

CHAPTER NINE

Sheep and Goat Flock Health

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Objectives

1. To describe the symptoms of economically important diseases of small ruminants.
2. To describe some important internal parasites that affect small ruminants.
3. To introduce control strategies for major diseases of small ruminants.

Expected Outputs

1. Ability to identify important diseases of small ruminants.
2. Knowledge of the symptoms of major diseases of small ruminants.
3. Ability to assist the animal health assistant in the design and implementation of disease control strategies.
4. Know and advise farmers when deworming is needed.
5. Know when to organize vaccination campaigns for important infectious diseases.

Introduction

Many important livestock diseases that inflict major socio-economic losses in Ethiopia occur every year. Annual disease losses amount to 8–10%, 14–16%, and 11–13% of the cattle, sheep and goat populations, respectively. It is estimated that some 700 million Birr (1US\$ = 9.2 Birr) is lost annually due to helminth (internal parasite) infestation of domestic animals. Besides affecting the quantity and quality of livestock products, the prevalence of infectious and economically important animal diseases in Ethiopia excludes the country from profitable international markets, thereby greatly reducing the country's foreign exchange earnings. Poor husbandry practices and inadequate veterinary services are the major factors favoring the expansion of livestock diseases.

Brief introductions on the control and eradication of diseases, major internal and external parasites, and infectious diseases of sheep and goats are presented in this chapter of the handbook. *Kebele* Development Agents (KDAs) and other development workers must familiarize themselves with the nature of disease problems, symptoms of diseases and their prevention and control, and the life cycle of parasites. This knowledge is necessary to assist sheep and goat owners in taking appropriate disease prevention and control measures and to assist animal health assistants in organizing producers for necessary animal health interventions. The more detailed sections on the treatment of animals are generally meant for animal health assistants who have the authority to treat animals.

9.1. Biosecurity

Biosecurity is the prevention of disease-causing agents from entering or leaving any place where animals are present. It involves a number of measures and protocols designed to safeguard producers, animals and the livestock industry from disease outbreaks. A biosecurity program includes the following measures:

- Isolate new animals from the flock or stock returning from the market or other places.
- Do not bring infection onto your farm, or spread it around your farm through clothes, footwear or hands.
- Where possible, limit and control farm visitors.
- Do not allow contact with neighboring animals, such as through fences.
- Do not share injecting and dosing equipment with other producers. If necessary, cleanse and disinfect all equipment thoroughly.
- Dispose of dead animals properly.
- Use separate equipment and personnel for isolated animals.
- Keep the isolation barn as near as possible to the farm entrance and separate it from other pens or barns by at least 3 meters.
- Dispose of bedding properly so that other livestock do not have access to it.

9.1.1. Importance of disease control, prevention and monitoring

Disease control

- Disease control is the reduction in the incidence of disease and the number of deaths in a flock.
- Disease control can be achieved by treating diseased animals and by preventing disease through proper herd management practices.

Strategies of disease control

Quarantine

- Quarantine is the isolation of animals that are either infected or suspected of being infected with a disease or diseases. Non-infected animals that are at risk of getting a disease may also be quarantined.
- A quarantine period is also used to isolate new animals before allowing them to mix with a flock.
- A quarantine period is a minimum of 3 weeks.

Slaughter

- If a disease is infectious, affected animals can be a source of infection to others. In such circumstances, it may be economically and technically advantageous to slaughter the infected animals to prevent further spread of the disease.

Vaccination

- Vaccines are used routinely to prevent disease.
- A vaccine is a suspension prepared in a laboratory from the cause of the disease. When injected into an animal, the animal produces immunity to that disease, which protects the animal from that specific disease.
- Vaccines are of two types, dead and living vaccines.
- Vaccines need to be kept in a cold chain, meaning kept cold at all times from production through transport and storage, and before injecting into an animal. Hence, vaccines must be kept:
 - ◆ in an ice box with sufficient amount of ice during transport,
 - ◆ at 4⁰C or -20⁰C while in the clinic, and
 - ◆ out of direct sunlight.
- Vaccines are easily damaged if handled improperly.
- Always exactly follow the instructions given for the storage and use of vaccines.
- Most vaccines are injected under the skin.
- Always use sterile syringes and needles for vaccination.
- Always give the correct dose by the correct route.

Movement of susceptible animals

- Susceptible animals can be removed from high risk areas where infections are endemic.

Control of biological vectors

- Infectious diseases transmitted by biological vectors (insects, birds, rodents, etc.) can be controlled by eliminating the vectors.
- As examples, insect vectors can be killed with insecticide; snail habitat can be destroyed to prevent liver flukes.

Disinfection of fomites

- Fomites include farm equipment, surgical instruments, etc., used with animals.
- Fomites can be disinfected to prevent the transmission of infectious agents.

Disease prevention

- Preventing disease is much more effective than trying to cure sick animals.
- Through good husbandry practices, livestock owners can reduce the risk of diseases entering a flock.
- Understanding the main disease threats to a herd can assist a producer in taking appropriate disease prevention measures, and thus lower the impact of disease problems.

Good management practices are vital to preventing diseases

- These include provision of clean water and proper nutrition, maintaining clean housing with adequate ventilation, and clean pastures that reduce parasite and disease build-up, and the strategic treatment of stock with anthelmintics. All of these measures will reduce disease challenges.

Housing and feeding

- Housing that provides protection from wind and rain, is easily cleaned and is well ventilated is preferred to warm, wet and airless conditions.
- Feed racks should be used to avoid contamination of feed with feces and urine.

Drenching and spraying

- The build-up of parasites is likely to occur where sheep and goats are kept in intensive conditions. Regular practice of sanitation measures such as manure removal or rotation of grazing areas or paddocks can assist in disease control.
- Sheep and goats in these conditions may need regular treatment with effective anthelmintics to reduce worm burdens.
- The same approach is required with external parasites such as ticks, lice and flies.
- Spraying or dipping of animals is needed to reduce external parasites during periods of high infestation.

Disease prevention program

Disease prevention programs can be developed by the animal health staff and the *Kebele* Development Agent (KDA) considering local information on disease occurrence together with epidemiological knowledge. In addition to following the recommendations above on management and husbandry, vaccinations are also needed. The program will include the following elements:

- Routine vaccination using some of the following vaccines:
 - ◆ Pasteurellosis
 - ◆ Sheep and goat pox
 - ◆ Anthrax
 - ◆ Pest des petits ruminants (PPR)
- Ring vaccination is carried out during outbreaks of Contagious Caprine Pleuropneumonia (CCPP).
 - ◆ Goats that are found around the outbreak areas will be vaccinated. This will serve as a barrier to halt the spread of infection.

Importance of vaccination programs

Properly conducted and managed vaccination programs are critical to enhancing the immune status of the herd. Proper timing of vaccinations and booster immunizations will assist in combating disease and minimize the severity of any disease outbreak.

Transferable Message

The KDA will carry out the following disease control activities:

1. Coordinating the community on the prevention of animal diseases.
2. Reporting on disease outbreaks to appropriate authorities.
3. Keeping records of livestock resources on the station.
4. Provide regular public awareness education on the prevention and control of animal diseases.

Table 9.1. Locally available vaccines for bacterial and viral diseases of sheep and goats.

Disease	Vaccines	Dosage, administration, revaccination, and precaution	Package
Peste des petits ruminants (PPR)	PPR 75/1, Vero 76	Sheep and goats, inject 1 ml under skin; immunity lasts 1 year, revaccinate annually	Vial of 100 doses
Ovine pasteurellosis	<i>Pasteurella multocida</i> type "A"	Sheep and goats, inject 1 ml under skin; immunity lasts 1 year, revaccinate annually	Vial of 50 doses
Anthrax	Sterne 34 F ² strain of <i>Bacillus anthracis</i>	Sheep and goats, inject 0.5 ml under skin; immunity lasts for one year, revaccinate annually	Vial of 100 doses
Sheep & goat pox	Sheep & goat pox ksgp-0180	Sheep and goats, inject 1ml under skin, immunity lasts for one year, revaccinate annually	Vial of 100 doses
Contagious Caprine Pleuropneumonia (CCPP)	F38	Goat, inject 1 ml under skin, immunity lasts for one year, revaccinate annually	

Source: National Veterinary Institute, Debre Zeit.

9.1.2. Disease occurrence and transmission

Diseases can be classified into infectious and non-infectious.

Infectious diseases:

- Diseases that can be transmitted from a sick animal to sensitive healthy animals.
- The agents for infectious diseases are germs such as viruses, bacteria, fungi, and several parasites.

Non-infectious diseases:

- These are mainly related to feed (diet-related) such as mineral deficiencies, toxic plants and poisons.
- Some non-infectious diseases may be genetic (received from parents) or due to an injury.

Animals most likely to get sick are:

- The young, weak, underfed or pregnant.
- Animals under stress, living in unclean conditions or those that are poorly fed.

- The occurrence of a disease may be due to contact between a sensitive or susceptible animal and a source of the disease or another sick animal. This can occur under the following circumstances:
 - ◆ Bringing new animals into the flock. The new animals could be a source of disease.
 - ◆ A healthy animal may come into contact with a sick animal, such as in a market place.
 - ◆ Healthy animal eating toxic plants. Several plants contain substances toxic to animals. The plants may not cause sickness when consumed in small amounts. However, toxic effects appear at high consumption levels.
 - ◆ A healthy animal may accidentally eat or drink poison. Poisons such as insecticides and rodenticide carelessly stored can be consumed by animals and may have a fatal effect. Poisoning can also occur by inadequate cleaning of a poison container later used as a waterer or feeder. It is best to discard all poison containers and not reuse them.
 - ◆ Animal consumes feed contaminated with germs, parasites or poison.
 - ◆ Animal drinks contaminated water.
 - ◆ An animal is placed in a pen previously used by a sick animal where the germs are still present.
 - ◆ Disease-causing agents may be carried by insects, a farmer or animal health worker who just took care of a sick animal on a nearby farm or by the wind (aerosol spread).

Diseases introduced by vectors

Vectors are living transmitters of infectious agents. Vectors are usually invertebrates. Major diseases that are introduced by vectors are: Babesiosis of sheep and goats, Anaplasmosis, Heartwater, Bluetongue, Rift Valley Fever, Nairobi sheep disease and Trypanosomiasis.

Routes of disease transmission

Aerial transmission

- Airborne transmission of infectious agents.
- An example is the foot-and-mouth disease virus shed from ruptured vesicles and taken long distances by air. Healthy animals can be infected when they inhale the foot-and-mouth virus-contaminated air.

Contact

- Contact transmission is direct transmission without involvement of transmission factors (e.g., mechanical vectors) and without participation of an external medium.
- This is particularly important in relation to infectious agents that are shed from the body surface. Transmission may be through bites (e.g., rabies).

Inoculation

- Inoculation transmission is the introduction of infectious agents into the body by puncture of the skin, or through a wound (e.g., when tsetse flies infected with Trypanosoma puncture the skin of an animal to feed on blood and transmit the disease).
- Introduction of infectious agents by dirty instruments such as during treatment or vaccination using needles that haven't been sterilized.

Disease monitoring

Disease monitoring is an ongoing effort in Ethiopia, directed at assessing the health and disease status of animals found in a peasant association. There is a standard disease reporting format that is used for reporting disease outbreaks. The KDA should assist the Animal Health Assistant in collection of the data. He should

also keep a copy of the report for use in planning disease prevention and control activities of the peasant association (PA).

The KDA should keep the following records of his operation area, i.e., peasant association:

- Disease outbreak reports
- Vaccination and treatment records
- General health records
- Laboratory test results

These records are useful for planning an animal health program of the PA in collaboration with the Animal Health Assistant, who is in charge of the animal health activities of three Peasant Associations.

9.1.3. Disease surveillance

Disease surveillance is very important to the country for monitoring and assessing health threats to livestock. KDAs and producers should, therefore, participate in disease surveillance programs. Disease surveillance is a more active system than monitoring and implies that some form of directed action will be taken. It provides data on the occurrence of a disease and its geographic and temporal patterns. A KDA can initiate a disease surveillance activity in his PA by examining the health records he keeps and providing them to animal health authorities. These records may indicate that specific health problems are present in the PA and that there is a need for conducting disease surveillance. The surveillance will be done by the Animal Health Assistant, who is in charge of the PA animal health activity, under the supervision of the *woreda* veterinarian and the responsible animal health laboratory. The collected samples will be tested by the regional laboratory. An animal health intervention, carried out by the Animal Health Assistant in collaboration with the KDA, may be undertaken based on the test results.

Disease surveillance entails the collection of various samples and performing necropsy of dead animals as described below. The animal health technician will have the proper equipment for collection and preservation of samples.

Collection of blood samples

- In some diseases, there may be a need to isolate the causal agent from blood.
- The most appropriate time for taking blood samples is when the animal has a high body temperature.
- The skin should be shaved at the site of puncture (jugular vein), cleaned with 70% ethyl alcohol and allowed to dry.
- Blood is then drawn with a sterile needle and syringe and 10 ml is added into vials containing anticoagulant depending on the type of test required.
- Shake the vials to ensure thorough mixing.
- Label clearly, and place on wet ice in an ice box.
- Send to the nearest animal health laboratory.

Collection of tissue samples

- Blocks of tissue not more than 0.5 cm thick and 1–2 cm square are cut and placed in neutral buffered formalin.
- The amount of formalin used should be at least ten times the volume of the tissue sample.

Collection of fecal samples

- Restrain or hold the animal.
- Using a plastic glove, or a hand covered with a plastic bag, use a finger to expel a few fecal pellets from the rectum.
- Sometimes, as animals move in a pen they naturally defecate and these fresh pellets can be caught before they hit the ground.
- Place the fecal pellets in a clearly labeled plastic bag and either refrigerate or put on ice.

Necropsy

- If an animal dies, it is helpful to carry out a simple post mortem examination to try to find the cause of death.
- This is important in identifying infectious diseases and preventing their spread to other animals in the flock.
- It is useful for extension staff to learn how to conduct a simple post mortem examination and systematically record what is observed.
- How to do post mortem:
 - ◆ Find an area that is isolated from other animals and nearby houses, and a place where the dead animal can be burned or buried at a depth of at least 1 m.
 - ◆ Never perform a post mortem close to water supply or a grazing area.
 - ◆ Dig a small hole beside the carcass, into which organs and fluids can be placed.
- Observe the dead animal. If there are any dark, bloody discharges from the mouth, nose or anus, do not open it, as it may have died of anthrax. Anthrax spores can contaminate the area and also infect the personnel doing the post mortem.
- Touch the body to check for any gas under the skin. Does it crackle under the skin? If yes, there may have been a clostridial infection. Check the body for any external abnormalities. Check for ticks. How severe is the infestation? If there are any ticks, take samples. Check all legs for foot rot and wounds.
- Lay the body on its back or side and cut the skin in a line along the centre of the abdomen and chest. Remove the reproductive organs (testicle or udder). Pull the skin back. Bend the top foreleg and hind leg back.
- Open the body by cutting the ribs along the line of the back bone and along the chest to remove the rib cage.
- Remove the whole digestive tract without opening it, by tying the top and bottom ends of the tract with string. Remove the tract with the liver and spleen and keep it for later examination.
- Check the heart for fluids inside the outer membrane. If a lot of fluid is present, heartwater may have been the cause of death.
- Cut the top of the trachea and remove it with the lungs and keep them for later examination.
- Look for kidneys, which will be in some fat at the back of the abdominal cavity. Extract the kidneys from the fat, remove and keep them.
- Check the bladder, open and observe the color and quantity of urine. Check inside the bladder for any hemorrhage or dots of blood. If present, suspect poisoning.
- Look for the spleen, which is attached to the rumen close to the liver. Check the length and edge of the spleen. Is it sharp or blunt? A normal spleen is firm, with sharp edges. Feel the consistency. If the spleen is enlarged and soft with a blunt edge, then the cause of death was possibly Anaplasmosis. If the spleen is very swollen and lymph nodes are swollen, suspect Trypanosomiasis.

- Check the liver for size and consistency, cut across the length in 2–3 places and press. If liver flukes are present, dark colored flukes will come out.
- Check the lung by opening the trachea and continuing to cut into the lung. Check for foam, worms, and blood. Adult worms in the bronchi indicate lung worms. Cut across the length of the lung to look for any foam. If there is much straw colored fluid, then suspect Contagious Caprine Pleuropneumonia (CCPP). If there is clear fluid and the lower part of the lung is red, then suspect Pasteurellosis. If there are oozing abscesses in the lung, then suspect melioidosis.
- Check the kidneys; they will normally start to putrefy 12–24 hours after death. However, if the kidney putrefies within six hours after death, suspect enterotoxaemia (pulpy kidney).
- Check the digestive tract by first observing the whole tract for any dark patches.
- Observe the small intestine, if there is a dark patch, open that area, if the small intestine appears normal, cut it open at random places. Remove the contents into a container. Cut along the length and check for any attached worms. If the contents are bloody and nodules are present on the intestinal surface, suspect Coccidiosis.
- Check the large intestine, looking carefully for blood lines, the so called “zebra markings,” which are common in Peste des Petits Ruminants (PPR) cases.
- Cut the rumen along its greatest curve. Remove the contents. Look for worms attached to the wall. Small red worms full of blood indicate paramphistomum.
- Check the contents of the reticulum for foreign material such as nails, plastic bags, wires, etc.
- Check the contents of the omasum for foreign material.
- Open the abomasum and put the contents into a container. Wash the flaps of the wall into the container. Look for small white worms with red spiral patterns attached to the wall, these are probably *Haemonchus contortus*. The presence of many worms indicates a major worm problem.

Taking samples during a post mortem

- Any organ found abnormal can be taken fully as a sample.
- Put the organ in a plastic or glass container.
- When taking samples from different organs, always take both the affected part and the normal part of the organ.
- Samples should be preserved in 5% formalin or frozen. If that is not possible, preserve samples in a strong saline solution.
- Samples should reach the diagnostic laboratory within 12 hours.
- Clearly label the sample and send it to the laboratory with a copy of the post mortem examination record.

9.1.4. Disposal of dead animals

- Burial is a common method of disposing off dead animals.
- The burial site should be far away from water and should not be a place that is easily flooded.
- Dig a 2 m deep hole, insert the dead animal and cover it well to prevent excavation by dogs.
- If the cause of death is anthrax, put quicklime under and above the dead animal.

9.2. Routine Health and Diagnostic Procedures

9.2.1. Signs of ill health — clinical examination

A complete clinical examination/observation consists of three important elements: case history, inspection of the environment, and physical examination of animals.

9.2.1.1. Clinical examination

- Make an inspection of the environment; particularly those places known to favor disease, such as marshy, damp areas, should be closely observed.
- Identify the animal by some means, brand, nick name, ear tags, etc. Carry out the examination while the animal is still quiet. Further examination can be carried out later while the animal is restrained.

You should ask several questions during the clinical examination. The answers may allow you to form an opinion of the disease responsible before conducting the physical examination. The following are some of the procedures:

- Closer inspection of all body regions:
 - ◆ First, look at the animal from a short distance before you disturb it.
 - ◆ Observe the animal's behavior. Is the animal calm? Is it excited or aggressive? Is its breathing normal or distressed? How fast is the animal breathing? Is it shaking and grinding its teeth? Does it move normally? Is it with its group or does it stand alone?
- Closer examination of the nose, mouth, eyes, head and neck:
 - ◆ Is there a discharge coming from the nose? What type of discharge? — runny, thick, clear, cloudy or colored? Are there any sores on the nose? Does the breath smell bad?
 - ◆ Is there abnormal salivation?
 - ◆ Are there ulcers around the lips, gums, tongue, etc.?
 - ◆ Is there any discharge from the eyes? What color is the mucous membrane inside the eyelid?
- Closer examination of the skin:
 - ◆ Are there any places where the wool or hair is missing?
 - ◆ Are there any sores or blisters on the skin? Wet, sore patches of skin may allow disease-agents to enter, causing infection.
 - ◆ Are there any swellings under the skin? These may be *lymph nodes* or *abscesses*.
 - ◆ Is the coat normal and healthy?
- Closer examination of udder and genitals:
 - ◆ Is the udder swollen or warmer than usual?
 - ◆ Is the udder painful to the touch and does the animal refuse the udder being touched?
 - ◆ Are there injuries on the teats, udder?
 - ◆ Is the milk normal in color, quantity, and consistency?
 - ◆ Is there any vaginal/vulva discharge?
 - ◆ Are there any ulcers/scabs around the vulva?
 - ◆ Is there any injury on the scrotum?
 - ◆ Is there any discharge from the penis?
- Closer examination of legs and feet:
 - ◆ Is the animal lame? Examine the foot and legs for wounds, swelling or pain.
 - Are one or more legs involved?

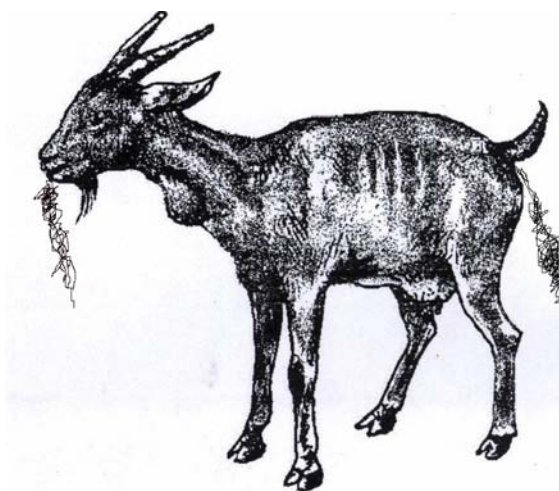


Figure 9.1. A sick goat with nasal and mouth discharges and diarrhea.

- Closer observation of changes in ways of defecation and urination:

- ◆ Does the animal pass urine and feces normally?
- ◆ Does the animal look distressed when it passes feces and urine?
- ◆ Does it have a strange pose during defecation and/or urination?
- ◆ Is the feces watery, and passed more frequently than normal?
- ◆ Is there blood or mucous in the feces?
- ◆ Is the color of urine normal?



In general, during clinical observation and/or examination you can notice the following:

- A healthy sheep/goat:
 - ◆ has a good appetite.
 - ◆ appears bright, alert and responsive when playing and climbing.
 - ◆ stays with the flock.
 - ◆ has smooth, clean and shiny coat.
 - ◆ has clear eyes with some pink color in the eyelids.
 - ◆ has an erect tail and a moist nose.



Figure 9.2. Healthy goat (top) and sick goats (bottom).

- Healthy lambs/kids are active and alert, and breath normally. They are up on their feet in 30–60 minutes after birth, move freely and feed often.
- A sick/unhealthy sheep or goat:
 - ◆ has reduced appetite.
 - ◆ has breathing that is too fast or too slow.
 - ◆ sits or lies separated from the flock/herd.
 - ◆ has an ill-appearance with a dull, matted coat, hunched-up stance and tail and ears that droop down.
 - ◆ has a dry nose or has discharge from the nose, eyes, and/or mouth.
- Unhealthy lambs/kids are:
 - ◆ often unwilling to move or feed.
 - ◆ appear weak, cold, lazy and hunched up.
- Unhealthy older lambs/kids show similar clinical signs as smaller lambs/kids. Often they stand separate from the rest of the flock in pain, scouring (wet tail with feces), and move slowly.

Taking temperature

A sick animal may have a body temperature higher or lower than normal. You can estimate the temperature of an animal easily by feeling its back or ear with your hand. This is not applicable when the animal is hot because of the sun. Follow the steps below to measure the body temperature of an animal using a thermometer.

- Turn the thermometer until you can see the silver line, the place where the line stops marks the temperature.
- Hold the thermometer at its end firmly and shake it so that the line of liquid (mercury) stops near the bulb of the thermometer.
- Smear a little Vaseline on the bulb end of the thermometer.
- Have someone hold the animal, or if you are alone, tie it up. Lift the animal's tail and gently insert the thermometer about 5 cm into the rectum.
- Keep the thermometer in the rectum and touching the wall for at least two minutes.
- Take the thermometer out, wipe it clean and turn it so that you can see the line and read the temperature.
Normal temperatures of sheep and goats:
 - ◆ Adult sheep: minimum, 38.5°C; maximum, 40.5°C
 - ◆ Lamb: minimum, 38.5°C; maximum, 40°C
 - ◆ Goat: minimum, 38.5°C; maximum, 40.5°C
- Finally, shake the thermometer again, wash it in cold water and dry it before storing it.

Pulse or heart rate

An animal's heart rate is usually measured after the animal has rested for at least five minutes. You can feel the left side of the chest behind the leg and tell how fast the heart beats by placing your hand directly over the heart.

Each instance the heart pumps blood through the arteries is known as a pulse. You can feel the pulse by putting your fingers over arteries, usually done by feeling the femoral artery inside the back leg.

- The pulse rate of sheep and goats normally ranges between 60 and 80 per minute.

Respiration

An animal's respiration is measured by watching the rib cage movement. Animals breathe in three separate movements: breathing in, breathing out and a short pause. Very young, very old, very fat or pregnant animals breathe faster than other normal animals. An animal resting in the shade breathes slower than those standing in the sun. Sick animals breathe slower or faster than a normal animal.

- Sheep and goats normally breathe roughly 12–15 times per minute.

Rumen movement

Push with your hand just behind the last rib on the left side of a sheep or goat to check whether the rumen is contracting normally. You must feel the rumen contracting about once every minute.

- Average rumen contractions occur at a rate of 1–2 per minute

Checking mucous membranes

The thin skin that lines the inner surface of the body is called the mucous membrane. Mucous membranes are often wet with mucus. They are good indicators of what is happening inside the body, since they are so thin and transparent that you can observe blood vessels through them. The mucous membranes inside the mouth, at the vulva/vagina and inside the eyelid are easy-to-observe examples. The easiest place to look at mucous membranes is inside the eyelid.

Follow the following steps to examine the mucous membranes of the eyelid:

- Examine the sheep/goat in good, natural light.
- Open the eyelid as shown in the figure.
- Push the upper eyelid up with the upper thumb, while the lower thumb pulls the lower lid downward. Open the eye for a short time only, if open for a longer time congestions will take place and your reading will be false.
- Look at the color inside the lower eyelid.

Normal, healthy animals have pink/red mucous membranes (Figure 9.3). When an animal is sick, the mucous membrane becomes pale, white, yellow, very dark-red, red-blue or brilliant. These are signs of ill-health. For example:

- Pale mucous membranes are signs of *anemia*.
- Yellow mucous membranes can be a sign of liver diseases due to liver flukes.
- Brilliant red is a sign of *cyanide poisoning*.

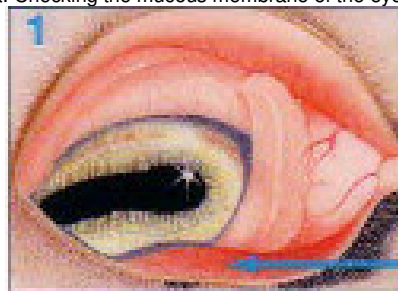
9.2.1.2. History

The history of a disease situation must be obtained from the people associated with the animals. Such a history can be obtained by asking questions like the following:

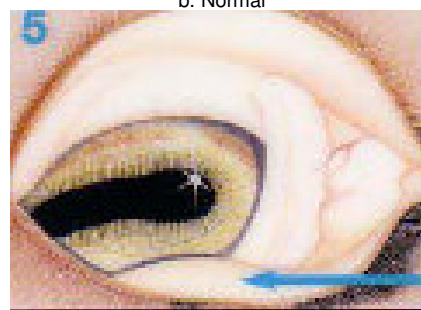
- Why do you think the animal is sick?
- When did people first notice signs of disease?
- How old is the animal?
- What sex is it?
- What kind of place does the animal come from?
- Has the animal been in contact with other animals?
- Which treatments or vaccinations have been given?



a. Checking the mucous membrane of the eyelid



b. Normal



c. Anaemic

Figure 9.3. Checking the mucous membrane of the eyelid.

General enquiries usually involve assessment of the following issues:

- Number of animals in the flock involved.
- Previous treatment or vaccinations given.
- Recent movements of the flock.
- Any contact with animals from other flocks.
- New introductions of animals into the flock.
- Variations in weather conditions, particularly temperature, humidity, wind direction and speed.
- History of disease occurrence, the time the disease was first noticed, including hour of the day.
- Number of animals affected, their ages, physical condition, sexes and the time of death.
- Feeding and watering routines.

Transferable Messages

1. Disease problems are mostly reflected with signs or symptoms likely to be recognized by farmers. During farmer training sessions, encourage farmers to share their experience on how they identify animals that need medical attention.
2. Let each participating farmer mention symptoms of illness in sheep and goats before your descriptions or presentation of your prepared teaching materials.
3. Remember that many diseases can show similar symptoms and animals may not always show the same signs, even when they have the same diseases. Signs of illness do not usually happen at once or in the same order. For example, sheep or goats often stop eating when they are sick. The animal may have stopped eating because of foot problems and will not walk to its feed, or due to some other simple reason such as a problem in the mouth.
4. It is general knowledge that one should not expect to find out exactly what is wrong with the sheep or goat from clinical signs of diseases. Such signs of illness may help to recognize some important diseases.
5. It would be best if training of farmers/pastoralists on how to detect sick animals among their flocks is carried out with a demonstration using a sick sheep or goat. Carry out the demonstration from nose to tail, on a step-by-step basis, explaining that farmers should perform observations for symptoms of diseases before taking their animals for treatment.
6. The use of flipcharts is often good for the training of farmers. Prepare flipcharts where you write the symptoms observed on one side and the possible or suspected disease types on the other side. For example, if one or two sheep or goats have died, and dark blood comes from the mouth, nose or anus and no signs of diarrhea, show that the suspected cause of death is anthrax. If diarrhea and signs of bleeding from the anus are observed, then the cause of death may be heartwater. If liver flukes are found in the liver of the dead sheep, the possible cause is liver flukes.
7. Similarly the KDA can prepare flipcharts showing signs of disease concerning eyes, ears, skin, lumps and swellings, breathing problems, eating and digestion problems, reproduction and udder, urine and feces, and signs relating to behavior and movement of animals.

9.2.1.3. Veterinary procedures and activities

Restraining animals for treatment

Mass handling

Without a handling system, health programs or activities will be delayed or not accomplished.

- Handling systems that are properly designed allow sheep or goats to flow through smoothly with minimal stress and injury.
- When you have to work with sheep and goats and there is no handling system, it is necessary to pack them into a small, fenced space or in a long working pen, 1 to 1.5 meters wide. Work your way (vaccinating, spraying, other health activities) along the pen, keeping the treated animals behind you. Make sure to separate treated from untreated animals.
- Weighing scales, tipping cradles and treatment crates can all be arranged in the line of traffic of animal flow.

Catching and restraining individual sheep/goats

A group of sheep or goats can be herded into a collecting pen or enclosure from where individual animals can be caught. Approach an animal from the side and attempt to bribe it with some kind of feed and be fast to catch the horn, legs or neck. Get assistance to hold it firmly so that you can examine the head, the neck, eyes, and other parts of the body. Adult animals and big lambs/kids can be individually restrained by holding the skin under the chin and by holding the tail head on its rump. The easiest technique to hold a sheep or goat is in the following way:

- Grasp the animal by the neck or upper part of a back leg.
- Put your right hand on its muzzle and turn its head slowly but firmly sideways. The animal will fall to the ground. Shift it into a sitting position with it leaning slightly against your legs keeping its feet off the ground.
- The animal should now be relaxed and you can examine its udder or testes, collect various samples such as ticks, lice and other external parasites (maggots), take blood from the jugular or ear veins, trim its hooves, etc.

There is an alternative way of handling a sheep/goat in a sitting position. First, reach under the belly and gently pull the two furthest legs towards you. With the animal on its side lean over to catch both front legs, and turn the body towards you so that it sits on its bottom, as in Figure 9.5, Step 3.

To restrain a sheep or goat in a standing position, its head can be held in a loop of rope or strong string. The loop should be about 50 cm in circumference and tied to a tree or a post at the same height as the sheep's shoulder. Tying a knot that does not slip but holds the loop at a fixed size prevents the animal from being strangled. Catching and restraining of sheep (rams) is easy when they have collars. Under these conditions, you can simply collect fecal samples directly from the rectum and other samples from different preferred sites.

Animals can also be restrained in a standing position using a neck crush. The neck is trapped between two pieces of strong, upright planking.

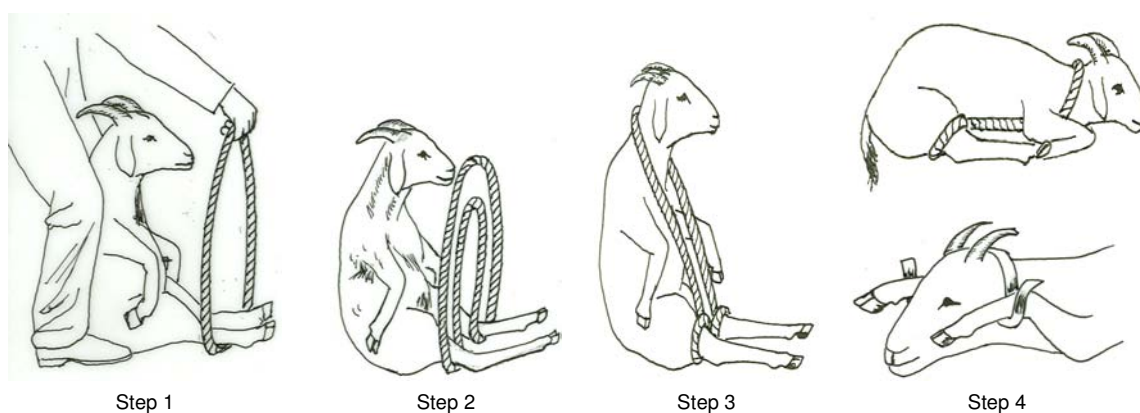


Figure 9.4. Restraining a goat.

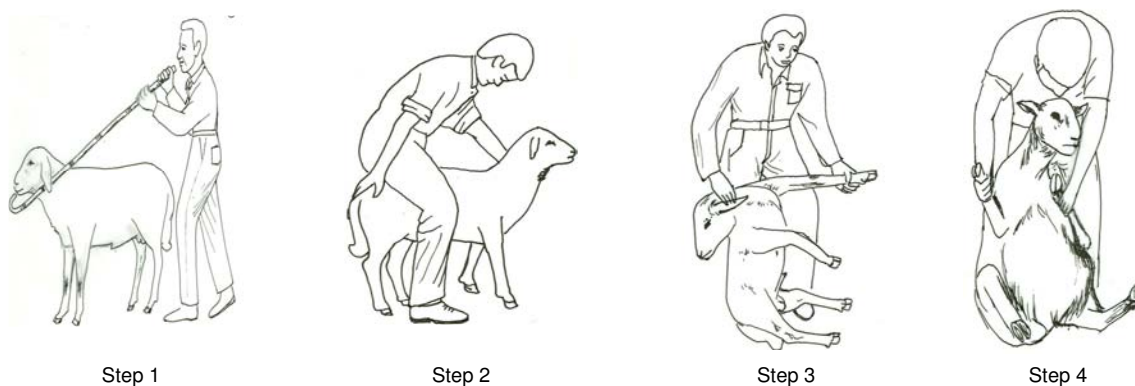


Figure 9.5. Holding and twisting a sheep to restrain it in a sitting position.

Treatment

Sick animals should be isolated from the flock and treated as soon as symptoms appear. The following are some of the useful basic veterinary supplies for the clinical care of sheep and goats.

Veterinary equipment

- Stethoscope
- Automatic vaccination syringes, size 20 ml with corresponding needles
- Dosing gun for anthelmintic treatment
- Blood collection tubes with no additive (for serum) or with Ethylene Diamine Tetra acetic Acid (EDTA) (for whole blood).
- Clinical thermometer
- Water-based lubricant gel
- Disposable gloves
- Bacterial culture swabs
- Rope halter
- Hoof shears or trimmer
- Elastrator and rubber rings or Burdizzo for castrating and docking
- Sterilization kit
- Knapsack sprayers
- Plastic buckets of 5, 10, 20 liters capacity
- Knives



Figure 9.6. Pulling two furthest legs towards you.

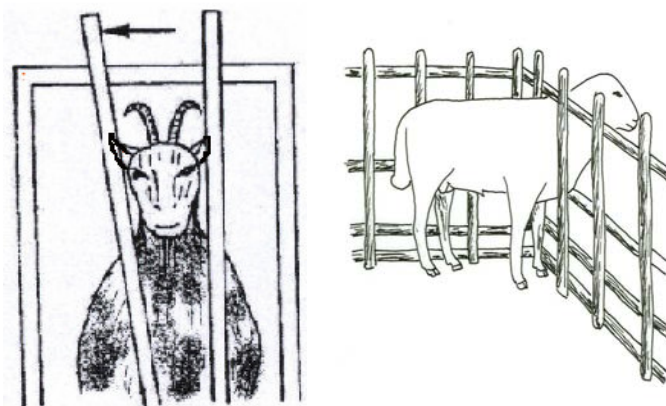


Figure 9.7. Restraining of an individual goat or sheep in standing position in a neck crush.

Drugs, chemicals and reagents

- Sterile 50% dextrose solution
- Sterile calcium-magnesium-phosphorus-dextrose solution (CAMPD)
- Iodine solution, with cotton or other materials for applying iodine to wounds
- Oxytetracycline aerosol spray, wound powder, etc.
- Injectable antibiotics (long- and short-acting oxytetracycline, penicillin and sulfonamides, antibiotic ointments)
- Anthelmintics
- Acaricides
- Anticeptics
- Vaccines
- Vitamins and mineral supplement
- Denatured alcohol

Deworming of animals is needed when:

- an animal is thin, probably poorly-fed;
- an animal is not growing well;
- an animal eats less than normal;
- an animal is weak, tires easily and lags behind the flock;
- an animal has rough coats;
- you observe a number of animals with diarrhea and dehydration; and
- you observe swellings or edema (e.g., bottle jaw) or see animals with pale mucous membranes.

Drenching and dosing

A variety of routes exist for administration of medications to sheep and goats, including several methods for the oral dosing of small ruminants.

- When dosing a sheep or goat orally, the head of the animal should be kept in a reasonably normal position to enable the animal swallow the drench.
- Administration is easily accomplished using dosing guns. However, dosing guns are often expensive for farmers to buy and cheaper means are available.
- Use a syringe to drench animals. This prevents animals, particularly older ones that recognize drugs in boluses or pills, from spitting them out minutes later.
- When administering a drug or anthelmintic, the dosing gun or syringe should be placed on the base of the tongue. The drug will then go to the rumen.



Figure 9.8. Drenching an animal using a syringe.

Tubing an animal

Large volumes of medication or liquid substances may have to be given by stomach-tube for adult sheep and goats.

- The tube to be used should be soft and with an inner diameter of 0.5–1.0 cm depending on the size of the animal. There must be no sharp edges on the tube.
- The total length of the tube to be inserted is estimated by measuring from the mouth to the last rib. Mark the length on the tube before it is inserted into the animal's mouth.
- The end of the tube is lubricated using edible oil, then placed in the animal's mouth and slowly pushed towards the throat and down the esophagus towards the stomach. The tube should be seen and felt going down the neck. If it is neither seen nor felt, check the position to make sure the tube has not entered the trachea and traveled to the lungs.
- The location of the tube in the stomach is indicated by possible smell of rumen gases. It is confirmed by ensuring that there is no air passing through the tube as the animal breathes. (If air is flowing through the tube, it is in the lungs and giving medicine there may kill the animal.)
- The medication/liquid is administered slowly by means of a syringe attached to the stomach tube.

Lambs are often fed colostrum via stomach tube instead of bottle feeding. Kids that are weak and unable to suckle must be given colostrum with a stomach tube. Tubing is also a temporary measure for feeding potential foster lambs, preventing them from becoming fixated on milk bottles. Sterilize tubes with boiling water before use. The technique for stomach tubing of lambs and kids is as follows:

- Place the lamb/kid wrapped in a towel on your knee.
- Lubricate the tube with vegetable oil.
- Hold the jaw with your left thumb and forefinger, with the fourth finger across the neck.
- Let the lamb/kid chew your finger, then slide the tube over the tongue and into the stomach until about 5–8 cm are left.
- Normally, the lamb/kid will relax and chew the tube.
- Attach the full syringe to the tube and empty the contents gently.
- When finished, pinch the end of the tube and withdraw it slowly. Clean the tube and store.



Figure 9.9. Tubing a lamb.

Bolus/pill administration

Boluses are one of the easiest and most reliable ways to administer medicines. Always follow the maker's instructions when preparing the dose. You can break boluses into two or four parts to get the correct dose.

Use the balling gun to administer boluses or pills to sheep and goats. The bolus is inserted into the opening of the balling gun and pushed out by the plunger. Care should be taken to place the bolus behind the tongue in order to activate the swallowing reflex.

In the absence of a balling-gun, boluses/tablets are simply given to sheep and goats by hand with or without wetting them with drinking water. You can dip boluses in edible oil so that animals can easily swallow them.

Hold the animal securely, with one hand firmly over the top jaw to open the mouth (Figure 9.10, Step 1) and place the bolus behind the tongue of the animal. Hold the mouth closed and keep the head tilted upwards stroking the throat to stimulate swallowing (Figure 9.10, Step 3). For both procedures, observe the animal for a few minutes to make certain the bolus was swallowed and not spit out.

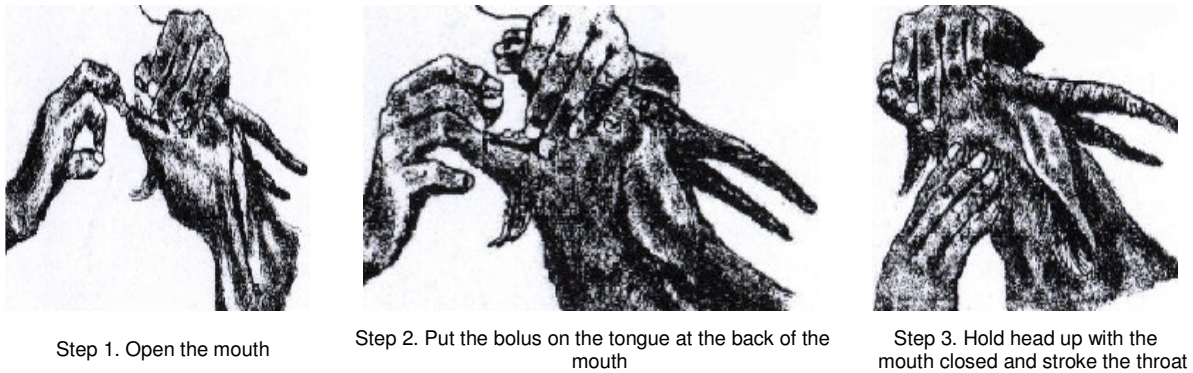


Figure 9.10. How to give boluses to goats.



Figure 9.11. How to give a bolus using a tube (balling gun).

Proper equipment, dosage and injections

There are various types of syringes and needles with different gauges and sizes. –

- Disposable syringes, 3 ml, 5 ml, 10 ml, 20 ml
- Hypodermic syringes, 12 or 15 mm, 16 or 18 gauge needles.

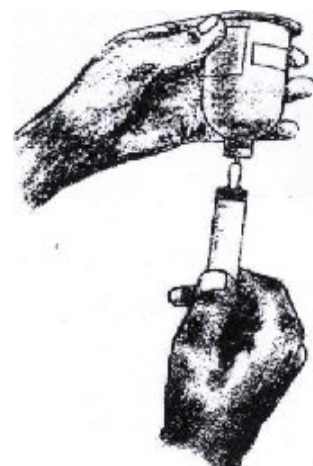
Dosage

Careful use of anthelmintics and antibiotics, as well as other medicines, is necessary if drugs are to remain effective. Underdosing or overdosing and frequent use of drugs may lead to the development of resistance. Therefore, it is always good to give accurate doses by calculating the weight of individual animals. For group treatment, some people estimate the dose based on the weight of the heaviest animal or the average weight. In this case, some animals will be overdosed and some underdosed. Accurately estimate the weight of animals you treat. Weigh some of them if you can. There is a useful technique to correctly estimate the weight of an animal. This is known as girth measurement. Estimation of body weight using heart girth measurements is presented in the Management section of this handbook.

Dose calculation for antibiotics

Dosage should be measured according to the manufacturer's recommendations based on the weight of the animal. The following example shows the steps needed to calculate how much medicine to give:

- You estimate that an animal weighs 50 kg.
- The manufacturer's dose tells you to give 10 mg/kg bodyweight of oxytetracycline.
- Multiply the animal's weight, 50 kg, by the dose rate (10 mg/kg). This shows you that the animal needs 500 mg of actual medicine ($50 \times 10 = 500$).
- The medicine you have contains 50 mg/ml of oxytetracycline (which means that 50 mg of actual medicine is available in each ml of the injection).
- Divide the amount of actual medicine the animal needs (500 mg) by the strength of the medicine (50 mg/ml) to find that the animal needs 10 ml of medicine ($500/50 = 10$).



Injections

- Assemble the syringe and needle, shake the bottle, and swab the cap with clean surgical spirit.
- Always check the recommended dose on the bottle label.
- Draw a volume of air into the syringe slightly more than the volume of liquid to be withdrawn.
- Thrust the needle through the rubber cap of the bottle.
- Turn the bottle upside down and push the plunger to inject the air in the syringe into the bottle (you will have difficulty withdrawing the dose if you do not do this).
- Make sure that the needle tip is below the surface of the fluid.
- Pull the plunger down, drawing slightly more liquid into the syringe than required.
- Push the plunger slightly to expel any air bubbles and adjust the right dose.
- Detach the syringe, leaving the needle in the cap for next dose withdrawal.
- Finally, attach a second needle to the syringe; expel any air from the needle.
- Needles should be changed between every 5–10 sheep/goats. If a blood-borne disease is suspected in the flock, a new needle must be used with each animal.
- Always discard partly-used bottles of medicine at the end of the day.



Figure 9.12. Filling a syringe with medicine.

Care of syringe and needles

- Immediately after use, the syringe should be dismantled, thoroughly cleansed, and then sterilized by boiling in clean water for twenty minutes.
- Do not inject animals within four weeks of slaughter
- Never vaccinate animals in wet conditions. Wet fleece carries a greater risk of infection.

Types of injections and procedures

• **Intramuscular (IM)** is the most common injection method. Use an 18-gauge needle, 2–3 cm long, to inject antibiotics. In small, young lambs and goats, a smaller 20-gauge needle should be used. Inject into the neck muscle just in front of the shoulder or the fleshy part of the shoulder itself. Injections should not be given in the hind leg or quadriceps muscles of the thigh. Injections can leave injection-site lesions that could decrease the value of the meat. To give an injection:

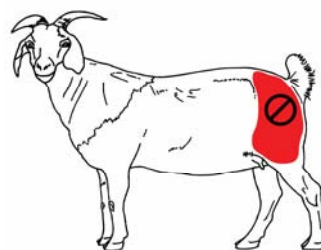
- ◆ Gently tap/hit the muscle two or three times with your fist to accustom the sheep/goat.
- ◆ Insert the needle quickly, straight into the muscle.
- ◆ Before injecting, draw the plunger out slightly to check if the needle has entered a blood vessel. If blood enters the syringe, withdraw the needle slightly and redirect into the muscle.
- ◆ When a correct spot has been entered, slowly press the plunger down. Volumes of no greater than 2 to 4 ml should be injected into a single IM site.
- ◆ Remove the needle from the animal and rub the injection site or press with cotton to prevent excess bleeding. This will also help the medicine to stay in the muscle.

• **Subcutaneous (SC)** injections are given under the skin, often in the skin just behind the shoulder or in the neck or inside the elbow of the front leg. A short needle, 1–2.5 cm, should be used to inject under the skin:

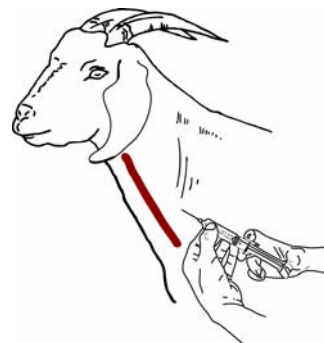
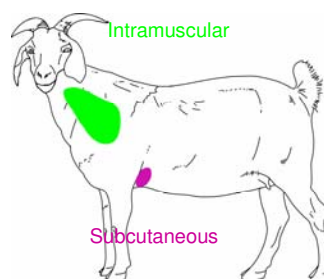
- ◆ Pull out a fold of skin and insert the needle at a right angle to the skin-fold. Care must be taken to ensure that the needle does not pass through the skin and exit on the other side.
- ◆ Gently press the plunger down.

• **Intravenous (IV)** injections are given into veins in order for the antibiotics to enter the blood stream as quickly as possible. Common sites for intravenous injections include the cephalic vein and the jugular vein. Use an 18-gauge or 20-gauge hypodermic needle.

- ◆ During an IV injection, the compound is administered slowly and the animal monitored for evidence of respiratory or cardiac distress. If there is any adverse reaction, the injection should be stopped.
- ◆ An intravenous injection should only be given by a veterinarian or experienced animal health technician.



Don't inject in red area!



Intravenous

Figure 9.13. Injection sites for intramuscular and subcutaneous injections.

Abscesses

An abscess is the result of a traumatic skin penetration with consequent infection. An abscess may also be the result of infection with the disease *Caseous lymphadenitis*.

- Subcutaneous abscesses are common in sheep and goats.
- Foot abscesses occur in sheep during the wet season. Lameness is the main symptom.
- The common sign of an abscess is swelling. The lump will grow and eventually burst.
- Abscesses contain bad-smelling pus enclosed in a pocket.
- Abscesses commonly occur under the throat, behind an ear, at the point of shoulder, in front of or inside the hind legs.
- A more serious form of abscess involves the development of internal abscesses, often on the lungs, causing pneumonia and loss of body condition.
- Abscesses must be opened, drained and treated as an open wound. Lancing abscess is carried out as follows:
 - ◆ Isolate the infected sheep or goat away from other animals.
 - ◆ Clean the abscess with soap and water, or antiseptic.
 - ◆ Stick a needle into it. If blood comes out, stop immediately. If pus comes out, continue and incise the abscess with a sharp, sterile blade, making a downward cut to allow the pus to drain.
 - ◆ Drain the pus onto cloth, paper or other material that can be burned or buried. Wash the abscess with boiled salty water or mild alcohol.
 - ◆ Use dressing forceps and cotton wool to clean the inside edges of the abscess.
 - ◆ Finally, wash with iodine or other antiseptic.
 - ◆ Treat the animal with sodium sulfadimidine solution (1 g/8 kg body weight), sulfonamide that may need to be continued for several days, procaine penicillin (3 ml/50 kg), or long-acting tetracycline 5 ml/50 kg) once, and if needed, every 3 days.



a. Treat when hair has fallen and there is a soft spot in the middle



b. Cut a cross over the soft spot with a sharp sterilized knife





c. Squeeze out the pus

d. Clean wound with boiled salty water

e. Wash with iodine or other antiseptic

Figure 9.14. Lancing abscesses in sheep.

9.3. Internal Parasites

Internal parasites are worms. Worms are small creatures that are found inside animals. Sometimes they can be seen with the naked eye, but sometimes they are not easily seen. Unless you specifically look for worms in an animal that dies or which is slaughtered, you may not see worms.

9.3.1. Signs of internal parasites in live animals

Some animals are more badly affected by worms than others, while some animals never develop a bad worm infection. How will you know if an animal is suffering from worms? There are a number of signs that may indicate that an animal has a worm infection. However, the signs will not tell you that the problem is definitely caused by worms, but should make you suspicious. Some commonly seen signs are:

- Bottle jaw
 - ◆ You may notice that a sheep or goat has a bottle jaw. This is a soft, cold swelling under the chin of the animal. It may be seen with a serious worm infection.
 - ◆ Brisket edema or swelling between the front legs and belly.
- Pale mucous membrane (*anemia*)
 - ◆ Sometimes the inner eyelid of animals may be very pale. This may be a sign of bad worm infection.
- Shabby wool or hair (poor condition)
 - ◆ Animals may have poor hair or shabby wool during the dry season. You may notice at first that sheep or goats are emaciated. You should feel the animals over their lower backs.



Loss of condition and rough hair coat



- Diarrhea
 - ◆ It may be difficult to see that a sheep with a fat tail has diarrhea unless you look carefully under the tail.
 - ◆ Diarrhea can be caused by round worms, coccidian or liver flukes. It may also have other causes. Sometimes toxic plants or an inappropriate diet may cause diarrhea.
- Weakness, depression and lying down abnormally.
- Eating less than usual or stopping eating altogether.
- Decrease in milk production.
 - ◆ Ewes or does may not have enough milk for their lambs or kids. The young may die of starvation.
- Pass tape worm segments in their feces.

Signs of bad worm infection in dead or slaughtered animals

You may notice the following signs of worm infection when you open the carcass of a dead or slaughtered animal.

- Worms and bleeding in the milk stomach
- Worms and fluid in the intestines
- Fluid in the body cavities
- Bumps on the intestines
- No fat on the carcass
- Pale carcass

9.3.2. Types of internal parasites

The major types of internal parasites of sheep and goats can be categorized into four groups according to their locations in the animal.

- Abomasal worms – nematodes (round worms)
- Liver flukes – trematodes (leaf-like worms)
- Intestinal worms – cestodes (tape worms)
- Protozoa (coccidia)

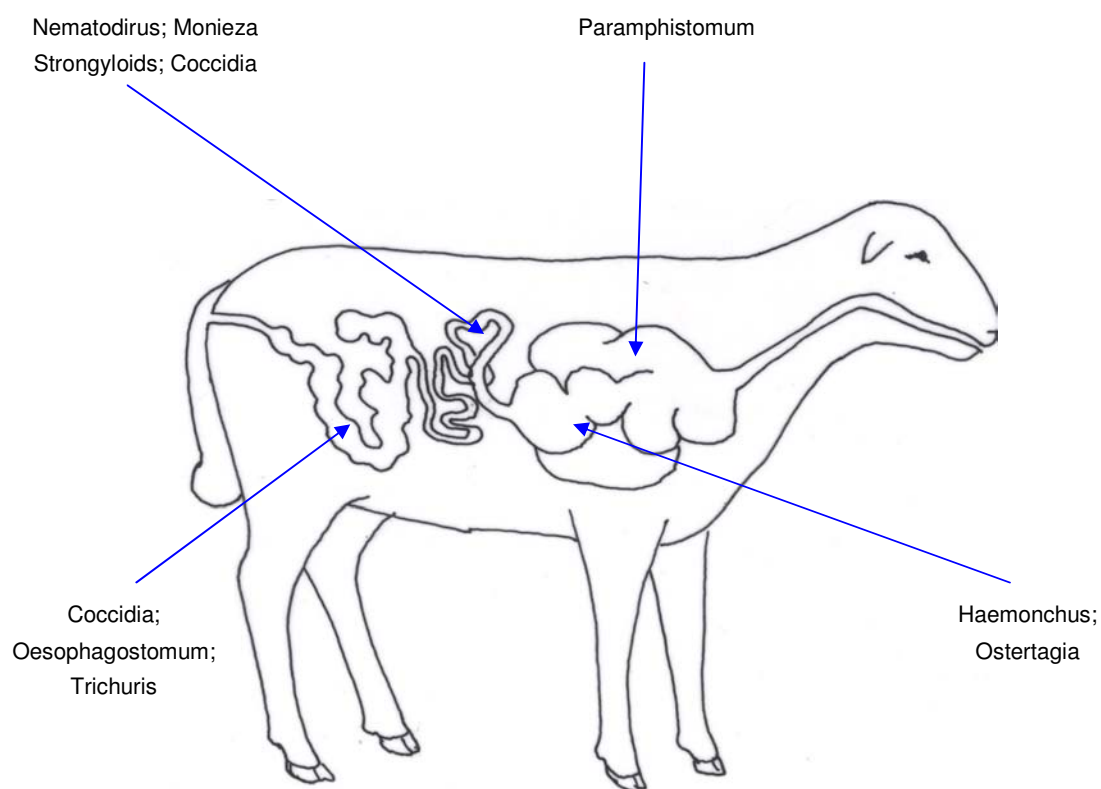


Figure 9.16. Locations of main parasites in sheep and goats (adopted from Peacock, 1996).

Table 9.2. Major parasites of small ruminants.

Location	Specific name	Common name
Abomasum	<i>Haemonchus contortus</i>	Barberpole worm
	<i>Ostertagia circumcincta</i>	Small brown stomach worm
	<i>Trichostrongylus axei</i>	Stomach hair worm
Liver	Trematodes	Liver flukes
	<i>Fasciola hepatica</i>	
	<i>Fasciola gigantica</i>	
Small intestine	<i>T. colubriformis</i>	Black scour worm
	<i>Nematodirus spathiger</i>	Thin-naked intestinal worm
	<i>Strongyloides papillosus</i>	Thread worm
	<i>Cooperia punctata</i>	Small intestinal worm
	<i>Bunostomum trigonocephalum</i>	Hook worm
Large intestine	<i>Trichuris ovis</i>	Whipworm
	<i>Oesophagostomum columbianum</i>	Nodule worm
	<i>Chabertia ovina</i>	Large-mouthed bowel worm
Lungs	<i>Dictyocaulus filaria</i>	Large lung worm

Nematodes (round worms)

Of all the gastro-intestinal parasites that affect sheep and goats, abomasal worms are by far the most important type.

- *Haemonchus contortus* is the most dangerous worm. In the adult form, it is a small worm, 1–4 cm long, which is usually found attached or freely swimming in the contents of the gastrointestinal tract. The male is red, while the female has red and white stripes in a spiral up its body, giving it the common name ‘barberpole worm’. It is a blood-sucking parasite. It is estimated that twenty adults can suck 1ml of blood per day from a sheep or goat. In acute infections, where large numbers of larvae ingested over a period of days lead to large adult worm populations, anemia can cause death before any effective treatment. In chronic infections, where the rate of infection has been slower, anemia results from the loss of whole blood.
- In infections with *Ostertagia* spp., *Trichostrongylus* spp., *Nematodirus* spp. and other intestinal parasites, animals show signs attributable to reduced feed intake, while others develop severe diarrhea with dark green or black feces. Some animals die quickly while others linger for days or weeks and become progressively weaker. This accounts for much of the lost productivity associated with these parasites.
- Life cycle of round worms:
 - ◆ Round worms are a single-host parasite, meaning that they live and reproduce in a single animal.
 - ◆ The adult worms live in the stomach and intestine of the animal where they lay eggs.
 - ◆ The eggs are passed out in the dung of the animal, but are too small to be seen in the dung.
 - ◆ The eggs hatch and young worms crawl up the moisture on blades of grass.
 - ◆ When a sheep or goat eats the grass, the animal takes in the young worms.
 - ◆ The worms then grow into adult worms in the intestine and stomach and the cycle begins again.

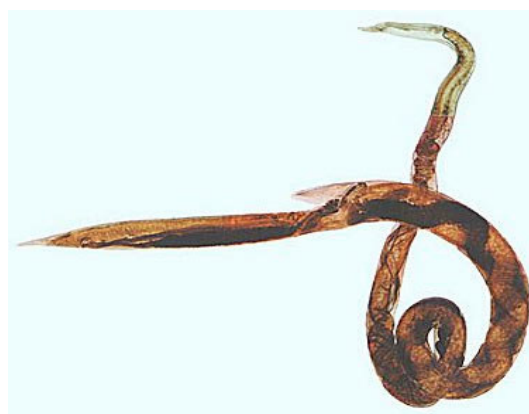


Figure 9.17. Barberpole worm in the stomach of a goat.

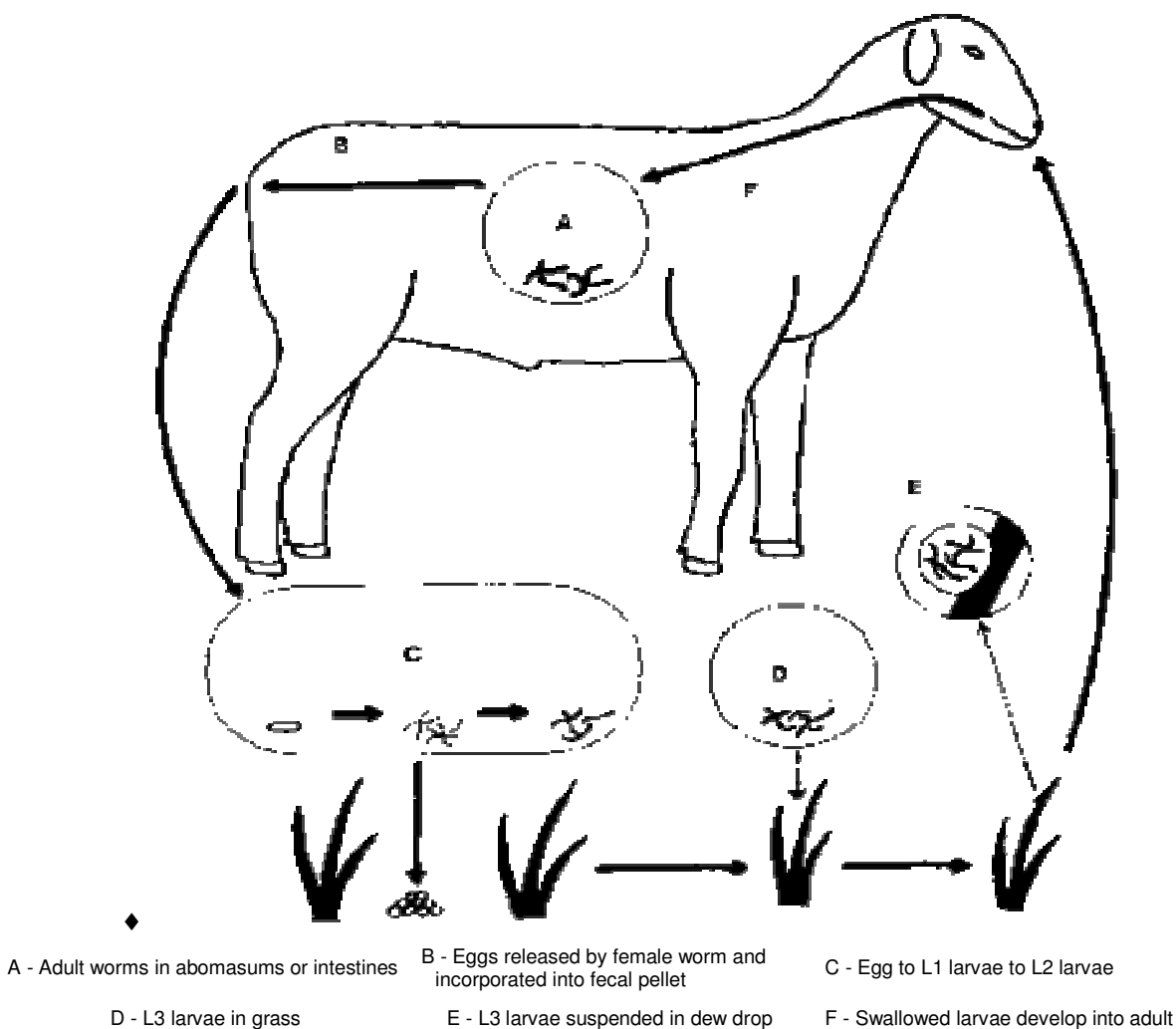


Figure 9.18. Life cycle of *Haemonchus contortus*.

Liver flukes

- The liver can be infected with two main types of flukes: *Fasciola hepatica* or *Fasciola gigantica*. Both use a snail as an intermediate host. Liver flukes are widely distributed in the highland and semi-highland areas. Marshy, poorly-drained pastures and grasslands beside irrigation channels are common sources of infection for both sheep and goats. Infection often occurs during the dry season.
- In the life cycle, eggs shed from ruminant animals hatch and produce cysts able to swim and infect the snail host. In the snail, they further develop into larvae (metacercariae) that are able to infect sheep and goats or other major hosts. Once ingested by sheep or goats, the larvae penetrate the intestinal wall and develop further in the liver, which may become severely damaged. Acute hepatic fascioliasis occurs 5–6 weeks after the ingestion of large numbers of metacercariae due to the sudden invasion of the liver by masses of young flukes.
- If unusually large numbers of flukes invade the liver over a short period, the damage may be sufficiently severe to cause acute hepatitis. Adult flukes in the bile ducts cause biliary obstruction, fibrosis and anemia. The adults are tissue feeders which possibly suck blood, leading to losses of plasma protein into the gut. Anemia results from the combined effects of mechanical blood loss, decreased red blood cell production and increased destruction of red blood cells.

Clinical signs include weight loss, diarrhea, sub-mandibular edema (bottle jaw) and sudden death due to anemia following acute or chronic infections.

Lung worms

- Most lung worms are caused by *Dictyocaulus filaril*. Lung worms are usually found in the highland and semi-highland areas. They inhabit the air ways of the lung.
- Male worms may be 3–8 cm long and females 5–10 cm. Eggs are laid in the lungs, coughed up and swallowed, then passed out in the feces. Once outside the animals, the larvae take 6–7 days to develop and become infective. Infection is by ingestion of larvae on herbage. After consumption, the larvae penetrate the intestinal wall, entering the lymphatic vessels, then blood vessels, and eventually the lungs.
- The principal signs of infection are coughing and difficulty in breathing. The disease is very important in both sheep and goats. Mortality rates can be high in weaned lambs/kids, and lactating females, and low in non-lactating (dry) adults. From 2 to 10% can die within a few days of an outbreak before preventive action is taken. Deaths in young lambs/kids from malnutrition following parasitism in lactating dams can also be important.
- Lung worm infection can be mistaken for pneumonia or pasteurella infection, and as a result, lung worms go untreated. Coughing without any fever usually indicates lung worm infection.

Cestodes (tape worms)

- Almost all domestic and wild animals, birds and fish are susceptible to tape-worm infections. In sheep and goats, tape worm parasites cause diseases and economic loss. Often animals carry moderate or even heavy infestations without showing any ill effects. Heavily infected young animals will have stunted growth and may die when factors such as under nutrition or drought are present.
- *Moniezia expansa*, up to 6 m in length, and *Avetelina* spp. more than 3 m long, occur in small intestines of sheep and goats. *Stilesia hepatica* occurs in the bile ducts. It ranges from 20 to 50 cm long.
- The symptoms of tape worms in sheep and goats may not be too obvious, and the clinical effects of such as rough hair coat, digestive disturbances, constipation followed by diarrhea, pot belly, anemia, and edema may also be caused by round worms. However, when large numbers of tape worms are present, they may cause obstruction of the intestine and precipitate enterotoxemia or overeating disease.
- Larval tape worm infections of sheep and goats are very important because of zoonotic significance. The adult parasite, *Taenia hydatigena*, lives in the small intestine of dogs. The larval stage, *Cysticercus tenuicollis*, is found in the peritoneal cavity of sheep and goats. *Taenia multiceps* is found in dogs. The larval stage, *Coenurus cerebralis*, occurs in the brain and spinal cord of sheep and goats. *Echinococcus granulosus* is a very small tape worm of dogs. The larval stage, hydatid cyst, is found in sheep and goats and in many other intermediate hosts. Cystic echinococcosis is a major helminthosis with regard to public health. The threat to human health can be minimized by preventing dogs from eating any animal organ meat that contains hydatid cysts. The disease may also need attention to meet the future requirements of meat and live-animal export markets.

Coccidiosis

- All kinds of animals, particularly young animals, get coccidiosis.
- Coccidiosis is caused by protozoal parasites that live in the intestines of animals. The most well-known parasites that cause coccidiosis belong to the *Eimeria* and *Isospora* species.

- Animals get coccidiosis from food or water contaminated by feces of infected animals. Animals become sick with coccidiosis when large doses of protozoa enter into their stomach, usually when they live in wet and dirty places that are contaminated by the parasites.

Animals show the following signs when they are infected with coccidia parasites:

- Reduced feed consumption.
- Weakness and lethargy (fatigue, tiredness).
- Diarrhea, potentially severe, with blood and mucus in the feces. Animals strain to pass feces.
- Most animals recover quickly but animals with severe infections may take a few weeks or more to recover.
- Young animals suffer most and death is common.
- Treatment must be given to sheep and goats as soon as possible. Medications can be given in food or drinking water.

Prevention and control of coccidiosis can be done the following ways:

- Separate sick animals from the flock and treat as soon as possible.
- Keep animal shelters clean and dry.
- Keep animals, especially young lambs and kids, on clean, dry bedding.
- Clean fecal material away from places where animals live.
- Keep feed and water containers off the floor to prevent feces contamination.

Fecal egg counts

Feces are collected in order to identify the parasites found inside the animal. This can be achieved by microscopic examination of the eggs, larvae and adult parasites of nematodes, trematodes, cestodes and protozoa. For laboratory techniques and procedures, refer to Hansen & Perry, 1994. The number of eggs per gram (epg) provides an indication of the severity of parasite infection with nematode parasites. Table 9.3 provides a rough guide to help interpret the results of fecal egg counts.

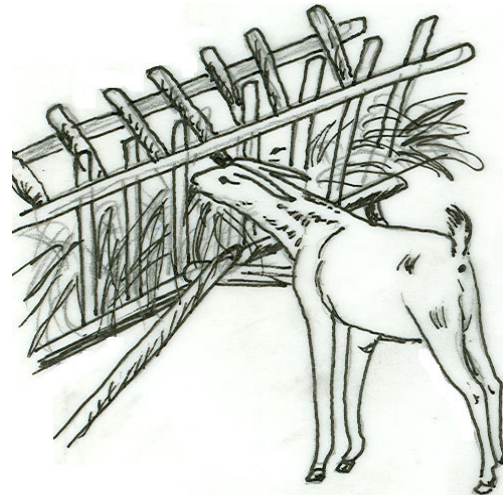


Figure 9.19. Feeding and watering animals by keeping food and water off the ground.

Table 9.3. A guide to the interpretation of fecal egg counts.

Species	Light	Medium	Heavy
<i>Haemonchus</i>	100– 1000	1000–4000	4000+
<i>Trichostrongylus</i>	100– 1000	1000–2000	2000+
<i>Nematodirus</i>	50–100	100–600	600+
<i>Oesophagostomum</i>	100–800	800–1600	1600+

Adopted from Hansen and Perry (1994).

9.3.3. Prevention and control of internal parasites

At present, internal parasites are mainly controlled by use of anthelmintic drugs. Unfortunately, drug resistance has become a problem to sheep and goat production areas throughout the world. It is inevitable that it will also occur in Ethiopia. Meat and live animal importing countries now require livestock products to be free from drug residues. Therefore, follow an integrated worm management program for sheep and goats as described below.

9.3.3.1. Curative deworming

As with other infections, the treatment of gastrointestinal parasites should be preceded by removal of the source of infection. However, in a communal grazing system, keeping animals away from sources of infection is difficult. You can use anthelmintic treatment to remove the parasites. There are several options from which to choose in deciding which animals to treat.

- Treat targeted groups:
 - ◆ Animals lagging behind the flock, showing weakness, ill-thrift, anorexia, diarrhea.
 - ◆ Young animals, lambs, kids/weaners, which are susceptible to infection.
 - ◆ Pregnant/lactating ewes and does because of weakened immune response during this physiological state.
- Treat anemic animals:
 - ◆ Use FAMACHA to check highly anemic animals. FAMACHA is a method developed in South Africa for testing for anemia caused by parasites, particularly for *Haemonchus contortus*
 - ◆ There is a 5-number scale on a FAMACHA card. Categories 1 and 2 need no treatment; an animal registering a 3 needs treatment only if it looks sick while categories 4 and 5 need treatment. Always treat sheep and goats with a score of 4 and 5.
 - ◆ Repeat the FAMACHA test every 4 weeks and treat as necessary.
- Treat animals based on parasitological parameters:
 - ◆ Use egg counts to monitor infection and proceed with the curative treatment by selecting appropriate drugs.
 - ◆ Goats require twice the cow dosage of all dewormers, except for Levamisole. Give Levamisole at 1.5 times the cow or sheep dose.

9.3.3.2. Preventive deworming

Preventive deworming (drug prophylaxis) consists of eliminating worm infections by regular treatment of herds/flocks.

- The treatment program should eliminate worms at peak infection and prevent reinfection of pasture during high-risk periods. Several treatment programs are proposed for different times of the year. In practice, a number of regular treatments for diseases such as fasciolosis should be given. The following program may be considered for sheep and goat production areas of Ethiopia.
- Treatment may be given at the end of the rainy season (September/October) according to the altitude. At this time, animals are well nourished and may have large numbers of parasites without seemingly being affected by the worms. Killing these parasites with anthelmintic drugs will improve performance during the upcoming harsh, dry season conditions.
- Another treatment is given at the end of the dry season (April/May). The entire herd/flock should be treated. This treatment reduces infestation of pastures by residual parasites and parasites which occur throughout the year. Two treatments per year, with improved management, seem to be an optimum.

Suggestions

- Kebele Development Agents and senior regional extension workers call a meeting with farmers to discuss herd health. Training is given on disease control and the danger of communal grazing areas if everyone doesn't treat their animals.
- Farmers should be encouraged to form consultative planning groups and appoint someone to make sure that the rules are followed.
- The farmers set guidelines for communal grazing and agree to follow them. This includes deworming, controlling grazing and not allowing sick animals on communal grazing areas.
- Penalties would have to be set for anyone not following the rules (e.g., ban from grazing until compliant). It is best if farmers themselves set these rules and work together to see that they are enforced.

9.3.3.3. Strategic deworming

Strategic deworming of animals with approved drugs is an important strategy in controlling internal parasites. Annual rotations of anthelmintic drugs are not currently recommended as this can increase rate of resistance to all drugs. Using one class of a broad spectrum drug until it is no longer effective and then switching to another class of a broad spectrum drug is considered a better strategy. The new strategy is thus recommended for use. Moreover, it is necessary to consider the following points seriously:

- Use a full dose of anthelmintics whenever treatment is carried out. This is recommended to help prevent the development of resistance.
- Treat all newly introduced animals before allowing them to mix with the remaining flock.

Two treatments are recommended at the beginning of the dry season and two treatments at the beginning of the rainy season. The interval between the first and second treatments should be 2–3 weeks. The treatment at the beginning of the dry season is done to eliminate the current parasite burden, enabling animals to better cope with the nutritional stress during the dry season. A treatment before the rainy season will prevent contamination of pastures at a time when conditions are becoming favorable for egg and larval development.

Transferable Messages

1. There are several types of worms of sheep and goats known by farmers. Farmers should be given opportunities to present their knowledge about worms in different animals during the training sessions. Encourage them to list the different symptoms of diseases caused by pathogenic worms. Prepare the lists of worms of sheep and goats clearly written as they are officially (scientifically) known, and the way they are called in the local languages.
2. All animals can be infected from different types of parasites. Clearly indicate which animals are mostly affected and why.
3. Discuss with the trainees on how poorly-fed animals often have worms. Sheep or goats utilize feed poorly because they have worms. Animals need better feed for maintenance for living, production and health.
4. Sick animals need treatment for worms. What are the remedies for worm infections? Discuss where true anthelmintic drugs can be purchased. Indicate all the possibilities of adulterated drugs that can be purchased at the different open markets, contrabands and illegal drug vendors. Some drugs with unknown sources may not be true drugs. Drug resistance occurs because of underdosing, frequent use of drugs or the use of the same drug for long periods without rotating different groups of drugs.

9.3.3.4. Pasture management

- Pasture management is designed through long-term planning with such factors as the age groups of animals and the time and intensity of grazing.
- **Pasture rotation:** dividing a pasture into paddocks and moving animals from one paddock to another to optimize use of grass. Use of a “50/50” grazing system, (all the animals on half of the farm).
- **Grazing height:** some experts recommend that animals be allowed to graze new pastures very close to the ground so that the sun can diminish the chances of survival of the parasites brought in with the animals.
- **Grazing time:** the drier the grass, the more parasites will stay at the base of the plants. The risk of infection is greatly lowered by waiting until the dew has lifted or until the grass has dried after the rains.
- **Graze by age group:** the susceptibility of animals varies with age. It is logical to graze younger animals in fields where parasite populations are very low and separately from adult animals. Alternate grazing pastures annually.
- **Multi-species grazing:** graze cattle after sheep and goats. Cattle clean the pasture after sheep and goats have grazed. The cattle ingest a significant quantity of mature larvae from the lamb stools, but cattle are not affected by most internal parasites of sheep and goats. If the cattle are allowed to graze the grass down to 3–5 cm from the ground, many parasites will be killed off due to exposure to the sun.
- **Improvement of drainage:** pasture that remains wet for a long period is an ideal environment for survival of internal parasite larvae. Drainage of a field reduces the larvae’s chances of survival.

Transferable Messages

1. Animals usually get worms from pasture contaminated with worm eggs or larvae. Worms often start causing problems at the start of the wet season because many worm larvae develop on the pasture at the same time.
2. Animals also get infection from parasitic larvae when they graze on the banks of streams or marshy areas. A good example is the case of liver flukes. Animals get liver fluke infection when they eat the metacercaria (young liver fluke) while grazing near such water bodies. Farmers can work together to reduce or control worm infections such as nematodes and liver flukes.
3. Remember the pasture-management approach and the guidelines for communal grazing areas, including strategic deworming, controlling of grazing areas, etc. Include in the training materials techniques of keeping animals away from areas of liver fluke danger by fencing water-logged areas and avoiding pastures that have been flooded. Encourage use of water from bore-holes or wells, use of forage from tress (cut-and-carry method), etc.

9.3.3.5. Control options through breed choices

Parasite control is possible through an integrated approach by combining different control strategies. The use of breeds that have increased worm resistance is one strategy. Some breeds of sheep and goats are more resistant to parasites.

- In sheep for example: Florida Native, Louisiana Native, Barbados Black Belly, Red Massai of Kenya, etc., are resistant breeds.
- Resistant breeds can be introduced in an area to replace existing susceptible breed(s) provided that they are productive under the new circumstances.
- A local breed can be crossed with a resistant breed imported from other areas.
- Note that sometimes one breed is economically desirable despite its relative susceptibility to major diseases (e.g., Merino for fine wool production despite its relative susceptibility to diseases from round worms such as *Haemonchus contortus*).
- Resistance of Ethiopian sheep and goat breeds to internal parasites is not known.

9.3.3.6. Anthelmintic drugs and dosages

There are different formula and presentation of anthelmintic drugs. The following are some examples:

- Boluses/pills or tablets — these are practical and easy to use.
- Liquid preparations/drenches — these are locally available ready-to-use preparations.
- Pastes — easy to administer if you have a dispenser. Not commonly available in local markets.
- Medicated blocks — difficult to control the amount of drugs consumed. Not locally available at present.
- Slow-release formulations — drugs placed in the rumen and hence will be delivered continuously. Not locally available.

Principal anthelmintics and their use

Nematocides

Most of the anthelmintics belong to the five chemical groups: **Benzimidazole** compounds, **Imidazothiazole** derivatives, **Pyrimidine** derivatives, **Pyperazine** and its salt, and **Organophosphates**. The following are the principal anthelmintics currently used in Ethiopia:

- Albendazole: Trade name, Valbazen. Active against nematodes such as *Haemonchus* and other trichostrongyles round worms; to some extent, liver flukes (*Fasciola hepatica*); tape worms (*Moneiezia*, *Taenia saginata*), etc. Dosage: 5 mg/kg for round worms, and 10 mg/kg for flat worms (trematodes).
- Camebendazole: trade names, Camben, Noviben. Good for the control of round worms, especially for lung worms and also for the control of tape worms. Dosage: 25–30 mg/kg.
- Fenbendazole: trade name, Panacur. It is very active against larval and adult form of round and tape worms. Recommended dose: 7.5 mg/kg.
- Mebendazole: trade name Vermox. It is very active against round worms, tape worms and liver flukes. Recommended dose, 15–20 mg/kg. Optimum dose: 35 mg/kg, in split dose.
- Oxfendazole: trade name Systemex. It is active against larval and adult gastrointestinal and lung worms. Recommended dose: 4.5–5 mg/kg. Effective against tape worms (*Moniezi expansa*) and adult liver flukes, at a very high dose.
- Thiabendazole: trade name TBZ, Thibenzole. Active against gastrointestinal round worms. Recommended dose between 75 mg/kg and 120 mg/kg (usually 80 mg/kg).

Imidazothiazole derivatives

Imidazothiazole derivatives include **tetramisole** and **levamisole**. The active form is levamisole.

- Available in several trade names such as Nemicide, Nilverm, Vermipan, etc. Active against gastrointestinal- and lung-worms. Recommended dose for tetramisole is 15 mg/kg and for levamisole, 12 mg/kg.

Pyrimidine derivatives

These are pyrantel and morantel form of pyrantel. Examples of trade names are:

- For pyrantel, Combantrin, Nemex; for morantel, ExparGylox. Active against gastrointestinal round worms. Recommended doses, pyrantel, 15 mg/kg; morantel, 7.5 mg/kg.

Piperazine and its salts

- Piperazine: trade name Dictyomazine, Larvazine, Vermizane, etc. Active against round worms, immature and mature lung worms, etc. Dosage depends on preparation, for example, piperazine dithiocarbamate, 150 mg/kg. 20 mg/kg for lung worm for 3 days or 40–50 mg/kg single dose.

Other nematocidal anthelmintics

- Phenothiazine: trade names, Nemathiazine, Neoavilep, etc. Active against gastrointestinal nematodes. Dose, 300–500 mg/kg.
- Febantel: trade name, Rintal. Active against nematodes of the digestive tract.

Trematodicides

These are effective against both adult and immature forms of liver flukes (*Fasciola* spp.). The worm killers are phenol derivatives. Some examples of anthelmintics against liver flukes are:

- Nitroxylinil: trade names, Dovenix, Trodax. Active against both adult and immature liver flukes. These are also effective against gastrointestinal worms. Recommended dose: against adult liver flukes 8–12 mg/kg; against immature, 15 mg/kg or more.
- Oxyclozanide: trade names, Diplin, Zanil. Active against adult form of liver flukes. Recommended dose, 15 mg/kg.
- Rafoxanide: trade name, Ranide, Flukanide. Active against immature and adult liver flukes and against abomasal or intestinal round worms. Recommended dose: against immature and adult liver flukes; 7.5–10 mg/kg; against adult *Fasciola*, only 5 mg/kg.
- Closantel (Flukiver), Albendazole (Valbazen), Trichlorphen (Bilarcil): these are the other trematodicidal anthelmintics, which are active against round worms, liver flukes and *Schistosoma*.

Cestodicides

Products that are active against the whole cestode family are rare. A drug may be active against some species, but not others. However, from the discovery of the activity of salicylanilide (niclosamide), a number of effective drugs have been developed. The following is an example of a drug against cestodes (tape worms):

- Niclosamide: trade names, Yomesan, Mansonil, Cestocid. Active against Anoplocephalosis (all species). Recommended dose varies: against *Moniezia*, 80 mg/kg, Avitellina and *Stilesia*, 100 or 150 mg/kg.

Ways of controlling most tape worms

- Keep uncooked meat and offal with tape worm cysts away from dogs.
- Avoid eating uncooked meat. Meat cooked until it becomes brown in color is safe to eat.
- When you kill sheep/goat at home, do not burst/open cysts if found, rather bury or burn them. Never give them to dogs.
- Treat dogs for tape worms regularly.
- Teach farmers/pastoralists to be treated for tape worm infection if they are infected.
- Always wash your hands after handling your dogs.

Combinations of anthelmintics

Several anthelmintics can be combined to increase the spectrum of activity of drugs. Such combined drugs are available in the market. Some examples are:

- Equinoxes = piperazine + thiabendazole
- Nilzan = oxyclozanide + tetramisole
- Ranizole = rafoxanide + thiabendazole
- Trivermax = bithionol-sulphoxide + phenothiazine
- Polypar = niclosamide + oxibendazole
- Wormex = bithiono-sulphoxide + tetramisole

Table 9.4. Anthelmintics for sheep and goats.

Generic name	Common commercial names	Dosage (mg/kg)	Spectrum of activity			
			GI	L	T	F
BENZIMIDAZOLE						
Albendazole	Valbazen	5–10	+	+	+	+
Febanel	Rintal	5–10	+	+	+	-
Fenbendazole	Panacur	5–7.5	+	+	+	+
Mebendazole	Telmin	12.5	+	+	+	-
Oxfendazole	Synanthic	5	+	+	+	-
	Systemex					
Oxibendazole	Widespec	10	+	-	-	-
Thiabendazole	Thibenzole	44	+	+	-	-
Thiophanate	Wormalic	50	+	+	-	-
Triclabendazole	Fasinex	10	+	-	-	+
IMIDAZOTHIAZOLES						
Levamisole hydrochloride	Nilverm	7.5	+	+	-	-
	Nilzan					
	Nilvax					
Levamisole phosphate		8–9	+	+	-	-
Tetramisole		15	+	+	-	-
SALICYLANIDES						
Rafoxanide	Ranide	7.5	+	-	-	+
Niclosamide	Seponver	53	-	-	+	-
Closantel	Superverm	7.5	+	-	-	+
Oxyclozanide	Zanil		-	-	+	+
TETRAHYDROPYRIMIDINES						
Morantel	Exhem	10	+	-	-	-
Pyrantel tartrate		25	+	-	-	-
MISCELLANEOUS						
Avermectin	Ivermectin	0.2	+	+	-	
Nitroxylnil	Trodax		+	-	-	+

GI = Gastrointestinal nematodes, T = Tape worms, L = Lung worms, F = Liver fluke; + = Effective, - = Ineffective

9.4. External Parasites

9.4.1. Effects of external parasites

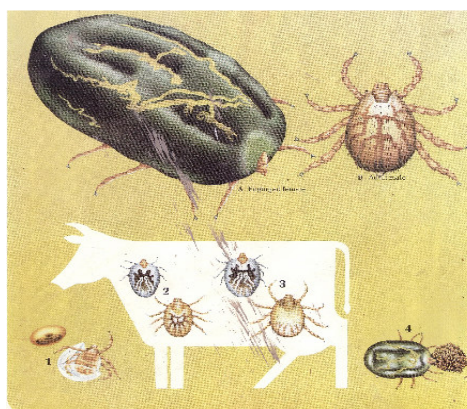
External parasites are responsible for a great diversity of animal health problems.

- Attachment to the host causes irritation of the skin with subsequent ulceration and secondary infections. The wounds attract screw worms and other flies, and myiasis can develop.
- Heavy infestations are associated with anemia, since adult female ticks can suck up to 10 ml of blood.
- The presence of large numbers causes annoyance and animals become restless. This may cause loss of weight and condition.
- One of the most damaging effects of external parasites is their ability to transmit diseases to their hosts. Some of these are serious with fatal consequences.
- Cause tick-paralysis.
- Bites can damage sensitive areas of skin (teats, vagina, eyes, etc.)
- Tick attachment between the claws of the feet may cause severe lameness.
- Transmit diseases.

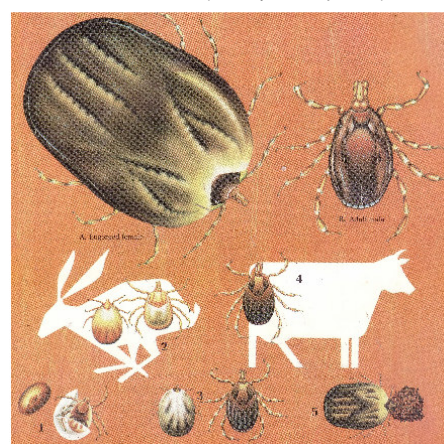
- There is an associated economic loss through skin damage, rendering the skin unsuitable for the leather industry.

9.4.2. Ticks

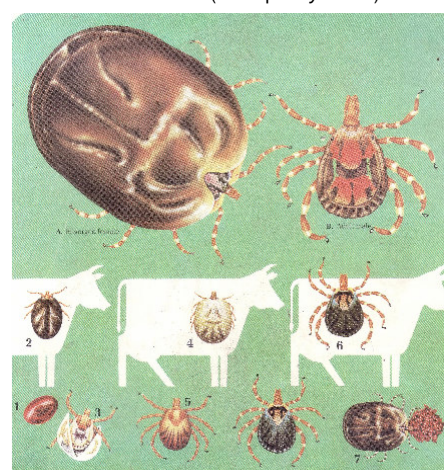
- The tick is the most important ectoparasite of livestock.
- Ticks may be divided into two major groups, namely the soft ticks (Argasids) and the hard ticks (Ixodids).
- Soft ticks:
 - ◆ The soft ticks lay their eggs in cracks of walls and wood.
 - ◆ The larvae and nymphs suck blood and lymph and drop off the host to become adults.
 - ◆ Ixodid ticks such as *Amblyomma* and *Rhipicephalus* lay their eggs under stones and clods of soil. Their larvae climb onto grass and shrubs and wait for a suitable host.
- Hard ticks can be classified into 3 groups according to the hosts they infest.
 - ◆ One-host ticks complete their life cycle on one host (one host from the larval stage to the adult stage). The egg hatches on the ground, the larval tick attaches itself to the host animal, matures and drops off as an engorged adult to lay eggs.
 - ◆ Two-host ticks are those in which the egg hatches, the larva attaches itself to the host animal, develops to the nymph stage and drops off. The nymph attaches itself to a second host where it develops to maturity before dropping off to lay eggs.
 - ◆ Three-host ticks are those which infest 3 different hosts at different stages of their development.



One-host tick (example *Boophilus*)



Two-host tick (example *hyalomma*)



Three-host tick (example *Amblyomma*)

Figure 9.20. Types of ticks based on number of hosts required.

Treatment, prevention and control of ticks

- Treat with acaricides only where ticks are present in large numbers.

- If tick numbers are not large, do not use acaricides. In this case, it is possible to kill them by hand using a needle or thorn.
- Shear the animal's hair and then use an insecticide such as Amitraz.
- Solutions can be sprayed on the animal, used as a dip or pour-on.
- Knapsack spraying is the most practical method if more intensive control measures are needed for a small number of animals. The most efficient method of hand-spraying is as follows:
 - ◆ Spray along the entire length of the back.
 - ◆ Spray the sides and flanks in a zigzag pattern.
 - ◆ Spray the brisket.
 - ◆ Spray each leg.
 - ◆ Spray the belly, udder or scrotum.
 - ◆ Spray the tail and anal area.
 - ◆ Finally, spray the head, face, neck and ears.
- Pour-on acaricides: a small volume of a special acaricide is poured along the back of an animal. It is a very effective method of control.
- Dipping is very effective. Currently, mobile dipping vats for sheep and goats are available.
- After treating, place the animal in the sun to dry.
- Check recently purchased or borrowed animals for ticks, especially around the shoulders.
- If ticks are seen on an animal, it should be treated immediately to prevent transmission to other animals.
- Some traditional methods of external parasite control include:
 - ◆ Washing the animal with salt water.
 - ◆ Smearing the animal's body with spent oil.
 - ◆ Using repellent herbs.
 - ◆ Using kerosene to rub the predilection sites.
- Ticks can develop resistance to acaricides and this is encouraged by frequent dipping and the use of dip solutions at lower than recommended concentrations. The manufacturer's recommendations should be strictly followed.
- Acaricides are toxic to people as well as animals and care should be taken to limit contact with the skin and prevent any possibility of dip fluid being drunk, or contaminating ground water.
- Acaricides are also very damaging to wildlife and fish, so great care is needed when discarding used dip fluid.

Do not recommend unnecessary tick control.

- It can create a disease problem.
- It will waste a farmer's money.

Other ectoparasites can usually be controlled by improving animal nutrition, ensuring better hygiene of animal houses and by occasional spraying or dipping.

Transferable Messages

1. Discuss with farmers that there are some ways to control ticks without the use of chemical insecticides. One of the ways to control ticks and the disease they spread is probably by not completely killing all the ticks. Why is that? Elaborate the following points to the farmers:
 - It is good to try to get a balance between ticks, the disease they carry, and animals' resistance. This balance is called "enzootic stability."
 - Young animals that get bitten by ticks develop immunity to diseases spread by ticks. Animals in such areas develop enough resistance to withstand sickness.
 - If enzootic stability occurs in the area, dip or spray animals when they have numerous ticks. Do not dip or spray them if they have only a few ticks.
 - It is important to often check animals for ticks.
 - It is possible to remove ticks by hand. However the tick's head and mouth parts should not be left buried in the skin because they may cause an abscess.
2. There are also good reasons for controlling ticks by using chemical insecticides based on recommendations by veterinarians.
 - Spray or dip animals when they move to new areas where ticks spread new diseases.
 - Spray or dip animals when some diseases such as East Coast Fever (ECF) and other tick-borne diseases (TBD) are suspected of spreading.
 - Spraying animals is a good way to use insecticide when you treat a few animals.
 - Farmers should learn how to apply sprays using a knapsack sprayer.
 - Tie the animal securely.
 - Spray the entire animal.
 - During spraying, a strict sequence must be observed. Start at the head, finish at the tail, and spray all areas of the body thoroughly.
 - It is also possible for farmers to make a good dip tank using half of an old drum or they can purchase such material made of plastic.
 - Farmers need to keep records of which animals get dipped and the chemicals used.
 - Use thick grease and/or old engine oil, to reduce tick numbers on animals. Soak cloth with a mixture of old engine oil and insecticide and hang it on a tree or on a pole where animals will rub against it.
3. Farmers should also be aware of ways to reduce the number of ticks on pasture.
 - Pastures that have many ticks should be avoided as long as possible.
 - Chickens can be kept in places where there are many ticks, for example around watering places, etc.
 - Animal houses need to be cleaned regularly and grass/plants around the barn removed.
 - Animals with heavy tick burdens should be separated from the flock.

9.4.3. Lice

- Infestation of sheep and goats with lice is common.
- Lice are wingless insects and have flattened bodies.
- Lice infestation can be quite serious or fatal. They are easily overlooked because of their small size. They can multiply very fast before being discovered, by which time the animal may be too anemic and emaciated to recover. Transmission among animals is by way of direct contact. Confinement rearing favors transmission.

Signs

- Lice cause considerable irritation to the skin. This is usually shown by the animal biting and rubbing itself against fixed objects.
- Wool-breaks and general unthriftiness, matted, dull fleece with tufts of wool may indicate lice infestation.
- The saliva and feces of lice contain substances capable of causing allergies, giving rise to severe irritations, followed by skin thickening and sometimes self-inflicted trauma. Animals exhibit reduced weight gain and loss in production. Anemia and sucking or biting stress also attributes to the decrease in production.
- Lameness can result from the foot louse of sheep.
- Lice are associated with development of cockle. Cockle is an inflammatory response of the skin to the presence of lice and their saliva. This is seen after the wool or hair has been removed from the skin.



Figure 9.21. Sheep louse.



Figure 9.22. Sheep ked.

Treatment and control

Spraying or dipping with insecticides is effective and should always be carried out twice. The first time to kill the lice currently on the body and the second, 14 days later, to kill lice hatching from eggs present at the first treatment. The eggs are not affected by insecticides.

9.4.4. Sheep Ked

- Flat, brown wingless fly.
- About 6–7 mm in length.
- It is an important parasite of sheep, commonly called sheep ticks.
- It is a blood sucker and permanent ectoparasite.
- A sheep ked has mouth parts adapted for piercing the skin of the host and sucking blood.
- The ked cannot live long away from the host and transmission from host to host is by direct contact.
- Keds are generally prevalent in colder, wetter areas.

Signs

- Keds cause loss of blood when present in large numbers, with consequent anemia and loss of body condition.
- They cause intense irritation, manifested by scratching, biting and stamping.
- Animals in poor condition are likely to suffer.
- Skin prick caused by blood-sucking keds causes the development of cockles in the finished sheep skin.

Treatment and control

- The shearing of wool sheep greatly reduces the infestation, not only because of the removal of the keds with the wool, but also exposing those remaining on the skin to the environment. This greatly reduces their development.
- Spraying or dipping with insecticide after shearing will destroy keds.

9.4.5. Mites

- Mites are small arthropods. The majority of species are free-living but some are parasitic on animals and cause the condition known as mange.
- The life cycle of mange mites is similar to ticks in that there are egg, larva, nymph and adult stages.
- All these stages stay on the host, feeding on the epidermis, serum, hair, and in some cases, burrowing beneath the epidermis or into hair follicles.
- Mites spread from one animal to another mainly through direct contact.
- Mites do not live very long when removed from the host.
- Mange may be sarcoptic, psoroptic, chorioptic or demodectic according to the species of the infesting mite.

9.4.5.1. *Psoroptic ovis* — the sheep scab mite

- *Psoroptes ovis* is a parasite of sheep.
- The parasite is located on most areas of the body, especially those heavily woolly and hairy such as shoulders, sides and back.
- *Psoroptes ovis* feeds on tissue fluid and causes the formation of scabs under which they live.
- The eggs are laid on the skin at the edge of a scab and hatch in 1–2 days.
- The whole life cycle is completed in 10–11 days.
- All stages are capable of survival away from the host for up to 10 days.
- Optimum conditions for development include moistness and cool temperatures.
- When conditions are adverse, as in summer, mites survive in protected sites of the body.

Signs

- Affected skin is covered with exudates (fluid). This dries to form a scab.
- Massive loss of hair usually occurs.
- Lesions may cover the entire body.
- The sheep will usually die if it is not treated.



Figure 9.23. Sheep affected by *Psoroptes scabiei* variety *ovis*.
(Source: Kassa Bayou, 2006).

Treatment

- Infected sheep should be dipped, not sprayed, with acaricides such as Diazinon 60%.
- Ivermectin injection (200 mg/kg) is also effective.

Prevention

- Newly introduced animals are the main sources of infection for a flock. These animals must be checked carefully and possibly treated before being introduced into the new flock.
- Quarantine of newly introduced animals is also a very useful way of preventing the parasite's spread.
- Animal houses and pasture fences must be sprayed with acaricides.

9.4.5.2. *Sarcoptic ovis*

Sarcoptic mange

- Sarcoptic mange is caused by infestation with *Sarcoptes scabiei* variety capri in goats and *Sarcoptes* variety ovis in sheep
- Sarcoptic mites burrow into the skin forming galleries where they remain for the rest of their lives.
- Eggs are laid in the burrowed skin at the rate of two or three each day.
- Infestation is spread mainly by direct contact between infected and healthy animals.
- Sarcoptes are very susceptible to dryness and are unable to live more than a few days away from the host.
- Sarcoptes mites are severe in goats, spreading extensively, and in some instances causing death.
- Sarcoptic mange is more acute than the other forms of mange in that it may involve the entire body surface in a short period of time.

Signs

- It causes small red papules and general erythema of the skin.
- The affected area is itchy and frequently excoriated by scratching and biting.
- Loss of hair, thick brown scabs and thickening and wrinkling of surrounding skin is observed.

Treatment

- Infected sheep should be dipped, not sprayed with acaricides such as Diazinon 60%.
- Ivermectin injection (200 mg/kg) is also effective.



Figure 9.24. Goat affected with Sarcoptic mange

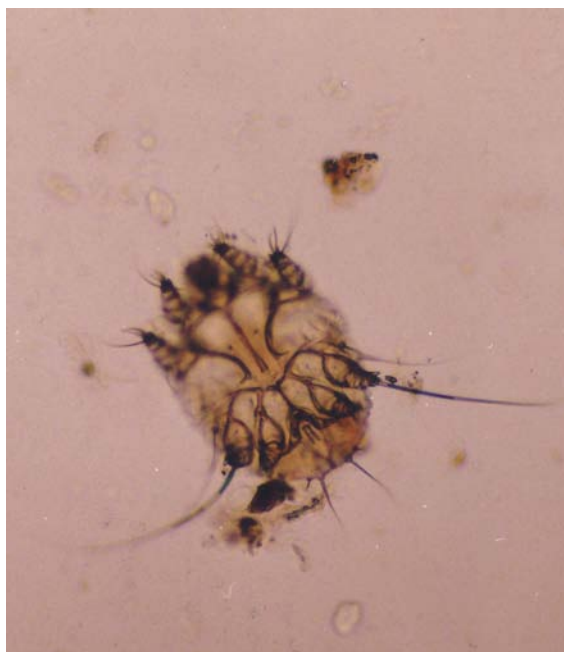


Figure 9.25 *Sarcoptes scabiei* variety Capri.

Prevention

- Newly introduced animals are the main sources of infection for a flock. These animals must be checked carefully and possibly treated before being introduced into the new flock.
- Quarantine of newly introduced animals is also a very useful way of preventing the parasite's spread.

Demodectic mange

- Invades hair follicles and sebaceous glands of all species of domestic animals.
- The disease is very severe in goats, spreading extensively before it is suspected, causing death in some instances.
- The disease causes significant damage to the skin, causing small pinholes in the skin which interfere with its industrial processing and limit its use.
- In most cases, the lesions are difficult to see externally.
- The disease spreads slowly and transfer of mites takes place by contact.

Signs

- It causes small nodules and pustules, which may develop into large abscesses.
- The lesions occur most commonly on the brisket, lower neck, forearm and shoulder.
- In severe cases, there may be general hair loss and thickening of the skin.
- The contents of the pustules are usually white in color and cheesy in consistency.
- The pus is more fluid in large abscesses.
- Severe cases in goats are commonly the result of being affected with several skin diseases such as mycotic dermatitis, ringworm, besnoitiosis and myiasis.

Treatment

- Repeated dipping and spraying with acaricides such as Diazinon 60%.
- Ivermectin injection is also effective.

Acaricides disposal

- When the contents of a mobile dip are to be discarded, care must be taken to avoid contamination of the environment. Dip contents can be drained into pits. The pits should be at least 150 m away from water sources.
- It is extremely dangerous to reuse an empty acaricide container. Plastic or metal containers should be punctured or crushed. The containers should then be buried in an isolation area at least 50 cm below ground surface.



Figure 9.26. Demodectic mange. White spots in the center represent pus squeezed out of the nodules.

Source: Kassa Bayou (2006)

9.5.2. Flies

- Flies are blood suckers causing many disturbances to animals and are capable of transmitting diseases. They have a life cycle consisting of the egg, and one or more larvae, pupa and adult stages.

Black flies - Simuliidae

- These small flies can occur in vast numbers and cause serious annoyance.
- Flocks will stampede, often with disastrous consequences
- Bites are inflicted on all parts of the body, giving rise to vesicles which burst, exposing the underlying flesh.
- Skin wounds with secondary infection and myiasis may result.

Control

- Fly breeding sites may be eliminated by drainage.
- Fly breeding sites can be treated with diesel oil thinned with water to kill the larvae.

Haematopota spp. Horse flies

- These large robust flies suck blood and inflict a painful bite.
- Several species of horse flies attack sheep and goats.
- Animals get restless when horse flies are around and even small numbers of these flies are sufficient to hinder grazing.
- Losses become significant when infestations are heavy.
- They mechanically transmit a number of diseases such as anthrax, Anaplasmosis and Trypanosomiasis.
- They breed in or near water.

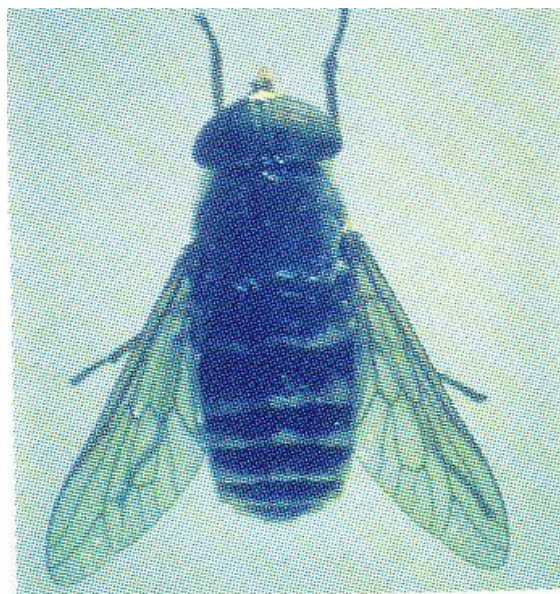


Figure 9.27. Biting fly – *Tabanus*..

9.5.3. Mosquitoes

Mosquitoes are of various species such as Anopheles, Culex and Ades. They are important vectors of diseases like Rift Valley Fever, Bluetongue and others. They may occasionally attack animals in large numbers, causing severe losses in production. They are dependent on water for breeding. They are usually more prevalent during and after rainy periods.

Control

- Mosquito breeding sites may be eliminated by drainage.
- Mosquito breeding sites can be treated with diesel oil thinned with water to kill the larvae.

9.6. Important Infectious Diseases of Small Ruminants

9.6.1. Strategies and approaches used in Ethiopia

Serious outbreaks of sheep and goat diseases such as sheep and goat pox, contagious caprine pleuropneumonia (CCPP), peste des petits ruminants (PPR), pasteurellosis and anthrax continue to occur in Ethiopia contributing to significant production losses. Widespread epidemics are controlled through prophylactic measures and nationally organized campaigns in the face of outbreaks. However, none of these diseases has been eradicated so

far. Production losses resulting from such outbreaks are still considered significant, but are lower than those caused by poor nutrition and internal parasites.

9.6. Common Diseases

9.6.1. Contagious caprine pleuropneumonia (CCPP)

CCPP is a per-acute, acute or chronic contagious disease of goats affecting the respiratory system. Infection occurs by direct contact between goats. The disease is widely distributed in the Rift Valley and lowland parts of the country.

Signs

- Many goats are usually sick at the same time, 20–30 days after infection with CCPP.
- Some animals die before they show signs of the disease.
- Affected goats cough and have a discharge from the nose.
- In severe occurrences that happen quickly:
 - ◆ animals have distressed breathing.
 - ◆ animals become weak and tired and have a high fever.
 - ◆ many goats die after 4–5 days.
- With the mild form of the disease that lingers:
 - ◆ animals develop joint problems.
 - ◆ does may get mastitis.
 - ◆ goats become thin and look very sick. Most recover slowly but some become very sick and die.
- In dead animals, the lung looks very dark and has some yellow pus in it. The lungs often stick to the side of the chest. A lot of yellow fluid is observed in the chest.

Treatment

Treatment of sick animals with broad spectrum antibiotics is effective.

Prevention

- Ring vaccination of CCPP vaccine is given around the outbreak sites. The National Veterinary Institute (NVI) at Debre Zeit produces a limited amount of CCPP vaccine.
- Ring vaccination of CCPP should be given around an outbreak area in order to stop the spread of the disease.
- Restriction of movement of goats from and to the outbreak areas is necessary to prevent spread of the disease.



Figure 9.28. Goat artificially infected with CCPP.
Source: National Veterinary Institute

9.6.2. Foot and Mouth Disease (FMD)

- The disease is common in Ethiopia and neighboring countries.
- Animals become sick with FMD 2–14 days after infection.
- Animals get infection from direct contact with infected animals, from feed infected by the saliva of infected animals and from people or things that infected animals have touched. Infective organisms can also spread hundreds of kilometers through the air.

- Sheep and goats get a much milder type of foot and mouth disease.

Sign

- Blisters in their mouth. The blisters are often very small.
- Most blisters are on the dental pad.
- It is difficult to see blisters on the feet.
- The feet are painful and the animals are often lame.
- Animals usually recover but often lose body condition for a long time.

Treatment

- There is no treatment for FMD but it is helpful to give infected animals plenty of water, shade them from the hot sun, and give soft, green feed.
- Antibiotic treatment is important to prevent bacterial infection of the blisters.

Prevention and control

- Due to limited production capacity of the National Veterinary Institute, vaccine is given only for improved cattle and cattle intended for export. Sheep and goats are not vaccinated since the disease is mild in them, but they could be sources of infection for cattle.
- Movement of animals to and from outbreak areas should be restricted in order to stop the spread of the disease.

9.6.3. Maedi-visna

The occurrence of Maedi-visna in Ethiopia was reported in imported sheep in 1986 at Agarfa, Bale. It was also reported in eastern Amhara. Lambs are infected by drinking infected colostrum or milk during nursing. Adult animals become infected when they come in contact with nasal discharges of infected animals. The disease occurs principally in sheep but has also been observed in goats.

Signs

- Animals become sick with Maedi-visna 24–36 months after infection.
- The sign of maedi is a slow-progressive pneumonia. Visna is rarer.
- The signs of visna are slow-progressive neurologic signs with hind limb weakness and loss of condition, incoordination, muscle tremors, and paresis.

Treatment

- There is no treatment for Maedi-visna.

Prevention

- In endemic areas, prevention can be attempted by separating the lamb from the ewes at birth, giving them no colostrum or feeding other sources of colostrum and rearing them separately
- Restriction of inter-farm movement of sheep.

9.6.4. Peste des petits Ruminants (PPR)

PPR is common in Ethiopia. It is an acute contagious disease of sheep and goats that is particularly severe in goats. Transmission of PPR requires close contact between healthy and sick animals.

Signs

- A clear discharge from the nose.
- Sores in the mouth that come and go.
- Intermittent diarrhea.
- Low fever.
- In dead animals:
 - ◆ The eyes and nose will have a dirty white/grey discharge.
 - ◆ The animal's rear will often be covered with bad smelling, watery feces.
 - ◆ The mouth has many sores in it.
 - ◆ Upon necropsy, pus will be found in the lungs.

Treatment

- There is no treatment for PPR but antibiotic treatment will stop secondary infection with bacteria.

Prevention and control

- Immediately isolate animals with signs of PPR.
- Vaccine for PPR is effective. Vaccinate before start of the rainy season. Vaccinate all the sheep and goats around an outbreak area. Vaccine for PPR is produced by the National Veterinary Institute.



Figure 9.29. PPR depression, hemorrhage, diarrhea.

Source: National Veterinary Institute



Figure 9.30. PPR in a goat : mouth lesions

9.6.5. Rift Valley Fever (RVF)

Rift Valley Fever is a viral infection of ruminants and humans. Animals become sick with RVF 1–5 days after infection. Animals are infected when bitten by infected mosquitoes. The disease only occurs every few years and usually after a very wet period when mosquitoes hatch from infected eggs lying dormant in dry mud. The occurrence of this disease interrupts export market of live sheep and goats.

Signs

- The animals have a high fever, nasal discharge and vomiting.
- Animals stagger about. Young animals usually collapse and die within a few days.
- Adult animals have a less severe condition that happens slowly:
 - ◆ Animals look weak and tired.
 - ◆ Abortions occur in ewes/does.

Warning

- It is dangerous to open the body of an animal with RVF because people can get this disease.

Treatment

- There is no treatment for RVF.

Prevention

- Vaccine is not produced in Ethiopia.
- It is best not to move animals from places where RVF is prevalent until the disease dies out.

9.6.6. Anthrax

Cattle, sheep and goats get anthrax most often. People also can get anthrax. Animals become sick with anthrax 12–24 hours after they get infected. Animals get the disease while grazing on infected pastures.

Signs

- Animals, especially ruminants, often die before disease signs are seen.
- Infected animals have a very high fever and may have blood in the urine, feces or milk.
- They often have difficulty breathing and usually collapse and die after 1–3 days.
- Dark blood often comes from the nose, mouth and anus of dead animals.
- This blood stays liquid (does not clot) and the body does not go stiff after death.

Treatment

- People usually do not see animals with anthrax soon enough to treat them.
- Sometimes when the disease is less severe, there is time to treat animals with antibiotics.

Prevention

- Bury or burn the dead bodies of animals infected with anthrax. Avoid taking animals for grazing to places where anthrax was found.
- Follow annual vaccination with anthrax vaccine produced at the National Veterinary Institute.
- Vaccinate animals every year a month before disease occurrence is expected in common infection areas.

9.6.7. Sheep pox

Sheep pox occurs in both sheep and goats. It is severe in very young animals. Some young sheep and goats die before showing signs of the disease. The disease spreads by direct contact between animals and contaminated materials.

Signs

- Sheep and goats become sick 1–7 days after infection.
- Most animals are weak and tired and stop eating.
- They have a high fever for a short time.
- A watery discharge comes out of the nose and eyes.

- Animals have increased salivation.
- They have small red patches on the skin, usually around the mouth, on the head, under the tail and between the legs. The patches become swellings under the skin. Then they become blisters that break and become open sores that soon develop scabs.
- Animals often have distressed breathing.
- Pregnant ewes and does often abort.



a. Sheep affected by Sheep pox



b. Goat affected by sheep pox -note skin damage

Treatment

There is no treatment for sheep and goat pox but the following measures may help animals to recover:

- Topical antiseptic treatment of bad or deep sores.
- Antibiotics to prevent secondary infection.

Prevention

- Annual vaccination with sheep and goat vaccine produced at the National Veterinary Institute. The vaccine gives protection for at least one year.

Figure 9.31. Sheep and Goats affected by sheep pox.

Source: Dr. Muhumed - SORPARI

9.6.8. Nairobi sheep disease

Nairobi sheep disease is a tick-borne infection of sheep and goats. The common vectors for the disease are ticks, *Rhipicephalus* spp. and *Amblyomma variegatum*. Adult animals are more seriously affected than young animals.

Signs

- Animals become sick within 4–14 days after infection with Nairobi sheep disease.
- Infected animals have high fever.
- A grey/white discharge comes from the nose and eyes.
- The animals have diarrhea. The feces is often green and watery with blood mucus in it.
- The animals are weak and tired. They stop eating and collapse. Death occurs within three to four days.

Treatment

- There is no effective treatment.

Prevention

- Measure should be taken to control ticks.
- Movement of sheep and goats into and out of endemic areas should be strictly controlled.

9.6.9. Bluetongue

Bluetongue is an infectious disease of sheep. Goats can be affected but usually do not show signs. It is caused by a virus which is transmitted by an insect vector. Transmission is by blood sucking flies, *Culicoides* spp. Sometimes mosquitoes or infected needles may spread the disease.

Signs

- Sheep become sick 5–10 days after infection with Bluetongue virus.
- A high fever accompanied by unwillingness to feed.
- Rolling movement of the tongue and licking of the lips.
- Nasal discharge and salivation. The nasal discharge is at first thin and watery but soon becomes thicker and mucous-containing.
- The nasal mucosa is congested and may ulcerate.
- Blood then appears in the nasal discharge.
- Lips and tongue are very swollen.
- The head and ears may also be swollen.
- Erosion and ulceration are often found in the mouth.
- Lameness or stiffness is often observed.
- Pneumonia can occur from secondary infection.
- Diarrhea, which may be blood stained, is sometimes seen.

Treatment

- Antibiotics are useful against secondary infection.
- Mouth lesions may be treated symptomatically with an antiseptic.
- It is important to keep infected animals in the shade as sunlight appears to aggravate the condition.

Prevention

- Infection can be avoided by moving sheep during the rainy season to high, well-drained ground.
- House sheep in barns at night to avoid insects.
- A smoking fire at night and spraying or dipping animals in insecticides are useful methods of vector control.

9.6.10. Babesiosis of sheep and goats

- Babesiosis is a disease caused by protozoan parasites such as *Babesia ovis*.
- The disease is mainly transmitted by the tick of the *Rhipicephalus* family, which introduces the organism into the host blood stream while feeding.
- Sheep and goats found in an endemic area normally have immunity. Newly introduced animals into endemic areas are always susceptible.

Signs

- Animals become sick within 1–4 weeks after being bitten by infected ticks.
- Urine becomes red due to red blood cells.
- Animals become weak and lethargic with reduced appetite.
- High fever. Mucous membranes turn pale and soon become yellow.

- Animals exhibit rapid breathing.
- Accelerated heart rate.
- Older animals die in 3–4 days.
- Animals younger than six months old are not severely affected.
- Animals that recover are weak for a sustained period of time, during which they are susceptible to secondary infections/diseases.
- The blood of dead animals looks thin and watery.
- The flesh is yellow. The liver is also yellow.
- The gall bladder is large and full of green fluid.

Treatment

- Treatment should be started as soon as possible.
- Diminazine aceturate (Berenil) gives good results.

Prevention and control

- Prevent babesiosis by controlling ticks.

9.6.11. Anaplasmosis

- Anaplasmosis is caused by a rickettsia, *Anaplasma ovis*, which invades red blood cells and causes anemia.
- The disease may be transmitted by ticks and biting flies as well as contaminated needles and equipment.
- It is rare in sheep and goats reared in the presence of the disease.
- Sheep and goats introduced into these areas should be closely monitored.

Signs

- Animals become sick 20–28 days after they get infected with Anaplasmosis.
- Mucous membranes are pale and may become yellow.
- Animals breathe faster than normal and have a very fast heartbeat.
- Animals have high fever.
- Animals go off feed and do not pass feces.
- Older animals that have never been infected can be severely affected and often die in 3–4 days.
- Animals younger than six months are not severely affected.

Treatment

- Treatment works well if started soon enough.
- Give an antibiotic. Oxytetracycline works well.

Prevention and control

- Prevent anaplasmosis by controlling the vectors that spread it.

9.6.12. Trypanosomiasis

- Tsetse flies from the *Glossina* spp. are responsible for the spread of the disease. The fly has infested an estimated 130,000–200,000 square kilometers of fertile land in the western and southwestern parts of Ethiopia.

Signs

- Animals become sick with Trypanosomiasis 1–3 weeks after being bitten by infected tsetse flies.
- The disease lasts for a prolonged period.
- Animals become weak and tire easily, often lagging behind herd mates.
- Animals have rough, dull coats, slowly lose weight and become thin.
- Eyes have a watery discharge and may become cloudy.
- The animals blink a lot.
- Lymph nodes are swollen and noticeable under the skin.
- Mucous membranes become progressively pale over a period of weeks.
- Animals exhibit intermittent fever.
- Pregnant animals often abort or have weak offspring.
- Poor feeding, stress or overwork increases severity of the disease.

Treatment

- Medicines such as Diminazine aceturate and Nomidium chlorides are known to be effective.
- However, chemotherapy is becoming very difficult because trypanosomes have become resistant to available drugs. Underdosing and overuse of the drugs leads to the development of resistance.

Prevention and control

- Use insecticide-impregnated targets to kill mosquitoes.
- Use trypanocidal medicine routinely.

9.6.13. Heartwater

- Heartwater is one of the most important tick-borne diseases of sheep and goats.
- It is caused by rickettsia, *Cowdria ruminantum*, leading to the disease known as cowdriosis.
- The rickettsia is transmitted by *Amblyomma variegatum* ticks.

Signs

- Animals become sick 1–4 weeks after being bitten by infected *Amblyomma* ticks.
- In sudden, severe onset, animals quickly develop a high fever, collapse, convulse and die in a few hours.
- In slower disease onset, animals show the following signs:
 - ◆ Decreased appetite, nervousness, easily prone to agitation.
 - ◆ Muscle uncoordination, a very high stepping gait, often walking in circles.
 - ◆ Teeth-grinding and licking lips.
 - ◆ Collapse, convulse and die after 1–7 days.

The mild form of the disease occurring in sheep, goats, sometimes even in young cattle has the following symptoms:

- A few animals have diarrhea, which is often bloody.
- Animals have a low fever but few other signs of disease.
- The sac around the heart of dead animals is full of fluid. There is also fluid in the chest and abdomen. [Cattle have less fluid around the heart than sheep or goats.]

Treatment

- Treatment only works if it is started soon enough.
- Give an antibiotic, tetracycline.
- Check other animals in a group with a sick animal and immediately treat any that have a fever.

Prevention and control

- Control of ticks by spraying or dipping small ruminants with acaricides.

9.6.14. Brucellosis

- The disease is caused by *Brucella melitensis*. The disease is very severe in goats and death may occur. Sheep are more resistant.
- Large numbers of *B. melitensis* are discharged during abortion.
- Close contact between animals is necessary for infection to be transmitted.
- This is a zoonotic disease, which is transmissible to humans from infected goats.

Signs

- Animals become sick 3–20 weeks after infection.
- A primary infection following the introduction of disease by an infected male or female may at first result in a few abortions.
- This usually progresses to a serious storm of abortions.
- Goats seldom abort more than once due to brucellosis but many sheep abort twice or have dead lambs at the pregnancy following the abortion.
- Abortions usually occur beginning the fourth month of gestation.
- Mastitis is often the first sign seen, with milk appearing clotted and discolored.
- Lameness; orchitis may be found in males.

Treatment

- There is no effective treatment.

Prevention

- Hygiene and good management practice is essential.
- Dispose of all aborted material, including the fetus, and disinfect the surroundings.
- A separate shed should be used for kidding.
- Isolate infected flocks to prevent the spread of the disease.

9.6.15. Ovine Pasteurellosis

Ovine pasteurellosis commonly occurs in sheep and goats in many parts of the country.

Signs

- Sheep and goats become sick 7–10 days after infection.
- Many animals are affected simultaneously.
- Animals may go off feed and tire easily.
- Severe cases:
 - ◆ have high fever.
 - ◆ cough and have distressed breathing that increases in intensity.
 - ◆ in some cases, collapse and die in a few hours.
- In less severe cases:
 - ◆ animals lose weight, becoming emaciated and weak.
 - ◆ some animals may have a swollen abdomen.
 - ◆ animals grind their teeth.
 - ◆ animals have rapid, shallow breathing.
 - ◆ animals have diarrhea.
 - ◆ death after 5–6 days if not treated.
- Lungs of dead animals have red/grey patches in them. The air ways have mucus.
- Animals that were sick for several days have yellow fluid in the chest.

Treatment

- Antibiotic treatment, one of the following drugs can be used:
 - ◆ Sulphadimidin, streptomycin, and oxytetracycline are effective.

Prevention and control

- Avoid overcrowded conditions.
- Annual vaccination with Pasteurella vaccine produced by the National Veterinary Institute.

9.6.16. Orf

Orf or sore mouth is a common disease of sheep and goats. It is caused by a virus and is highly infectious.

Signs

- Sore patches around the mouth, usually starting at the corner.
- An affected lamb or kid may spread the disease to its mother's udder.
- Ewes and does with painful teats will not allow lambs or kids to suckle. The lambs and kids may die of starvation.
- Adult animals that are affected will not eat properly and may lose condition.

Treatment

- There is no treatment for orf. Antibiotic sprays or powders will prevent secondary infections in open sores.
- Affected animals should be isolated.
- Owners should be warned that humans can become affected by the sores.

9.6.17. Bloat

Cause

Bloat is the result of failure to expel stomach gases normally and, if not treated, can be fatal. Animals may bloat when they feed on lush legumes and froth develops in the rumen preventing gas from escaping. Bloat can also be caused by obstruction or blockage in the esophagus or stomach. A good example is animals eating plastic bags.

A bloated animal:

- Will be restless.
- Have difficulty breathing.
- The upper left side of the stomach will appear bigger than normal and will sound hollow when tapped.
- The animal urinates and defecates frequently.
- It bleats and walks unsteadily.
- Death due to restricted breathing and heart failure follow unless action is taken.

Treatment

- Keep the animals in standing position.
- Tying a piece of wood in the mouth will help stimulate saliva production that can assist in breaking up froth in the stomach.
- Apply side- or lifting-pressure to the stomach to help expel the gas by lifting the animal from below the stomach.
- Walking may also help in getting rid of the gas.
- If the condition does not improve, a small diameter rubber tube (0.5–1 cm opening) should be forced down the throat and into the stomach to release the gas.
- To make certain the tube is in the stomach, smell the gas released. It should smell like stomach contents.
- Another method is to place an ear next to the stomach on the left side of the animal and blow into the tube. A bubbly sound should be heard. This also helps to clear the opening of the tube.
- If it is a gas bloat, gas may be immediately expelled once the tube enters the stomach; in some cases, it may be necessary to move the tube and try to find the gas pocket.
- If it is a bubbly bloat, pouring a small amount of vegetable oil (100–200 mL) through the tube will help break up foam.
- For best results, use a tube within the first few hours of bloat occurring.
- If all other attempts fail, and as a last resort, a small tube can be inserted into the stomach through the side of the animal.
 - ◆ First, a small area on the top left side of the stomach is shaved and cleaned with iodine solution.
 - ◆ Determine the area to stab, about 3–4 fingers from the back bone in between the ribs and hip bone. Stab the area with a short piece of narrow metal tube (5 mm in diameter), which has been dipped in iodine solution.
 - ◆ Before stabbing, pull the skin slightly so that after the tube is pulled out, the wound will close.
 - ◆ The gas coming out through the tube will have a bad smell.
 - ◆ After the gas is released entirely, pull the tube out and clean the wound with iodine solution.

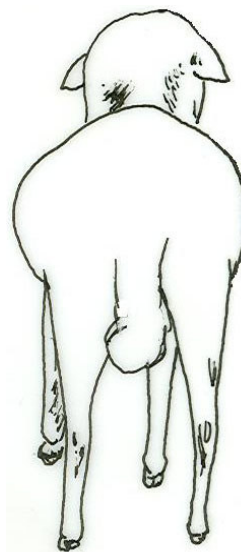


Figure 9.32. A bloated sheep.

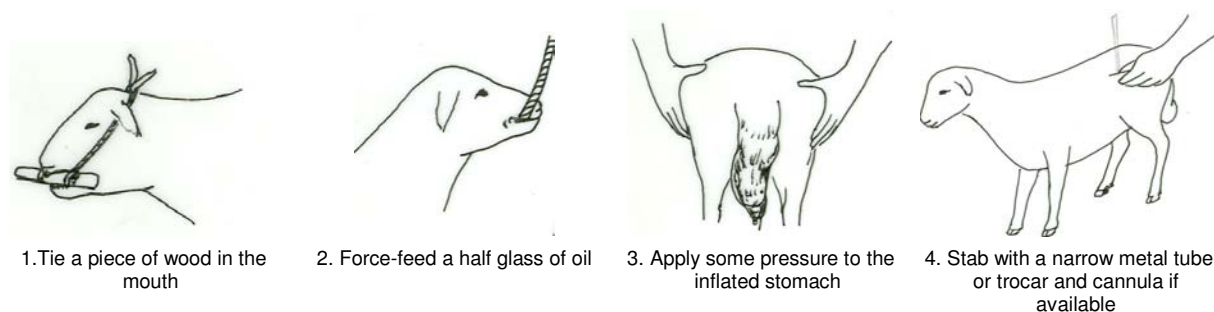


Figure 9.33. Treatment of bloat

Prevention

- Do not give animals too much wet lush legumes, grass, and grains that may cause bloating.
- Always feed dry roughage before feeding lush grass or before letting animals go on lush pasture.

Contagious foot rot

Cause

Foot rot in goats is caused by infection with two bacteria, *Dichelobacter nodosus* (from the feet of infected animals) and *Fusobacterium necrophorum* (commonly found in the environment). The source of *D. nodosus* is the hooves of chronically infected carriers that occur in approximately 10% of affected small ruminants. Because of *D. nodosus*' short life-span outside the hoof (usually less than four days), pastures or paths left alone by sheep and goats can be considered to be noninfectious after two weeks in wet/warm environments and after one week in a dry environment. Outbreaks of foot rot occur only when pastures are continually wet. Wet conditions soften tissues surrounding the hoof and can lead to infection or dermatitis, making the skin more permeable to infectious bacteria.

Signs

- In the mild form:
 - ◆ Skin between the hooves will be inflamed and swollen. There may be some secretion.
 - ◆ Mild lameness.
 - ◆ Can disappear spontaneously when the feet are exposed to dry conditions.
 - ◆ Usually only a few animals are affected.
- In the severe form:
 - ◆ The foot is red, swollen, and moist.
 - ◆ As the infection progresses, the hoof exudes a dark, foul-smelling pus.
 - ◆ The animal will limp or walk on its knees due to the painful hooves.
 - ◆ An animal may have a fever and will lose productivity.

Treatment, prevention, and control

Treatment, prevention, and control generally consist of combinations of antibiotic use, foot baths and foot trimming. Injectable antibiotics are highly effective. Keep animals in a dry environment for at least 24 hours following treatment. Topical treatment with antibiotics (5% tincture of tetracycline) or antiseptics (10% zinc sulfate, 10% copper sulfate solution) is adequate for mild foot rot in small flocks of animals. Large goat herds are treated more practically with foot baths.

In an outbreak:

- Treat weekly for four weeks.
- Separate infected from non-infected animals, treat, and then place on separate pastures.
- Foot baths must be deep enough to allow complete coverage of the foot and can be made from concrete, fiberglass, or plastic-lined wood. Foam rubber or wool can be placed in the solution to prevent splashing of caustic substances.
- Provisions should be made for drainage and proper solution disposal to prevent environmental contamination.
- Copper sulfate (5%) and zinc sulfate (10%) are commonly used foot bath chemicals. Both chemicals are slow to penetrate the hoof and soaking periods of an hour or longer are necessary. Using a detergent, such as dishwashing detergent, in the solution may help penetration.
- Dry foot baths (85% limestone, 15% zinc sulfate) can also be beneficial.

Foot trimming

Routine foot trimming is crucial in the prevention and treatment of foot rot. Overgrown hooves provide an anaerobic environment for *D. nodosus* to grow, and stress the foot, increasing the chance of damaging skin and allowing entry of bacteria. In treatment, it is crucial to trim the feet adequately to expose infected areas when topical disinfectants are used. Do not trim so severely as to cause bleeding.

Dermatophilus, streptothricosis, rain scald

Dermatophilus is a contagious skin condition seen in moist, humid, wet conditions. It is caused by the bacterium *Dermatophilus congolensis*. The ears, nose, face, and tail may be affected beginning with a low-grade, scaly, skin infection that spreads along the back and flanks. In severe cases, animals may scratch constantly. The bacteria can survive in soil or dust on an animal's skin during dry weather and are transmitted by direct contact, infected equipment, flies, etc. This disease is zoonotic, so care should be taken when handling affected animals.

Signs and symptoms

- Scabs form around the ears, face, nose, lower legs, or tail.
- These form crusty, scaly lesions that spread over the back and flanks of the animal.
- Affected areas are susceptible to secondary bacterial infection.
- Lesions around the mouth may be confused with orf.

Treatment, prevention, and control

- Antibiotics can be injected.
- Topical treatment with zinc sulfate 0.2 to 0.5%, 0.2% copper sulfate, or 1% potassium aluminum sulfate.

Prevent by providing shelter from rain for animals on pasture and ensuring good nutrition and control of external parasites.

Pinkeye, infectious keratoconjunctivitis

This often refers to any condition resulting in watery, red, or cloudy eyes. Causes include air-borne irritants and foreign bodies such as dust or small hay particles; trauma to the eye such as scratching from hay, straw, or wire; or from an infectious agent. Certain viruses and parasites can also cause this condition. In most cases, an infectious agent is responsible and even in cases of irritation or trauma, treatment to prevent

secondary infection by bacteria is commonly done. The onset of this disease is quick and it can spread through animal-to-animal contact.

Signs and symptoms

- Watery eyes, redness of the eye, swelling of the eyelids.
- Sensitivity to light.
- A cloudy cornea.

Treatment, prevention and control

Isolate affected animals to prevent disease spread. Treatment includes the use of an antibiotic eye ointment or antibiotic treatment. If it is not treated early, permanent eye damage or blindness can result. Inspect all new arrivals before mixing with existing herds.

Rabies

Rabies is a fatal disease in all mammals. It affects the central nervous system. It is transmitted usually through bites from an infected animal. If rabies is suspected, health officials must be notified.

Signs

- Paralysis of limbs.
- Abnormal behavior such as nervousness, excitability, irritability. Some animals may become uncharacteristically aggressive.
- Muscle in-coordination and seizures.
- Excessive salivation.
- Death.

Treatment

There is no treatment available. Animals suspected of having rabies should be destroyed and the carcass buried so no other animal has access. Animals in contact with infected sheep or goats should either be destroyed or quarantined to determine if they were infected.

Prevention

- Vaccination. Humans should be careful when handling animals suspected of rabies.

9.6.18. Plant toxins and pesticide poisoning

Cause

- Several plants, including some grasses and legumes, contain toxic substances.
- When consumed, may cause animals to suffer from the toxins.
- An animal that has consumed a toxic plant or poison may:
 - ◆ foam at the mouth.
 - ◆ have muscle spasms.
 - ◆ have blue spots on mucous glands.
 - ◆ have peeling skin.
 - ◆ have bloody feces.
 - ◆ have lesions on the face.

Treatment

Make sure the animal has plenty of water to drink and try one of the following treatments:

- Boil strong tea or coffee and let it cool. Give it to the animal to drink or force-feed it.
- Mix a small (handful) of fine charcoal powder in about one liter of water, give by mouth. Give daily for a few days if needed.
- Give vegetable oil by mouth.
- Give milk by mouth.
- Mix six eggs and ½ kg sugar with about 1 liter of water and give by mouth.



a. Skin lesion from toxicity after overconsumption of *Lantana camara* ("Yewef kolo")

Prevention

- Do not graze animals where poisonous plants are present. Remove any toxic plants from grazing areas.
- Avoid pasture that has just been sprayed with herbicides or pesticides.
- Do not let animals graze near rubbish where people have thrown things that may be poisonous.



Lantana camara ("Yewef kolo")

Figure 9.34. Example of plant toxin.

9.7. Community-Based Veterinary Service

Veterinary service-delivery is poor in most of the remote areas of Ethiopia. In these areas, livestock are highly valued, both socially and economically. Remote areas generally have harsh environments, difficult terrain, poor infrastructure and very few animal health personnel. Due to these constraints, a new approach towards veterinary service delivery for these areas is crucial. The new approach includes involvement of Community Animal Health Workers (CAHW) / Kebele Animal Health Workers (KAHW) to deliver basic veterinary services. In remote or inaccessible areas, the CAHW activity could be initiated by the community itself and the KDA. The community may select some community members who are respected by the community and recognized as knowledgeable and responsible livestock keepers to be trained as CAHWs and deliver basic animal health services. The CAHWs should be trained by qualified trainers, veterinarians or assistant veterinarians that have special skills in training CAHWs that may be illiterate. The objectives of the training are to:

- improve the community's access to essential veterinary drugs and basic animal health services in order to maintain the health of their animals.
- encourage CAHWs to train farmers and pastoralists in disease prevention and control.
- improve disease reporting and surveillance.

Duties of Kebele Animal Health Workers (KAHW)

- Treat minor problems such as wounds and carry out routine tasks such as deworming.
- Carry out castration.
- Spraying and dipping of animals with acaricides.

- Hoof trimming.
- Coordinate vaccination programs and assist the vaccination activity.
- Participate in disease-reporting activities.
- Report disease outbreaks to the nearest government veterinary service.
- Create awareness among farmers and pastoralists on disease prevention and control.

Questions

1. How do you help your community keep animals healthy?
2. Can you prioritize the constraints of animal health in your area?
3. In which season do you think farmers need to treat their animals against internal parasites?
4. How important are ticks, flies, lice and other external parasites in the health and productivity of sheep and goats in your area?
5. Internal and external parasites cause sickness and death in sheep and goats. Which of the methods you have learned in the manual can help farmers to minimize the problem? Is using and applying some of the control methods simple and practical for you?
6. The management of communal grazing pastures is important in controlling internal/external parasites and infectious diseases of sheep and goats. How can you implement the ideas suggested in this manual?
7. Have you noticed the impact of infectious diseases on the life of animals and their productivity?
8. Which of the infectious diseases are more dangerous to sheep/goats in your area? Which ones are transmissible to people?
9. What measures do you take to control and prevent infectious diseases in your area?
10. What common roles can Community Animal Health Workers (CHAWs), Kebele Development Agents (KDAs) and animal health assistants play for the betterment of sheep and goat health and the wellbeing of the community?

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