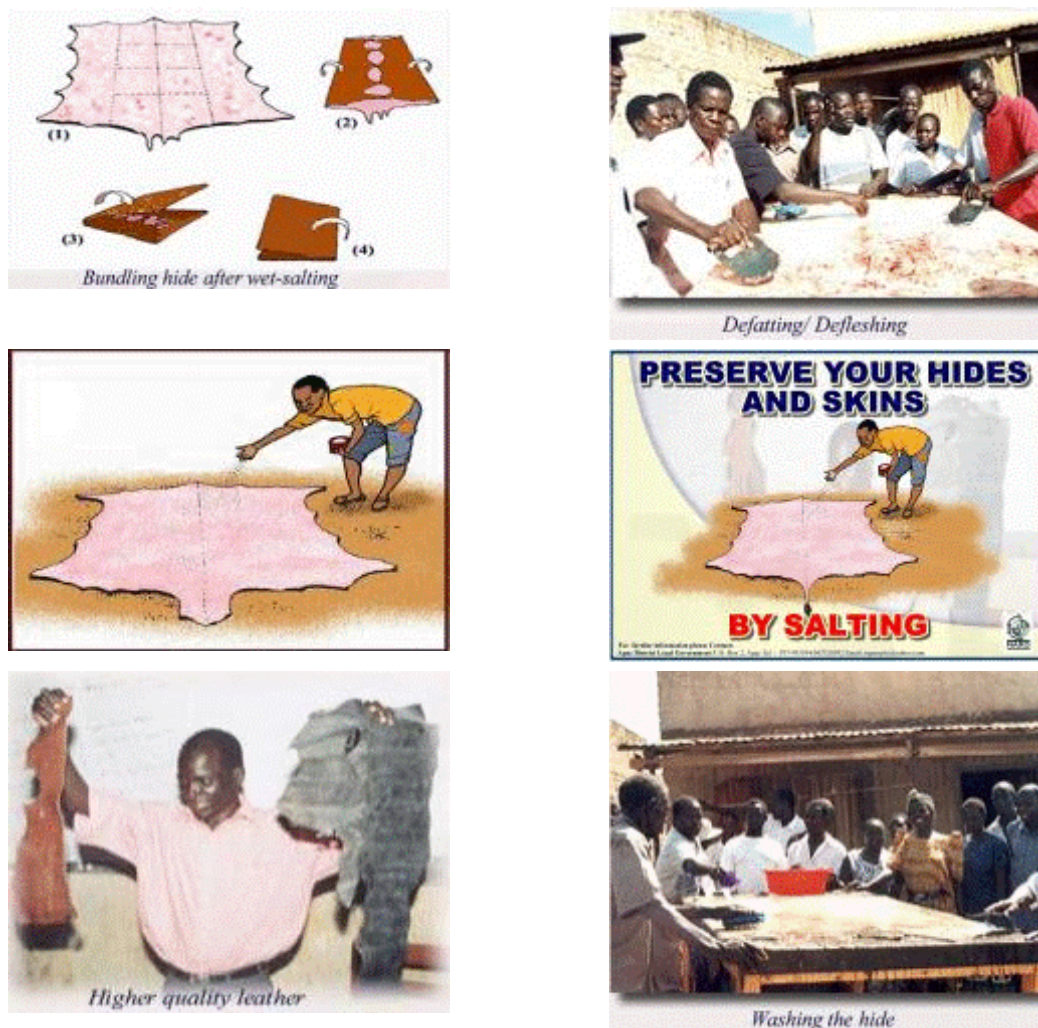


Figure 5.4: Best practice in wet salting of hides and skins

(Source; National Agricultural Productivity Research Organisation, Uganda, 2003)

1.17 Short Term Preservation Methods of Hides and Skins

1.17.1 Green hides

Increasing interest has been shown worldwide in the direct processing of green hides where tanneries and wet-blue plants are conveniently situated close to major hide sources such as large abattoirs. The possibilities in this direction are limited, however, without further restructuring within the tanning industry. Reports indicate little or no significant differences in leather quality resulting from green hide processing compared with salted hides; allowance has to be made, however, for the change in leather yields per unit mass of stock in going from salted to green hide intake at the tannery.

1.17.2 Refrigeration of hides

Refrigeration of hides either by chilling or freezing, significantly improves the storage life of green stock but requires substantial capital outlay in facilities for the initial cooling and maintenance of low temperature during subsequent transportation and storage. Freezing of hides below 0°C has been reported to give storage periods of many months without detriment to final leather quality, but suffers from the disadvantages that frozen stock is impossible to handle and sort and it takes a considerable time to thaw. Both chilling and freezing also pose problems in achieving rapid reduction of initial hide temperatures in that they necessitate suspending the material to expose both surfaces to pre-chilled moving air in specially designed chambers. Costs of refrigeration increase rapidly with lower storage temperatures.

1.17.3 Chilling methods

The temperature to which hides and skins should be chilled depends on the required time of preservation. Table 5.1 gives the maximum storage period at various temperatures when chilling is carried out immediately after flaying. If there is a delay before chilling, the storage time at a particular temperature is reduced, e.g. there will be deterioration within one day if hides are left at body temperature (37°C) for several hours before chilling to 20°C.

Table 5.2: Chilling of hides and skins

Storage Hide Temperature	Maximum Storage Period
35°C	6 hours
20°C	1 day
15°C	2 days
10°C	5 days
5°C	2 weeks
0°C	3 weeks

(Source: CSIRO, *Meat Technology Update*, 98/3 – June, 1998 (Reprinted November, 2006.

Website: www.meatupdate.csiro.au>date>Meat)

Various chilling methods can be used provided all areas of all hides and skins quickly reach the required temperature:

Crushed ice added to collection bins or drummed with hides, often in mixers. This is cost effective and the most commonly used method, particularly in the developed world, is ice machines (bought or leased), or bulky loads of ice stored in chillers until required

- ❖ Fluming, spraying or bath washing with chilled water.
- ❖ Application of dry ice particles (carbon dioxide snow – expensive).
- ❖ Placing in a freezer.
- ❖ Hanging hides on hooks on a conveyor in a chiller which can be mobile. In one chilling plant hides are hung on hooks on a continuous chain which firstly takes them through a high-pressure washer, then through a chiller which chills them to 5°C in 48 hours while they drain. They are then conveyed out of the chiller where after trimming, they are automatically removed from the hooks into a crate for storage in the chiller.

The flesh side of skins can partially dry out during chilling and, if these skins are subsequently salted, salt penetration problems occur. Moistening the skins before salting will allow rapid penetration of salt. If chilling facilities are not available but there are drying sheds on site, hanging sheepskins as for drying will lower their temperature.

a) Advantages of chilling

Chilling is used in various ways for holding hides and skins for up to three weeks. The main advantages of chilling are:

- ❖ Hides can be quickly chilled by water or ice as they come from the killing floor.
- ❖ No pollution.
- ❖ No contamination of by-products.
- ❖ Suitable for all types of hides and skins.
- ❖ No hair-loosening. Chilling is therefore suitable for woolskins and hides which will subsequently be cured or tanned with the wool or hair on.

b) Disadvantages of chilling

- ❖ Hides and skins are good insulators and retain the body heat, so they should be chilled individually, immediately after flaying.
- ❖ If low temperatures are not maintained during transport and storage, damage can occur.
- ❖ The temperature of chilled hides needs to be raised before *unhairing*.

1.17.4 Antiseptic preservation (Chemical curing)

Antiseptics (biocides, bactericides) have traditionally been used as curing salt additives to control the growth of salt-tolerant, “red heat” producing bacteria; it is only in the last few decades that they have been seriously considered as the main basis of preservation treatment. Developments in short-term antiseptic preservation stem from the need to

extend the storage potential of green hides, particularly under hot weather conditions, without the use of salt.

Since the basis of conventional salt curing is partial dehydration and lowering of the water activity in the hide or skin, this requires the application of relatively large amounts of salt to saturate the hide moisture to a level (approximately 90 % saturation) at which bacterial activity is substantially reduced. Antiseptic preservation methods used for short-term preservation do not depend on physical saturation of hide water, but rather on chemical toxicity to kill the bacteria and are normally effective in controlling growth at much lower, less polluting levels of application.

1.17.4.1 *Types of antiseptics*

The range of proprietary and other antiseptic compounds of interest in curing applications contains a wide variety of substances, which are generally classified in two categories namely; inorganic and organic, according to general chemical character and/or mode antiseptic action.

Amongst the inorganic biocides, the suitability of boric acid-dip treatments for short-term hide preservation has been widely used, particularly as this material is relatively non-toxic, cheap and readily available. Fifteen minutes soaking in saturated (5 % m/v) boric acid solution can give five days' preservation at 30°C while 60 minutes soaking gives 15 days preservation at 27°C. A mixture of boric acid with other proprietary formulations for short-term hide preservation can give an extended storage period of up to three weeks at 25°C. However, the presence of excess boron in tannery effluent has been reported to be detrimental to citrus and tobacco crops and suitable alternatives to boric acid are being sought.

Inorganic compounds offering broad general activity against hide bacterial types are the oxidizing agents, particularly chlorites and hypochlorites, which release chlorine gas into solution, resulting in non-specific chemical attack on bacteria present. A drum/dip method for short-term hide preservation based on sodium chlorite (0.375 %) and fungicide addition gives storage period of up to one week at ambient temperature.

Reducing agents such as sodium sulphite and sodium bisulfite (or metabisulfite) act in a similar non-specific way by releasing active sulphur dioxide (SO₂) gas into solution to chemically degrade bacteria. This type of preservation is commonly used in the food industry where 1 % sodium sulphide used in conjunction with 1 % acetic acid is applied by drumming in a 20 % float to give an extended short-term sealed storage up to 30 days. The major disadvantage is the toxic and irritant effects of the volatile SO₂ given off by the treated stock, necessitating storage sealed in plastic to reduce losses.

Compared with simple inorganic antiseptic compounds, the complex proprietary organic compounds are generally costlier and tend to be more specific in their bactericidal effects. Use of single antiseptics in hide preservation has shown that these generally provide limited storage. The application of compatible antiseptic mixtures will normally extend the activity range and provide enhanced antiseptic activity or synergistic effects

for longer storage protection. Relatively few proprietary antiseptics have been developed specifically for the leather industry and it is thus necessary to critically evaluate proposed products for undesirable pre-tanning, staining or other adverse effects on leather quality, before recommending their use as preservatives.

1.17.4.2 *Characteristics of antiseptic preservation*

The chief features which distinguish antiseptic preservation from the conventional salt curing can be summarized as follows:

- ❖ Preservation depends on the toxic effects of the antiseptic used toward hide bacteria as opposed to physical dehydration of the hide/skin due to uptake of moisture by the curing salt in the case of salt curing where bacteria are immobilized and rendered inactive.
- ❖ Only small quantities of compounds required to render bacteria harmless, but good antiseptic distribution is essential. Weight of treated hide is comparable with green hide as opposed to salt curing where weight losses up to 20 % may occur in going from green to cured state.
- ❖ Single antiseptic treatment is effective against all bacterial types as opposed to conventional salt curing where use of antiseptic additives (e.g. boric acid and naphthalene) is desirable to protect the hide over initial stages of cure and to control halophilic bacteria.
- ❖ Drying out should be avoided since antiseptic compounds lack the humectant properties of salt, fibre adhesion increases and wetting back may become difficult as opposed to salted stock where drying out is permissible since salt in the hide maintains fibre separation and promotes wetting back.
- ❖ Antiseptics in many cases have complex organic structures with mild tanning affinity whereas salt (in salt curing) has no chemical interaction with hide protein and can be removed by soaking.
- ❖ Antiseptic treatment times can be reduced to 1 hour with efficient drumming as opposed to salting, which is, essentially, a slow diffusion process leading to the possibility of delayed cure.
- ❖ Antiseptic preservation provides short-term storage which varies with the particular antiseptics used whereas salt curing produces long-term stability.
- ❖ Antiseptic compounds in many instances are degradable in acid or alkali, by oxidation or by bacteria at high dilution. On the other hand, salt is an intractable component in effluent which is costly and difficult to remove.

MODULE 6: MAINTAINING VALUE OF HIDES AND SKINS DURING STORAGE AND TRANSPORT

1.18 Module 6 Outcome and Objectives

Table 6.1 presents the module outcome and objectives.

Table 6.1: Module 6 Outcome and Objectives

Module Outcome, Objectives and Duration:
Outcome: By the end of the training the participants will have developed competency in approaches and risks of transporting and storing hides and skins
Objective: To enhance participants learning towards competency and skills of transporting and storing hides and skins
Duration: 3hours
Topic 1
Hides and skins storage site/ platforms
Tasks/Activities
<ul style="list-style-type: none"> i. Probing participants experience with hides and skins storage site platform ii. Trainer's verbal and illustration presentation on hides and skins storage site requirements, platforms, dimensions iii. Questions and answers
Teaching Aids
<ul style="list-style-type: none"> ❖ Flipcharts ❖ Marker pans ❖ Notebooks ❖ Posters and illustrations
Topic 2
Hides and skins storage facilities, tools and equipment and Hides and skins sorting and selection.
Tasks/Activities
<ul style="list-style-type: none"> i. Probing participants experience with hides and skins storage facilities, tools. and equipment ii. Trainer's verbal and illustration presentation on storage facilities, tools and equipment. iii. Hands-on-experience with raw hides and skins sorting and selection. iv. Questions and answers
Teaching Aids
<ul style="list-style-type: none"> ❖ Flipcharts ❖ Marker pans ❖ Notebooks ❖ Illustrations ❖ Posters and photos
Topic 3
Sorting and selection of hides and skins as a prerequisite to hides and skins marketing
Tasks/Activities
<ul style="list-style-type: none"> i. Probing participants experience with grading of hides and skins. ii. Participant's narration of their experiences with different grades of hides and skins.

- iii. Facilitators verbal and illustrative presentation on grading of hides and skins

Teaching Aids

- ❖ Flipcharts
- ❖ Marker pens
- ❖ Notebooks
- ❖ Posters
- ❖ Practical wit hides and skins

Topic 4

Packaging hides and skins for transport

Tasks/Activities

- i. Probing participants experience with packaging hides and skins for transport.
- ii. Trainer's verbal and illustration presentation on keeping hides and skins records.
- iii. Questions and answers

Teaching Aids

- ❖ Flipcharts
- ❖ Marker pens
- ❖ Notebooks
- ❖ Posters
- ❖ Dry and wet salted hides and skins for practical packaging.

1.19 Maintaining Value of Hides and Skins during Storage

The important stages between curing and tanning are storage, grading and transport of the materials. The quality of the products should be maintained at all times during these stages.

1.19.1 Storage platforms

Storage of hides and skins involves keeping them in a store awaiting dispatch (transportation) or processing. The storage method depends on the type of curing method used i.e. wet salted or suspension dried. In all cases, wooden platforms made of timber raised to height of about 6" (15cm) from the floor are used in the store. The size of the platform for skins is 3 feet by 3 feet (1 meter by 1 meter) and for hides 6 feet by 3 feet (2 meters by 1 meter). Wet salted materials are stored on different platforms from the air-dried ones. Similarly, hides are stored on separate platforms from skins.

1.19.1.1 Folding

In wet salted hides and skins, the pieces are folded flesh side out or hair side inside so as to prevent damage to the hair side (the grain). Also, this prevents further drying of the wet salted hides and skins since the tannery requires them in wet form.

In air suspension, dried hides and skins, the pieces are folded lengthwise along the backbone, hair side inside or flesh side outside. This one is done in order to prevent the damage to the air side (grain) since this is the most important side of the hide /skin in leather manufacture (grain side).

The dried pieces should be protected from insect damage especially hide beetles and vermin (destructive animals and pests). Insect damage is prevented by dusting with insecticide formulations e.g. green man powder, on the hair side whereas constructing vermin proof premises can prevent the vermin. Care should be taken to prevent wetting back of dried pieces of hides and skins by water or any other liquid.

Hides and skins produced and cured in homes or rural settlement areas should be stored in places where smoke will not come in contact with them since it damages the hides and skins by staining and particularly interfering with tanning.

1.19.1.2 Sorting

Classification of raw hides and skins covers two broad activities, namely sorting and selection. Both of them have the aim of determining the suitability of each piece for manufacture of specific types of leather with differing qualities and characteristics. Sorting entails the following activities:

- i. To separate raw hides and skins of different animal species e.g. cattle hides, goatskins, and sheepskins.
- ii. To separate hides and skins according to the type of curing carried out e.g. air-dried, dry or wet salted.
- iii. To separate them according to breed e.g. hair-sheep skins, and wool-sheepskins.

1.19.1.3 Selection

Selection involves the classification of raw hides and skins into different categories of weight ranges and quality grades.

The hides or skins can be grouped into various international weight ranges. Hides have different groupings from skins as shown in Tables 6.2 and 6.3

Grading is part of selection and is the process by which the quality of the hides and skins is assessed and ranked in an acceptable trade rank scale. The current scale for raw hides and skins consists of five ranks rising from the best to the poorest i.e. grades 1, 2, 3, 4 and 5. Grade 1 is the best while the fifth grade is commonly referred to as reject.

Table 6.2: Selection of hides according to weight of each hide

Category	Air dried (kg)	Wet sated (kg)
• Calfskins	0-1.5	0-4.5
• Light weight	1.5-3.5	4.5-9.0
• Medium weight	3.5-5.5	9.0-13.5
• Heavy weight	5.5-7.25	13.5-18.0
• Extra weight	7.5 and up	18.0 and up

(Source: *Hides and Skins Manual for the Arid and Semi-Arid Lands of Kenya*, 2007)

Table 6.3: Selection of skins according to weight of 100 pieces of skins

Category	Weight (kg) per 100 pieces
light weight	25-35
medium weight	36-59
heavy weight	60 upwards

(Source: *Hides and Skins Manual for the Arid and Semi-Arid Lands of Kenya, 2007*)

Note: ensure that while loading, the vehicle is covered to avoid contamination or wetting. Avoid tying the bales too tightly which might cause damage to the hides/skins.

The purpose of grading is summarized below:

- ❖ To determine the product (hides and skins) market value.
- ❖ Motivate producers to produce better quality for better income.
- ❖ It eases arbitration between parties in dispute over value.
- ❖ Grading should be uniform and carefully done so as to avoid disparity in grades.

1.20 Transportation of cured hides and skins

Hides and skins transportation is mostly done using trucks, bicycles, and animals back and by humans to the market. During transport, scratching, tearing, wetting back and contamination may occur which leads to loss of quality.

1.20.1 Causes of loss of quality

The loss of quality is brought about by

- i. Scratching and tearing.
- ii. Careless handling.
- iii. Inadequate strapping when hides and skins are baled.
- iv. Loosely packed bales torn off when being moved or thrown about.
- v. Excessive pressure by the baling process.

1.20.2 Wetting back and contamination

These occur if hides and skins get wet during transportation resulting to putrefaction (decay). This happens when hides and skins come in contact with substances such as water, oils, greases, mud or dust. This can be avoided completely by covering the goods with waterproof material. Dried hides and skins from rural homesteads and settlement schemes should be rolled flesh side, and if possible transported in plastic bags or sacks to avoid contamination and wetting back. In summary to prevent quality of hides and skins from deterioration during storage, packaging and transportation; the following should be observed:

- i. Handle carefully to reduce scratches and tearing - strap adequately, move bales carefully, do not over stack, and avoid abrasion.

- ii. Avoid wetting back and contamination while in storage or under shipment. Cover the consignment with waterproof materials and ensure there is no contact with iron decks. Also, avoid seawater.
- iii. Check out for insect infestation - some beetles damage hides and skins between the stages of curing and tanning more than any other pest. White ants also cause damage but not as serious as the beetles. Apply dust insecticides to eliminate these damages e.g. doom powder: green man powder or Actellic super.

MODULE 7: MARKETING OF HIDES AND SKINS

1.21 Module 6 Outcome and Objectives

Table 7.1: Module 7 Outcome and Objectives

Module Outcome, Objectives and Duration:
<p>Outcome: By the end of the module the participants and facilitators will share and understand the link between prevailing prices of hides and skins and selection (quality grading) and sorting (curing methods, weight ranges, breeds and size/area)</p> <p>Objectives: To develop participant skills and competence in sorting, grading hides and skins and rationale behind pricing and marketing and also to develop the participants' skills in establishing marketing networks and hides and skins stakeholder associations.</p> <p>Duration: 3 hours</p>
Topic 1
Developing marketing networks for hides and skins
Tasks/Activities
<ol style="list-style-type: none"> Probing participants experience with developing marketing networks; Probing participants experience with sharing information and strategies on hides and skins marketing and the leather industry in general.
Teaching Aids
<ul style="list-style-type: none"> ❖ Flip chart ❖ Marker pens ❖ Posters ❖ Diagrams ❖ Pieces each of hides and skins
Topic 2
Effects of curing methods on hides and skins pricing
Tasks/Activities
<ol style="list-style-type: none"> Probing participants experience with the level of moisture content in cured hides and skins using different methods of curing; Participant's narration of their experiences with different prices offered to hides and skins depending on the curing method used to cure the material; Facilitators' verbal and illustrative presentation on effects of the final weight of cured hides and skins on pricing.
Teaching Aids
<ul style="list-style-type: none"> ❖ Wet-salted hides and skins, ❖ Dry-salted hides and skins ❖ Suspension dried hides and skins ❖ Green hides and skins.
Topic 3
Establishment of hides and skins stakeholders association
Tasks/Activities
<ol style="list-style-type: none"> Probing participants experience with formation of and participation in self-help groups marketing associations. Facilitator's verbal and illustrative presentation on factors to consider when pricing and marketing hides and skins both locally and internationally.

Teaching Aids

- ❖ Flip chart
- ❖ Marker pens
- ❖ Posters

1.22 Marketing of raw hides and skins

Marketing is a process by which individuals and groups create, offer and exchange products for money. In hides and skins, they may be sold or bought in green or cured state. In both states, hides are sold by grade as well as by weight. Skins are sold by grade per whole piece.

Hides and skins contain different percentages of water depending on the curing method used. This helps in prevention of cheating during buying or selling. For example, a hide that is 10kg when fresh contains 6.5 kgs of water which it loses through evaporation leaving only 3.5kgs of dry hide.

Generally, wet salted pieces retain about 35% of water while dry salted Pieces retain about 25% of that water. These percentages may vary slightly depending on the location and weather conditions but they normally fall within the following range:

- ❖ A raw (green) piece of 10kg hide/skin contains 6-7kg water
- ❖ A wet salted piece of 10kg contains 3-4.5kg of water
- ❖ A dry salted piece of 10kg contains 2.5-3.5kgs of water

A freshly played hide or skin contains about sixty five percent of water, which is lost through evaporation during curing.

1.23 Marketing networks

Generally, the pricing of hides and skins is known and controlled by the buyers. The pastoralists and producers have little or no information on prices offered in the market per grade. This scenario leads to cheating on prices which lead to lack of incentives to improve on quality. There are some local and international marketing networks of hides and skins. These networks involve accessing information of the situation on the ground and opportunities available outside and includes ways by which these can be exploited. In hides and skins and leather industry it assists to know the demand, supply and prices of the commodities in the market. With good effective networks, one is able to effect trade within a short time.

1.23.1 History of hides and skins marketing networks

Hides and skins have always been produced from pre-historic times to our day, and mankind will continue to produce hides and skins also for all times to come. It has always been considered a pity not to utilize a hide or skin. In ancient times the requirement for the consumption of food in general and meat in particular was such that even in a small community a large number of hides and skins became available, exceeding the necessity of that community for clothing, footwear and protection from

the elements. That generated the requirement to find buyers for hides and skins. A pyramidal system developed itself for the collection of hides and skins wherever they were produced. This way a value chain developed. The pyramidal system is the most commonly practised marketing network in East Africa.

1.23.2 Hides and skins collection networks

There are generally two types of producers in the value chain of hides and skins. We have the small country butchers who produce a relatively limited number of hides and skins per week and you have abattoirs which produce relatively larger quantities of hides and skins.

The relativity depends on the size of community in which the butchers or the abattoirs work, and whether they produce also quantities of meat which are not designed for local consumption. It is obvious that abattoirs in large metropolis produce more hides and skins than abattoirs in provincial cities.

In the pyramidal collection system, small collectors (also known as buyers) buy a couple of hides and skins here and there from home slaughter, small butchers or small abattoirs. That can be to the tune of even a piece at a time. These small local collectors who store some 10/50 hides and some 100/500 skins at a time on their turn sell their collected quantities of hides and skins to regional collectors (also referred to as middlemen) who typically trade quantities of 100/500 hides and 1000/5000 skins. At the end of this pyramid is the big-time collector who can act also as exporter, or in some cases can be a local tannery.

Due to lack of financing through official channels like government and banks, the collection system is formed particularly in developing countries by the availability of funds with the individual collectors. Very small collectors generally work from hand to mouth. They buy a couple of hides and skins with the funds they have at their disposal, then sell them and with the available money the whole circle starts again.

Larger collectors either work with their own funds or get a prepayment from the exporter or tannery who are at the top of the pyramid. With the prepayment, they buy hides and skins from their suppliers and reimburse the prepayment with the delivery of the hides and skins. Once a prepayment has been reimbursed, it starts all over again with a prepayment etc. it is therefore very often that the top of the pyramid finances both the collection side of the trade and the sales/export side when buyers abroad buy at deferred payment terms.

1.24 Payment for Exported Hides and Skins in the International Market

1.24.1 Direct Invoicing

The sellers ship goods and issue their invoice to the buyers, who are required to pay depending on the agreement negotiated between the parties. This option has no guarantees to the sellers. The buyers enter in possession of the goods and become thus the legal owners after clearing customs with only a moral obligation of payment.

1.24.2 Payment by Draft

This form of payment provides the seller with a document in which either the buyer accepts his debt and promises payment on an established date (D/A), or the bank accepts to pay the buyer's debt by countersigning the draft (D/P). In the first case payment is not guaranteed as the buyer can refuse to honour his acceptance of the draft, whereas in the latter case the buyer's bank has made engagement which in fact guarantees payment as the buyer cannot withdraw his consensus for the draft acceptance, provided the bank itself is of course reliable. Payment can be cash or after a predetermined delay, which is usually 30, 60 or 90 days, but can reach 120 or even 180 days from the delivery date, from the date of the bill of lading. The draft, whether D/A or D/P is a legal instrument which gives the sellers the possibility to obtain satisfaction in court in case of non-payment. The D/A draft does not protect the sellers from insolvent buyers or buyers who file for chapter 11 or bankruptcy.

1.24.3 Payment against Documents

Instead of sending documents directly from seller to buyer, sellers can present the shipping documents through banking channels, a practice required by law in certain countries. This means that the shipper presents to his own bank a set of documents, which contains also the document of ownership (bill of lading), as required by the buyers with the disposition to present the said documents to the bank of the buyers for release of the documents in question against payment of the included invoice according to the clauses of the contract between buyers and sellers.

It is to be noted that buyers can refuse to pay the shipper's documents for any legitimate or illegitimate reason and the bank has no obligation towards the shippers for payment in case of refusal of the documents. In case of refusal the bank must hold the documents at the disposal of the sellers, but the sellers will be asked to pay for the service charges of the bank before the bank returns the documents to the sellers or their bank.

In case the buyers and shippers agree on a delayed payment all the requirements of deferred payment terms will have to be followed. According to the legal system in certain countries, companies that file for bankruptcy and who have goods in arrival, even if not paid or with documents still at the bank, become the legal owners of the goods in spite of the status of insolvency. The goods can become part of the assets of the bankruptcy and can be claimed by creditors. In such a case, the shippers become one of the creditors.

1.24.4 Letter of Credit

This form of payment involves and engages the banking system in a more detailed way. The buyer establishes through his bank an irrevocable means of payment in which the bank engages itself that payment will be effected according to a number of clauses, provided that the shipper presented documents conform to the conditions expressed in the letter of credit. Once a letter of credit has been opened by the buyer's bank in favour

of the shipper through the shipper's bank, it can't be revoked until its expiry date. If the shipper presents the buyer the letter of credit demanded documents in perfect condition, and within the outlined time limits, then the buyer's bank is obliged by international convention to effect payment of the shipper's documents.

However, if there is even one smallest discrepancy in the presentation of the documents, automatically the buyer has the right of refusal of the documents and hence of payment. In one way, a letter of credit is a safe means of payment but it can boomerang on the shipper if the documents are not in order. Documents are studied by banking experts and if there is a discrepancy, they will definitely find it.

In order to safeguard oneself against unreliable banks, one can demand a confirmed letter of credit, which adds the guarantee of the foreign bank's correspondent, making the letter of credit more or less "failsafe," but it does not protect against discrepancies in documents. The letter of credit protects against a bankruptcy because it is the buyer's bank who guarantees payment, and it is the buyer's bank who become creditors towards their client.

1.24.5 Prepayment

As far as shippers are concerned prepayment of a contracted lot of hides and skins is the safest method of delivery, but it does not safeguard the buyer in any way in case the shipper does not deliver or delivers bad quality. The banking system provides for what is called a "red-clause" letter of credit which has all the characteristics of a letter of credit, but grants a cash pre-payment to the shippers, who are obliged either to ship the counter value of the payment or re-pay the pre-paid amount. This method is not failsafe, because in case of bankruptcy of the shippers the bank does not cover the pre-paid amount to the buyers. Recommendations to improve on networks include

- i. Establishment of a hides, skins and leather board
- ii. Establishment of a national hides and skins stakeholders' association
- iii. Research documenting existing technical handbooks and disseminating to hides, skins and leather dealers
- iv. Sharing information and strategies on the leather industry among stakeholders

MODULE 8: HIDES AND SKINS TRAINING ACTION PLAN

1.25 Module 8 Outcome and Objectives

Table 8.1: Module 8 Outcome and Objectives

Module Outcome, Objectives and Duration:
<p>Outcome: By the end of the module the participants and facilitators will review and synthesize what they learnt in the course for the entire training program then develop an action plan for implementing their new skills in the areas of their work with hides and skins.</p> <p>Objectives: To enhance the capacity of participants to reflect on their learning and plan how to apply their hides and skins acquired techniques to their day to day interaction with hides and skins</p> <p>Duration: 4 hours</p>
Topic 1
Synthesis of skills and competencies developed in this training.
Tasks/Activities
i. List the skills and competencies from day 1
Teaching Aids
<ul style="list-style-type: none"> ❖ Flip chart and marker pens ❖ Notes taken during training
Topic 2
Review of participants' perceptions of the skills and competencies and how they can improve their work
Tasks/Activities
i. Use action planning matrix
Teaching Aids
<ul style="list-style-type: none"> ❖ Flip chart and marker pens ❖ Notes taken during training

1.26 What is a training program?

A training program is a set of activities and tasks that are carefully put together in a manner that aims to impart knowledge and / or skill. A good training program is one that:

- i. Is tailored to the needs of the participants in order to ensure that the training is beneficial to them;
- ii. Is scheduled to suit participants' own plans and schedules;
- iii. Allows the participants to practice the new technology or skill as much as possible;
- iv. Adopts methods and approaches to suit the learning style of the participants.

1.27 Characteristics of a good trainer

To be a good trainer, you should have the following qualities and attributes:

- i. Be well organized: Read the trainers guide before training so that you are well prepared and know how to handle your sessions.
- ii. Practice beforehand: Know how to conduct the sessions in the local language. You will have to get used to translating phrases.
- iii. Be friendly: Make everyone feel comfortable and part of the group.
- iv. Be observant: As well as listening closely, pick up information about the situation from non-verbal cues.
- v. Use open questions: these are questions that encourage people to give their own opinions, rather than a "yes/no" or single response. Example "what problems do you have with your water sources?" or "How can you raise money for the new facility?" These questions facilitate open discussion. They allow people to express their own ideas and find their own solutions without fear of giving a wrong answer.
- vi. Wait for responses: Give people time to think and come up with an answer. Do not bombard them with more questions.
- vii. Do not rush: Find the pace that people feel comfortable with.
- viii. Do not do all the talking: Remember your job is to ask questions and get participants to do the talking.
- ix. Encourage everyone to contribute: Make eye contact, use hands, walk close to shy people and use names. Try to draw out the silent and control the talkative.
- x. Use minimal encouragers: – "yes I see And then? tell me more" They help to keep the person talking.
- xi. Listen actively: Use eye contact and body language. Praise and encourage but do not over praise.
- xii. Re-phrase: briefly restate what people say in your own words, to make sure you have heard and understood. When you rephrase make sure to do two things – 1) verify with the speaker if you have understood correctly, and 2) see if others want to add something.
- xiii. Be gender aware: Encourage women to be active in the discussions.
- xiv. Probe: Do not be satisfied with one answer. Ask follow up questions to explore issues and make it clearer – "Why? What else? ... Tell me more. Can you explain further?"
- xv. Redirecting is a way of building on one person's answer in order to get others involved in the discussion. Example: "She said ... what do others think?"
- xvi. Watch level of participation: Look around and see who is participating and who is left out. Are people still interested?
- xvii. Summarize: Restate what people have said in a simple, brief form. This will make it easier for people to contribute.
- xviii. Watch the energy level: Look for signs of tiredness or boredom. When people get tired, change the activity, introduce a song, or take a break.
- xix. Be a good time manager: Estimate how much time each activity takes, watch the time and set an appropriate pace for the group;

- xx. Be flexible in planning: Create an atmosphere of flexibility, creativity and experimentation and develop insight into the learning process of the participants while using time efficiently to organize learning situations in a good sequence;
- xxi. Be open and self-reflective: Be open to feedback from the participants about the way you work and take time to examine your own attitudes, values and ideas.

1.28 Different ways of encouraging participation

There are different techniques to get information from a group and encourage participation. Whilst some are better for certain situations and according to group size and sensitivity of issues being discussed it is probably best to try to vary techniques to keep the sessions as exiting and interesting as possible.

- i. Use warm-ups and energizers: Warm-ups and energizers are not training techniques but they form an essential part of training. They are used to change the tempo of a session and encourage participants to move about and relax after spending time sitting in a discussion. Energizers should be active and humorous. Always be aware of the mood of the participants.
- ii. Use of questions during training: The effective use of questions is one of the most important skills needed by trainers. By asking questions, you help the participants to think for themselves and it stimulates a process of discovery. If participants think about a problem and come up with an answer themselves, they are much more likely to remember the information than if they you just told them that information as the trainer.
- iii. Use practical instruction: Practical instruction is used to teach participants a skill, such as how to service a diesel engine or how to repair a hand pump. Practical instruction is based on the principle that people learn by doing. Practice time for every participant forms a major part of the training session;
- iv. Use discussions, hum groups and buzz groups: There are various types of discussion techniques used in participative training courses. The most common are the paired discussion (sometimes called a hum) and the group discussion (sometimes called a buzz group). A paired discussion involves dividing participants into pairs and asking them to discuss a problem or task such as: "List the factors that limit the availability of borehole spare parts in your area of operation". During the plenary discussion for both hum and buzz groups you as the facilitator should ask probing questions to stimulate debate, share experiences and encourage participants to come to a consensus on issues, or agree to differ.
- v. Encourage brainstorming: One type of discussion method is brainstorming. This is a lively method used for gaining a rapid overview of participants' knowledge or ideas on a particular issue. A brainstorm should be run in 10-15 minutes. It is used to switch to a new subject; examine a subject very broadly; obtain 30-40 ideas quickly and to create a lively atmosphere and wake people up.
- vi. Use the debate: The debate is useful for encouraging participants to think for themselves and identify key points for and against a particular issue. The

participants also have to work as a team, decide which points to present during the debate and select a speaker to forward their views. An example of a debate can be technology choice between a solar powered or diesel powered water pump.

- vii. Come up with plays and drama for participants: Plays and drama are extremely useful training techniques because they can be used to focus on real-life problems in an active way, especially where participants are encouraged to act out issues themselves. For example, problem plays are used specifically to pose a problem or issue. A short play depicting a problem and lasting only two to three minutes is enacted at the beginning of the session. Participants are then asked to draw out and analyse the causes of the problems, discuss how it related to their life situation and then to suggest solutions or strategies for tackling that problem.
- viii. Use pictures and picture codes: Problem pictures are used in a similar way to problem plays, except a picture is used to pose a problem rather than a play. Problem pictures can be used to analyse issues that are difficult to depict in a play, such as overgrazing around a borehole. The picture used should show only one problem and should not show possible solutions. It should be a simple line drawing, avoiding too much shading and colour, and with no abstract symbols that might confuse the picture.
- ix. Give participants exercises: Exercises are used to give participants practice in certain skills and knowledge they have learnt. Examples include calculations of revenue to be expected at the end of the month based on volume of water consumed and number of consumers, etc. You as a facilitator can prepare hypothetical problems and tasks and then ask participants to work through them. These exercises can be used to test the skills and knowledge of individual participants and so you can ask each person to work alone. When everyone has finished the exercise, these can be discussed in plenary.
- x. Use training visits: During training visits, participants are taken to a specific site outside the training venue e.g. a public water point for livestock. Training visits are very useful for putting theory into practice in a real situation. It is important that the visit is well-structured with specific learning objectives.
- xi. Stories, songs, fables and poetry: Many rural or pastoral communities belong to societies that have a strong oral tradition in which stories, songs, fables and poetry form an important part of cultural life. Stories can be told by the facilitator or the participants, and can be an effective way of raising important issues during training.
- xii. Use games: Games can be used to raise issues about behaviour and attitudes, such as how people behave in groups, conflict resolution, cooperation and team work. Games can also raise participants' awareness about how their behaviour as individuals and as a group affects others in both a positive and negative way. The session should be structured with clear objectives and key learning points drawn out.
- xiii. Use of training aids: Training aids are used to help illustrate and reinforce key learning points during training. A wide variety of training aids are available such

as flip-charts and coloured markers, chalkboard and chalk, photographs, pictures, models, computer presentation systems e.g. video, slides and overhead projectors. The choice of training aids depends on many factors such as cost, electricity supply, literacy of the participants and the subject being covered in the training, etc.

1.29 Understanding Adult Learning Techniques

As the facilitator, you need to be conscious of the best approach for conveying messages to adults. The method chosen for training adults influences the rate of learning and retention of new knowledge and skills. A combination of approaches is strongly recommended. The Pyramid of Learning, Figure 8.1 provides an indication of the relationship between the training approach and the level of information that is retained

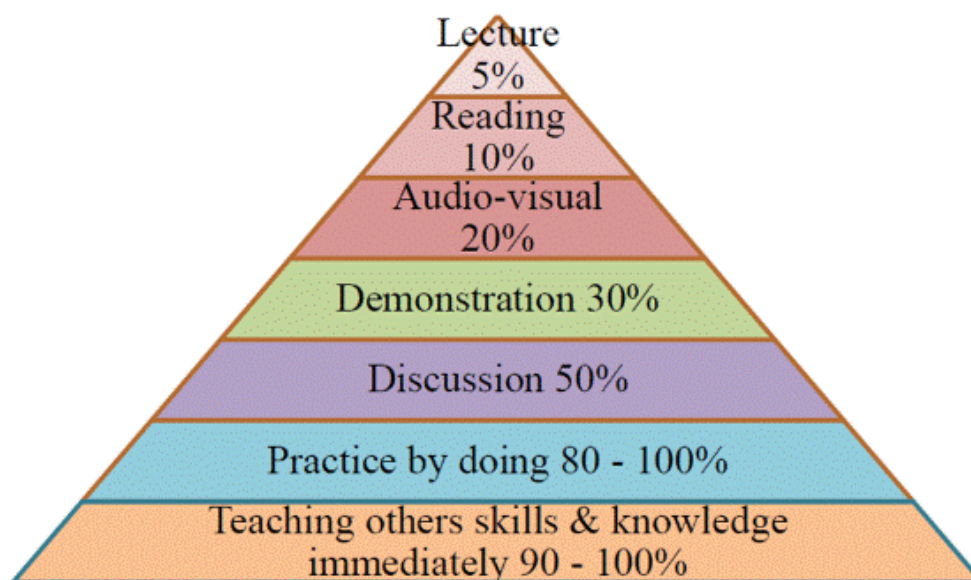


Figure 8.1: Pyramid of Learning

(Source: www.acrlog.org)

Nature of adult participants	Instructor's approach
Adults are often concerned that participating in a group will make them look weak, either professionally or personally	<ul style="list-style-type: none"> ❖ Design training sessions that help people feel safe enough to ask questions and confident that they will be respected. ❖ Do not ask people to take risks too early in a workshop or course (for example, engaging in a role play exercise) unless they already know each other well. ❖ Provide opportunities and allow time for people to establish themselves in the group.
Adults bring a great deal of experience and knowledge to any learning situation	<ul style="list-style-type: none"> ❖ Show respect for participants' experience by asking them to share ideas, opinions, and knowledge. Verbally recognize that they may be a good resource for reaching

Nature of adult participants	Instructor's approach
	<p>your teaching goals.</p> <ul style="list-style-type: none"> ❖ Carry out a needs assessment before the training. This can tell you more about the individuals in the group. Or, if you already know the participants, you may realize that particular individuals can provide helpful input before, during, or after your session(s).
Adults are decision-makers and self-directed learners	<ul style="list-style-type: none"> ❖ Do not seek to make people obey you. Adults will do what they need to do. ❖ Be the "guide on the side" rather than the "sage on the stage". ❖ Listen to what they want and need and be flexible in your planning. Seek feedback from the group. Change your approach if your agenda or methods are not working
Adults are motivated by information or tasks that they find meaningful	<ul style="list-style-type: none"> ❖ Conduct some type of needs assessment so that you are aware of what people want (and need) to learn, how much they already know, and the kinds of "generative themes" that might affect their attention span.
Adults have many responsibilities and can be impatient when their time is wasted	<ul style="list-style-type: none"> ❖ Be thoughtful and kind. ❖ Begin and end your session on time. ❖ Understand who is in the audience and why they are participating. ❖ Learn what questions they have about the subject. ❖ Don't cover material they already know unless there is a good reason for it. ❖ Recognize that your subject is only one of many that participants may be interested in learning more about.

1.30 How to conduct training/workshops

Adult learning and education techniques will be applied in all forums. The techniques rely more on participation approaches and doing things practically at all times. The training can be held in:

- i. Schools
- ii. At the slaughter house
- iii. Hides and skins curing premises (drying shed – Banda)
- iv. Agricultural/pastoral training centre
- v. Under a tree
- vi. At homesteads.

Note: the venue should be acceptable to all participants, and choice of venue should allow interaction and practical sessions.

Participatory training approach often known as learner centred is a means of helping learners take greater control of their lives and their environment by developing their skills problem solving and resource management. The approach focuses more on the

development of human capacities to assess, choose, plan, create, organize and take initiatives.

Participatory training focuses on the learners developing abilities and skills to diagnose and solve their problems. The trainer merely facilitates a process of competency building and self-discovery for the learners whose needs experience and goals are the focus of the training.

It is worth remembering that adult learners learn when they want and what they want. Therefore, there should be continuous consultation between the trainees and trainers on what to learn, when to end any session and when to take brakes.

Those planning to take out training /workshops should use this manual to develop training timetables and identifying topics to be covered and source for necessary support from other service providers where necessary.

1.31 Preparing for the training

Facilitator will:

- i. Survey community priorities/needs
- ii. Create awareness
- iii. Discuss with community representatives on dates, venue and timing for the training (consider seasonality)
- iv. Package information depending on target groups such as butchers, flayers (slaughter men), hides and skins traders, livestock traders and consumers of leather products e.g. handcraft makers (artisans) and leather cottage industries.

The facilitator will then assemble the essential training kit beforehand which should include:

- i. The training manual
- ii. Illustrations(posters)
- iii. Stationery
- iv. Translator when needed
- v. Training samples or livestock herd for practical demonstrations.

At the end of the training a report should be prepared. The report should have details about the group trained (names, locations) activities they are involved in, topics covered, training date(s) and venue.

Way forward (groups action plan) and any follow up activities that are recommended should also be included in the report highlighting major challenges.

In all training activities gender consideration, should be taken into account aimed at involving all members of the community.

Practical sessions should be planned well in advance to make use of all available chances to do this practically.

1.32 Discussion points

- i. What do you think of participatory training?
- ii. How applicable is it to your environment?
- iii. What new thing did you learn in the training or any other trainees?
- iv. Among the other things, you have learnt, what are you going to apply?
- v. Who are the right trainees?
- vi. What training materials have you seen on this subject?
- vii. How useful has the materials been?
- viii. What training tools do you think would be useful in the field?
- ix. Are there other training needs among the trainees?

MODULE 9: TOOLS AND EQUIPMENT USED IN SLAUGHTERHOUSES

1.33 Module 9 Outcome and Objectives

Table 9.1 presents the module outcome and objectives.

Table 9.1: Module 9 Outcome and Objectives

Module Outcome, Objectives and Duration:	
<p>Outcome: By the end of the module the participants and facilitators will share and understand the different types of tools and equipment used in slaughterhouse and hides and skins production operations and how they can appropriately be applied to enhance quality of both meat and hides and skins.</p> <p>Objective: To develop participant skills and competence in using the various types of slaughterhouse tools and equipment to enhance the quality of hides and skins</p> <p>Duration: 3 hours</p>	
Topic 1	
Identification of the different types of tools and equipment used in slaughterhouse operations	
Tasks/Activities	
<ol style="list-style-type: none"> i. Probing participants experience with identification and proper use of the various slaughterhouse tools and equipment; ii. Probing participants experience with sharing information and strategies on hides and skins marketing and the leather industry in general. 	
Teaching Aids	
<ul style="list-style-type: none"> ❖ Flip chart ❖ Marker pens ❖ Posters ❖ Diagrams ❖ Pieces each of hides and skins 	
Topic 2	
Appropriate use, care and functioning of slaughterhouse tools and equipment	
Tasks/Activities	
<ol style="list-style-type: none"> i. Demonstrations on appropriate use, care and functioning of slaughterhouse tools and equipment; ii. Participants' narration of their experiences with different tools and equipment used in slaughterhouse operations; iii. Facilitators' verbal and illustrative presentation on effects of improper use of the various slaughterhouse tools and equipment on final quality of hides and skins. 	
Teaching Aids	
<ul style="list-style-type: none"> ❖ Butcher's knife, ❖ Flaying (skinning) knife, ❖ Deboning knife, ❖ Sharpening steel, ❖ Sharpening stone, ❖ And other tools/equipment used in slaughterhouse operations. 	

1.34 Introduction

Tools, overalls and other protective working equipment represent the necessary equipment for people working in the slaughterhouses, meat processing facilities and other operations of the meat industry. These aids also help to protect meat and meat products against the bacterial contamination. This category of working aids and means is very wide and involves all things that are used by workers in the individual working operations and situations, e.g. knives, hangs and hooks for hanging meat, sharpening steel, meat choppers, meat saws, holders of price labels etc. This category involves also all types of machinery, especially those parts of these machines, which come in contact with the meat and different containers, dishes, roast plates utensils and others aids.

The current trend is oriented at a more and more intensive protection of hygienic quality and safety of food. The consumers should be protected against the microbial contamination and for that reason, the requirements concerning hygiene of individual operations are increasing not only in the meat industry but also in catering facilities and similar establishments.

1.35 The object categorization

The butchery work is a profession, which requires the corresponding qualification, dexterity, skill and physical ability to manage all the operations concerning meat and meat processing in slaughterhouses and butcher's shops. The butcher is either a person who processes and sells meat in a butcher's shop or a person who chops and processes it in an industrial way in the slaughterhouse. Nowadays, this is mostly the occupation of men because it is a very hard and physically demanding activity. If there are any women working in this profession, they usually perform only the final treatment of meat because the weight of carcass halves and quarters highly exceeds the allowed limit of manipulating weight for women (15 kilograms).

The butcher tools represent a highly-specialized assortment of commercial goods. As compared with the assortments of other types of consumer's, industrial and textile goods, there are not many producers and distributors of these products and for that reason they are mostly imported. Individual categories of tools used in the meat industry are presented in Figure 9.1.

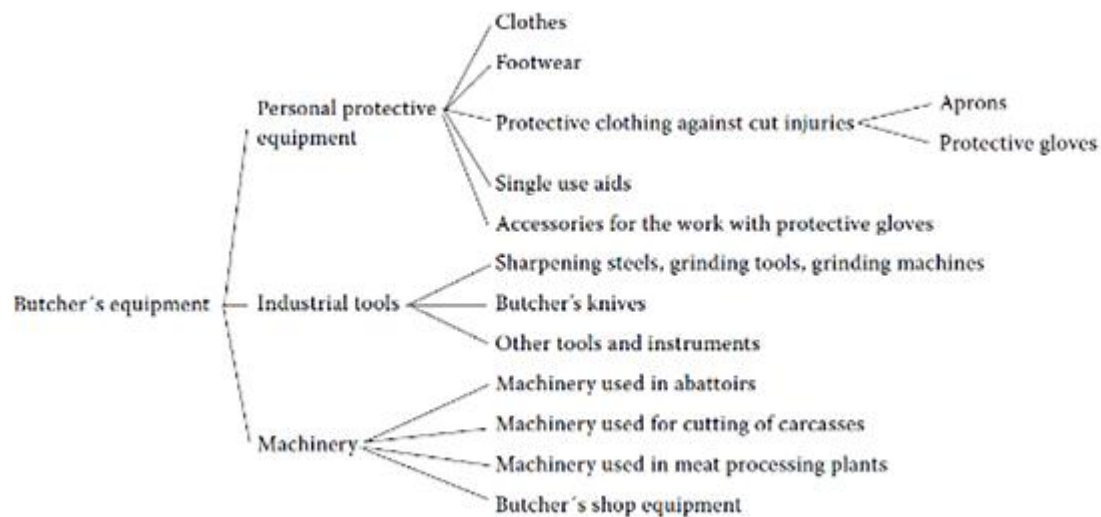


Figure 9.1: Butcher's equipment

(Source: Categorization of work equipment used in the meat industry; R. PRESOVÁ, O. TVRDOŇ; Mendel University of Agriculture and Forestry, Brno, Czech Republic, 2005)

1.36 Personal protective aids

Each employee who works in food processing industry must be adequately equipped with all necessary work-clothing and tools needed to accomplish his/her work. The basic categories are clothes, footwear, protective anti-cut instruments, knives, baskets for knives, sharpening steel and other things. These aids are generally called products for the work with meat and meat products.

1.36.1 Butcher's clothing

The work-clothing and accessories must meet hygienic requirements and conditions concerning products that come into contact with foodstuffs on the one hand and satisfy criteria of labor safety on the other. Hygienic regulations determinate the principles of handling with foodstuffs and concern above all work clothing. The standard work-clothing is of white color and should be made of 100% cotton or a combination of cotton, viscose and thermofibres. The priorities are also a nice look and easy cleaning. In some plants, the workers must use the thermo wear because of very low temperatures. In such facilities, butchers wear thermo jackets, blouses and trousers.

1.36.2 Protective aprons

Butchers slaughtering animals and processing animal carcasses use two different types of rubberized aprons. The first one is made of rubber and its mechanical resistance is low. The second type is also made of rubber but its resistance is higher. The workers use these aprons as a fundamental protection against water and blood when washing cadavers of slaughtered animals. These operations do not require highly resistant aprons. For operations requiring a higher degree of protection, the aprons are made of strong polymerized material which is rubberized either on one or on both sides (see Figure 9.2).



Figure 9.2: Protective apron

(Source: <https://avacaremedical.com/disposable-polyethylene-protective-apron>)

1.36.3 Footwear

Shoes used in slaughterhouses and chopping facilities must meet the requirements defined in standards of labour safety². An example is given in Figure 9.3. In slaughterhouse facilities people wear most frequently high leg boots (wellingtons). In boning rooms, the workers use heavy duty boots without shoelaces and/or polyethylene shoes. The use of shoelaces is not allowed because they can be easily contaminated. These shoes are of white color and are made of materials resistant to animal fats and albumins. This property is important because it prolongs the durability of footwear. Albumins are relatively aggressive and can destroy the surface of shoes. If the shoes were made of low-quality material, they would lose elasticity and the insulating capacity. The result would be a cracked surface and brownish-yellow color of shoes. Shoe soles are made of antiskid materials. The toecap should be reinforced with steel to avoid accidental injuries.



Figure 9.3: Footwear for Slaughterhouse Operations

(Source: <https://avacaremedical.com/disposable-polyethylene-protective-apron>)

1.36.4 Protective work-clothing against cut injuries

This work-clothing protects butchers working with cutting tools (see Figure 9.4). Protected are those body parts, which are most exposed to the injury (i. e. trunk and hands). There are special protective aids for these body parts, which are really indispensable.



Figure 9.4: Protective work-clothing against cut injuries

(Source: <http://www.dupont.com/products-and-services/personal-protective-equipment/cut-protection.html>)

1.36.5 Protective aprons

Aprons protect the chest and the belly (see Figure 9.5). They are made of stainless steel and aluminum. These aprons are manufactured as networks of interconnected rings, which protect butchers against injury by knife, saw and other sharp tools. The rings can have various diameters, most frequently about 7 millimeters. The disadvantage of aluminum aprons is that they produce aluminum dust, which results from friction of aluminum plates during the working movements and strongly pollutes the clothing worn below the apron.

These aprons are produced in different sizes. The largest one is called "kazak" and protects body from neck to knees.



Figure 9.5: Protective apron

(Source: <http://www.dupont.com/products-and-services/personal-protective-equipment/cut-protection.html>)

1.36.6 Protective gloves

Protective gloves are made of a dense network of rings welded from stainless steel. The ring diameter varies (from 3 to 5 mm) according to its location in the glove. The size of gloves is dependent on the size of hands. The size of gloves is indicated by different colors of drawstrings. The color sequence from the smallest to the largest ones is as follows: brown, green, white, red, blue, orange and olive-brown. Another system of differentiation of gloves is based on the length of the attached sleeve. Most frequently, the gloves are without sleeves but there are also gloves with sleeves 8, 15, 19, 21, 30 and 40 cm long. The longest ones reach to shoulders. Gloves with the adequate length of protective sleeves are used to avoid the risk of injury (see Figure 9.6).

**Figure 9.6: Cut-resistant protective glove**

(Source: <http://www.fleischbranche.de/en/zulieferer/berufsbekleidung-fleischerei/schutzhandschuhe?pid=524&sid=1316:heilemann-sicherheitstechnik-gmbh>)

1.36.7 Single-use aids

The single-use protective aids are used very often. For example, they involve various headgears, forearm gauntlets, dust masks, facecloths, latex gloves etc. (see Figure 9.7). Their advantages are easy use, expediency and low price. The headgear is made of non-woven textile of different colors, sizes and shapes. Nowadays, they have replaced nearly completely textile caps. The single-use forearm protectors cover the arm from wrist to elbow. They cover the butcher's clothing and protect it against too frequent contacts with the processed food. Very frequent are also protective shoe covers that are used by the visitors and protect their shoes against dirt.



Figure 9.7: Single-use aids

(Source: <https://gokrantimanch.wordpress.com/page/50/>)

1.36.8 Accessories for the work with protective gloves

These aids are essential when in working protective gloves. These cotton gloves should eliminate the touch of bare skin with the metal and maintain the temperature of hands. In addition to cotton gloves, it is also possible to use insulative gloves, which are made of polyethylene (40 μm). They function as a thermoregulation and prevent wetting of cotton gloves. The gloves are firmly and comfortably fastened with rubber strings ("spiders"). These spiders are elastic and prevent any sliding of gloves on the hands (see Figure 9.8). On the other side, however, they allow an easy movement of fingers and wrists. The use of these aids is dependent on the type of working activities.



Figure 9.8: Accessories for the work with protective glove

(Source: <https://www.huondistributors.com.au/Protective-Gloves.asp>)

1.36.9 Thermo Regulative gloves

These cotton-knitted gloves are designed to protect the hand in which the worker holds the knife. They keep the hand warm and obstruct any possible slip of the knife during the work with meat. The usage of these gloves depends on skills and willingness of a

worker. Some workers do not use them at all. A good example of such type of gloves is given in Figure 9.9.



Figure 9.9: Thermo regulative gloves

(Source: <http://www.safetygloves.co.uk/slaughterhouse-gloves.html>)

1.36.10 Categories of industrial tools

Butcher's tools involve all kinds of instruments and tools used for processing of meat. They are as follows: knives, sharpening steel, meat axes, bone saws and all other tools used for processing and cutting of meat. They facilitate the working operations, make them quicker and guarantee the quality of work. Most of these procedures can be carried out in several different ways but it is always necessary to remember that they have to be performed in accordance with technological and hygienic requirements.

1.36.10.1 Sharpening steels, grinding tools, grinding machines

The butchers have to have knives sharp enough to do a good job. Sharpening steels, whetstones and grinding machines are used to sharpen and align the razor-edges of knives.

Knowledge and experience is required for a high-quality whet especially when the sharpening procedure is done using simple tools.

In plants with a small number of employees, the knives are usually sharpened individually using both rough and smooth whetstones. There are sharpening stones of various grain sizes. The market also offers a large variety of sharpening steels. These can be classified according to the material of the sharpening surface. The advantage of sharpening steel is not only the fact that the knife is sharpened but also that it is aligned and polished. For individual types of working operations, special sharpening steels can be used. There are also combined sharpening steels available, which have several surfaces and which enable to carry out all necessary operations at once.

In plants with a higher number of workers, there are usually professional grinding machines, which are equipped with different types of sharpening, aligning and polishing discs. However, the sharpening steels are used here as well. The nickname "kliklak" is used for a special type of sharpening steel, which permits a quick and very good alignment of blade. These sharpening steels are used above all in cutting rooms for their easy and simple use and good final effect. A good example is given in Figure 9.10.



Figure 9.10: Sharpening steels, grinding tools

(Source: https://en.wikipedia.org/wiki/Honing_steel)

1.36.11 Butcher's knives

For any butcher, the most important tool is his/her knife. The most desired knives are of Swiss and German origin. Nowadays there are many different knives used only for a special operation, e.g. boning knives, sticking knives and flaying knives

Sticking knives are specially constructed for processing of meat in all technological steps, i.e. from slaughtering to cutting. They have a strong, straight and rigid blade of the length ranging from 16 to 21 cm. The end of the blade may have two shapes. One of them is "classical" and the edge of the blade is gradually skewed upwards (see Figure 9.11). The specific feature of the other is in that the end of the blade is sharpened on both sides (edges).



Figure 9.11: Sticking knife

(Source: <https://www.vpsi.gr/en/sharpening-knives-meat-proccesing/knives-for-slaughter-house-meat-proccesing>)

1.36.11.1 Skinning knives

The construction of skinning knives enables to remove skins from carcasses. They are of a curved shape and have strengthened points. This type of knife does not perforate or disrupt the skin and enables to work effectively and safely (see Figure 9.12 (a) and (b)).

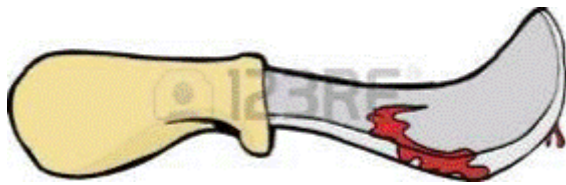


Figure 9.12 (a) Old skinning (flaying) knife



Figure 9.12 (b) Modern skinning (flaying) knife

(Source: <https://www.vpsi.gr/en/sharpening-knives-meat-proccesing/knives-for-slaughter-house-meat-proccesing>)

1.36.11.2 Boning knives

Boning knives are used most frequently. Work operations in cutting rooms usually do not require a high degree of accuracy, swiftness and quality. However, the cutting operations cannot be substituted by any kind of machinery and for that reason, boning knives have many and often very different shapes. These knives are made of stainless steel and usually are manufactured in different lengths. According to the elasticity of the blade it is possible to divide these knives into three groups: elastic, medium elastic and firm. The straight blades are manufactured only with a firm blade. Some butchers, however, prefer curved knives with elastic or medium elastic blades. Sales results confirm that these types of knives are more demanded than straight knives with a firm blade. A good example is given in Figure 9.13.



Figure 9.13: Boning knife

(Source: <https://www.vpsi.gr/en/sharpening-knives-meat-proccesing/knives-for-slaughter-house-meat-proccesing>)

1.36.11.3 Portioning knives

Portioning knives with a longer blade are used to shape the meat and to prepare it for sale. According to the requirements of customers and the method of meat treatment, it is necessary to choose the optimal length, rigidity, shape and treatment of the blade. The length of the blade of universal knives ranges usually from 20 to 26 centimeters and the steel is of medium rigidity. The blade is smooth or there are edged furrows on both sides (see Figure 9.14).



Figure 9.14: Portioning knife

(Source: <https://www.vpsi.gr/en/sharpening-knives-meat-proccesing/knives-for-slaughter-house-meat-proccesing>)

1.37 Types of Knife Sharpeners

There are a variety of different sharpening tools on the market.

- i. Sharpening Stones
- ii. Sharpening Steels
- iii. Pull-Through or Manual Knife Sharpeners
- iv. Electric Knife Sharpers
- v. Knife Sharpening Systems

1.37.1 Basic Overview of the Sharpening Stone

A sharpening stone is the most basic type of knife sharpener, this is not to say that they do not offer great benefits, but only that they do not have a lot of features. The traditional knife sharpener was constructed out of novaculite or aluminum oxide, but with technology the sharpening stone has come a long way. These stones are now constructed out of several different types of material including diamond, oil, water, and ceramic.

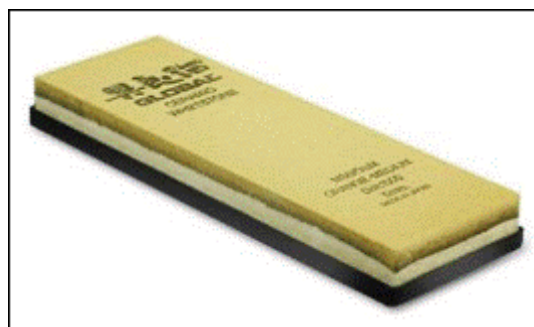


Figure 9.15: Sharpening stone (ceramic)

(<https://www.knifefellas.com/best-knife-sharpener-reviews>)

The ceramic stone shown in Figure 9.15 is very durable and capable of lasting a lifetime, if you take care of it properly. You will not need to oil or wet the ceramic stone, when you are using it to sharpen your knife blades. This will definitely offer a much cleaner

work space. You just simply need to wash the stone with soap and a traditional pot scrubber to remove the swarf, so it does not interfere with the cut.

1.37.1.1 Use a Sharpening Stone Properly

The first step of using the sharpening stone is to select the appropriate coarseness, which will basically depend on the knife that needs sharpening. Most individuals will use a series of grades, so all coarseness levels are covered.

The second step is to select the appropriate bevel angle, but most are around 20 degrees.

The third step is to apply the water or oil, if required. The ceramic or diamond sharpening stones do not require either of these products to work properly, so you will have a much cleaner work space, if you choose them over the oil or water stone.

The fourth step is to sharpen the knife, but always start with the coarsest stone first and work your way down to the finest. Use a 45 degree and make a slicing action, while holding the heel of the knife firmly.

The fourth step is to sharpen the knife, but always start with the coarsest stone first and work your way down to the finest. Use a 45 degree and make a slicing action, while holding the heel of the knife firmly.

1.37.1.2 How to Use Sharpening Steels

Overall, using a sharpening steel isn't overly complicated. The overall design of the item should give you a good idea of how to use it. Therefore, no instructions should be needed, but practice is essential. This is a two-handed system that will require you to grasp the sharpener in one hand and the knife in the other as shown in Figure 9.16. Be sure to hold both items securely and rake the edge of the knife down the sharpening steel.



Figure 9.16: Sharpening steel

(Source: <https://www.knifefellas.com/best-knife-sharpener-reviews>)

For your protection, you should never bring the knife towards your body. Instead, you should push it down the steel and away from yourself. Make sure that you proceed

carefully and maintain the appropriate angle with each single stroke! With a little elbow grease, this sharpener will restore your blade's edge to pristine condition.

1.37.1.3 *How to Use Pull-Through Knife Sharpeners*

The manual knife sharpener shown in Figure 9.17 is most likely one of the easiest to use. Although the electric is easier, the pull-through sharpener is very close behind. The process is very simple, but it will still require two hands, in most cases. Grab the sharpener's handle and hold it tightly to the table. While holding it securely, you will want to grab the handle of the knife and pull it through the sharpener. This process can be repeated, until the blade's edge matches your requirements. Overall, the process is simple and can be completed within a matter of seconds.



Figure 9.17: Pull manual knife sharpener

(Source: <https://www.knifefellas.com/best-knife-sharpener-reviews>)

1.37.1.4 *How to Use Electric Knife Sharpeners*

Overall, using one of these machines is entirely effortless and easy. You only need a single hand (see Figure 9.18), which cannot be said for the models above. Once you've got the sharpener and the knife, you will be able to adjust the settings on the machine. Remember that each individual model will have a variety of different settings to play around with. Once you've got them set to your particular preferences, you'll be able to insert the blade into the sharpener and allow the machine's motor to do all of the work.



Figure 9.18: Electric knife sharpener

(Source: <https://www.knifefellas.com/best-knife-sharpener-reviews>)

Some models work quicker than others, but all are faster than the other sharpeners above. Within seconds, your knife will be ready to use, regardless of the task at hand!

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