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TECHNICAL BULLETIN No.46
Prevention of Lamb and kid mortality



ESGPIP

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Foreword

This technical bulletin titled “*Prevention of lamb and kid mortality*” is the 46th in a series produced by the Ethiopia Sheep and Goat Productivity Improvement Program (ESGPIP). The ESGPIP is a USAID funded Project with the objective of improving the productivity of Ethiopian sheep and goats in Ethiopia.

Economic losses because of lamb and kid mortality in Ethiopia are huge. Up to 28% of lambs and 47% of kids die before weaning. This figure can go up to 60% in many instances. Improving the survival of lambs/kids is essential for the economic viability of a flock and for its long-term genetic improvement.

This technical bulletin is intended to create awareness of major factors affecting lamb/kid survival so that sheep and goat producers and other actors in the production process can avoid unnecessary loss. The contents of this bulletin are also useful for producers of other animal species. Kebele development agents can use it to create awareness among sheep and goat producers in their mandate areas.

At this juncture, I would like to thank all those involved in the preparation and review of this technical bulletin.

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Prevention of lamb and kid mortality

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1. Introduction

Improving the survival of lambs/kids is essential for the economic viability of a flock and for its long-term genetic improvement. However, studies have shown that up to 28% of lambs and 47% of kids die before weaning in Ethiopia (Tsedeke, 2007; Petros, 2009).

Awareness of major factors affecting lamb/kid survival will avoid unnecessary loss. Several factors such as type of birth (litter size), sex of lamb/kid, birth weight, parity and nutritional status of the dam and season of lambing/kidding affect mortality rate in lambs/kids. The predisposing factors may be lack of colostrum, poor mothering, poor nutrition of the dam during pregnancy and nursing leading to low milk production. Generally, highest lamb/kid mortality occurs within the first week of birth and from birth to weaning. Mortality from weaning to breeding age is relatively low in many production systems.

The most important causes of lamb mortality reported in Ethiopia include starvation, hypothermia, pneumonia, malnutrition, digestive and gastrointestinal problems (scours), infectious diseases, internal parasites, accidents and predators. Proper management of the flock during gestation and at lambing/kidding can significantly reduce lamb/kid mortality. A realistic goal for most producers would be 10% lamb/kid mortality.

2. Management of ewes/does

ESGPIP technical bulletin number 15 (“Successful rearing of lambs and kids”) provides information and guidelines for proper rearing of lambs and kids.

2.1. Before breeding

Lamb/kid mortality can be reduced by proper reproductive and health management of ewes/does and rams/bucks prior to breeding. Screen the ewe/doe flock and cull ewes/does with bad udders and any other physical deformities. Records of past performance are useful to predict future performance. Ewes/does with a history of poor mothering ability, low milk production or had lambing/kidding difficulties would be strong candidates for culling. Usually, a small percentage of ewes in a flock create most of the problems and eliminating these animals can drastically reduce lambing/kidding problems.

Evaluating body condition of the ewe/doe flock and flushing before breeding, if needed, can help to increase weaning rate. Lambing/kidding season is one of the factors that affect the survival of lambs/kids, it is advisable to consider adjusting the breeding/mating time so that lambing/kidding could occur at a favorable time for survival. Studies in Ethiopia show that lambs/kids born in the wet season have better survival (Hailu *et al.*, 2006; Tibbo *et al.*, 2010)

2.2. During gestation

Nutrition: Ewes/does must have enough body reserves at lambing/kidding to produce lambs/kids with adequate birth weights. It is also important that they produce sufficient colostrum and maintain milk yield in early lactation. Ewes/does that are too fat can face birth difficulties resulting in lamb/kid loss.

Most fetal growth, along with mammary gland development, occurs during the last third of gestation. Appropriate nutrition is very important during this time. Ewes/does should be consuming about 3% of their bodyweight daily in total dry matter feed intake of feedstuffs that contain 55 to 60% TDN. Sufficient protein intake (11 – 12% crude protein in the diet) is also necessary for proper fetal growth and udder development. Insufficient feed intake, particularly energy, will result in thin ewes/does that have weak lambs/kids. Moreover, such ewes/does produce inadequate colostrum, have reduced milk production throughout lactation and thus increased lamb/kid mortality. Clean, fresh water should be available for *ad libitum* consumption. (Refer to ESGPIP technical bulletin No. 34 for further details).

Vaccination: All ewes/does should be routinely vaccinated against clostridial diseases. Vaccinations against pasteurellosis and infectious abortion should also be considered if these diseases have caused losses in the past. A booster injection (for previously vaccinated dams) is best administered approximately one month before lambing/kidding. Vaccination of dams in late pregnancy will not only boost their own immunity to infection, but the antibodies produced are concentrated in colostrum and are crucial to lamb/kid survival.

De-worming: Ewes/does should be dewormed 3 to 4 weeks before lambing/kidding so that lambs/kids are born into an environment with low parasite challenge.

3. Lambing/kidding management

In lambs/kids, most deaths occur in the neonatal period. Causes include starvation, lambing injuries, infectious conditions and difficult birth, among others. Special attention should, therefore, be given to reduce losses during this period through interventions like assisting dams with difficult births and making sure that the lamb/kid consumes enough colostrum of about 10% of their body weight or 60 milliliter per kilogram of body weight within 24 hours.

The dam should give birth in a clean environment; either on a well-rotated pasture or stall bedded with straw or other absorbent material. The bedding on the floor is important as dirty bedding can transfer disease from one occupant to the next. The lamb/kid had been in a germ-free environment in the uterus prior to birth and parturition represents exposure to common disease organisms from the environment.

Watch lambing/kidding ewes/does carefully: The location of the lambing/kidding stall or pasture should be near a well-traveled area so that the ewe/doe can frequently be observed for birthing difficulties. Few adult females require assistance at parturition though problems are always a possibility. First-time birthing ewes/does should be closely watched, especially if bred to rams/bucks known to sire large lambs/kids.

Clear airways and dip the navel cord: The first thing to check at the birth of a lamb/kid is whether the airways are clear. Clean off any excess mucus. The second step is to disinfect the navel by dipping the cord in a solution of 7% tincture of iodine to prevent entry of disease causing organisms. Dipping of the cord in iodine also promotes rapid drying and the eventual breaking away of the cord from the navel. The solution is best applied by using a small plastic bottle in which the cord is dipped. Replace the

solution regularly to ensure its cleanliness. Examine the navel a few hours after treatment to see if it has dried up - if not it should be dipped again.

Feeding colostrum: One of the most important functions of colostrum (first milk) is to provide lambs/kids with immunoglobulins (also called antibodies) that provide immunity for the first couple of months of life. Colostrum is also a highly concentrated source of energy, acts as a laxative and is an essential feed within 6 hours of birth. Colostrum enables the newborn to follow its mother and protects it from over cooling (chilling) which is the single most important cause of death. Moreover, allowing the lamb/kid to suckle colostrum is an important part of the maternal bonding process.

The immunoglobulins in the colostrum are absorbed intact by the kid through the lining of the gut. If a lamb/kid does not get enough colostrum within the first 24 hours after birth, its chances of survival are very slim. This is because the efficiency with which a lamb/kid can absorb immunoglobulins declines within just one hour after birth, drastically decreases after 12 hours and is essentially gone by 24 hours of age. This is normally not a problem as long as ewes/does accept their kids and have enough milk and teats. However, occasionally one will run into the problem of a ewe/doe rejecting her lambs/kids or producing more offspring than she is capable of nursing effectively.

Check that dams, especially those lambing/kidding for the first time, have adequate colostrum supplies and that the newborn consumes a sufficient quantity. Supply extra colostrum to lambs/kids if the dam has little colostrum. Colostrum from other ewes in the same flock is ideal. Use cows' colostrum if ewe/doe colostrum is not available. In large intensive farms that have the necessary facilities, it is possible to set up a colostrum bank with colostrum from the farm's own ewes/does. It is possible to collect excess colostrum from dams and freeze it for later use. Freeze colostrum in small quantities (50 – 100 ml) and thaw slowly when needed.

Supplement newborns by stomach tube in case of suspicion that they have not received a bellyful of colostrum within the first two or three hours of life.

Amounts of colostrum for lambs

Lamb/kid size/weight	per feeding	per 24 hours
Large lamb -5.5kg	250ml	1000ml
Medium lamb -4.0kg	200ml	800ml
Small lamb-2.5kg	150ml	600ml



Figure 1. A lamb or kid that has adequately consumed will have a bulging belly when held up by the front legs.

- **Bottle feeding colostrum:** Lambs/kids may not suckle their dams. Under such situations, it may be necessary to feed using bottles. If the lamb/kid is too weak to suckle from a bottle, colostrum can be fed using a syringe. It helps to insert a finger into the mouth and pour milk along the finger



- **Feeding colostrum using a stomach tube**

1. Do not use a stomach tube on very weak or unconscious lambs/kids. There is a risk of the tube entering the windpipe.
2. Collect colostrum from another dam or thaw frozen colostrum, if available, gradually in warm water.
3. Warm the required quantity to body temperature. Do not overheat
4. Hold the lamb/kid on its belly. Right size tube and pre-warmed colostrum should be next to you.
5. Measure the tube on the outside of the lamb to see how far to insert. Lay the tube along the lamb from the tip of its nose, along the neck and side, so the tip lies at the last rib. Mark the tube at the nose and this will show the length to insert
6. Slide the tube into the side of the mouth. Do not force. (Softening plastic tubes in warm water will help). You should feel the tube moving down the throat.
7. Slide tube down until the mark is at the level marked earlier. Alternatively, the tube may be inserted until resistance is felt.
8. If the lamb/kid shows signs of distress remove and try again.
9. When the tube is in place, attach syringe of colostrum and depress the plunger slowly (25 seconds).
10. Leave the tube in place and repeat until all colostrum is given. Lambs/kids must be fed colostrum 4 or 5 times in the first 24 hours.
11. Remove tube and syringe.

- **Adoption/Fostering:** Fostering is the transfer of a lamb/kid from its natural mother to another ewe/doe that rears the lamb/kid as her own. Fostering is needed when a dam dies leaving an orphan which must otherwise be hand-reared, or when a newly lambed/kidded ewe/doe has no surviving lambs while others have triplets. One of the triplets is then fostered onto the ewe/doe having no young. Successful methods of adoption/fostering include:

- **Wet adoption** – e.g., introducing a lamb/kid to a single bearing dam at the time of birth. It is important to cover the orphan young with birth fluids and to remove the dam's own newborn from sight until the orphan is accepted. It is also possible to remove the single lamb completely to be replaced by two matched orphans. In this case, make sure that the single lamb is fed colostrum immediately;

- **Skinned lamb** – if a dam has a stillborn young, the dead newborn may be skinned and the skin placed over the rear of the orphaned lamb/kid. This masks other odors and the dam will accept the orphan as its own; and
- **Adopter crate** – restrain the dam in a crate and introduce the orphan. This method may be difficult and time consuming, particularly if the ewe has rejected the lamb on initial contact, but perseverance often pays off.

These can be useful techniques for rearing orphan lambs/kids helping to avoid expensive artificial rearing. Dam and newborns should be kept in well- supervised small groups until bonding is complete.

4. Hypothermia and starvation

Hypothermia and starvation are the two principal causes of early lamb/kid mortality and may result in losses of 5-20% of lambs/kids born alive. The recognition and treatment of these two problems will return significant dividends.

4.1. Hypothermia:

This term refers to a condition when body temperature drops below the normal (39-40°C). Hypothermia occurs when the lamb/kid loses heat to the environment at a rate faster than the body can produce it. Small lambs/kids are more likely to suffer from hypothermia. The following can contribute to the development of hypothermia:

- A lamb/kid may exhaust its energy reserves during a difficult birth which can reduce the potential for heat production.
- Long time intervals between birth and the first feeding can deplete energy reserves.
- Newborn lambs/kids lose heat at a much higher rate when they are wet than when they are dry. Evaporation of moisture from the surface causes cooling.

Treatment of Hypothermia:

- *Moderate hypothermia (temperature 37-39° C) in a lamb/kid less than 5 hours old:* The lamb/kid should first be vigorously towel-dried and then given colostrum. If it can nurse, encourage it; if not, feed 60 ml by stomach tube at two-hour intervals.
- *Serious hypothermia (temperature less than 37° C) in a lamb/kid less than 5 hours old.* This lamb/kid should again be dried and warmed, with rapid warming becoming more important. This can be done by dipping the lamb/kid into warm (40° C) water or by using a warming box. When the lamb's/kid's rectal temperature has reached 38° C, it should receive colostrum, as stated above for moderate hypothermia.



- *Serious hypothermia (less than 37o C) in a lamb/kid over 5 hours old:* This lamb/kid has most likely utilized a large proportion of its energy reserves and has low blood glucose. This newborn is unlikely to digest colostrum if energy (glucose) must be provided before it is able to nurse. However, should be injected only by trained person or a veterinarian as follows:

Figure 4. Warming a lamb in warm water

The lamb/kid should be towel dried and glucose administered by a professional if possibilities are there. Subsequent heating without glucose administration can result in death from a lack of glucose available to the brain.

Warm (39°C) glucose solution is most effectively administered by intra-peritoneal injection but attention to cleanliness is essential. The dosage is 10 ml per kg body weight of a 20% glucose solution (40% solution diluted 1:1 with boiled water). A sterile syringe and a new 1 inch by 20 gauge needle must be used. The lamb/kid is suspended by its front legs with the needle entering a scrubbed area of the abdomen 1 cm to the side and 2 cm behind the navel, aiming (at a 45 angle) toward the lamb's/kid's rump (Figure 5). An intramuscular dose of antibiotic will help prevent infection, but it is no substitute for absolute cleanliness.



Figure 5. Intra-peritoneal injection of glucose

Alternatively, glucose can be given subcutaneously, but absorption into the bloodstream is much slower and there are some risks of abscess formation. When the subcutaneous route is used, distribute the dose over 2 sites. Preferably, under the loose skin behind the front or hind legs. Absolute cleanliness is

essential to prevent abscess formation.

Glucose administration is followed by heating. Give colostrum by stomach tube when the rectal temperature has reached 38° C. Lambs/kids unable to nurse on their own should receive colostrum by stomach tube three to four times during the first day of life. Return the lambs/kids to the ewe when rectal temperature is normal (usually one to three hours). They can now stand and nurse on their own. If lambs/kids are still weak after treatment, feed regularly by stomach tube until they are strong enough to join their mother.

4.2. Starvation:

This is the most common cause of lamb/kid mortality and the level of losses in a flock is related to management. Body energy reserves become critically depleted unless newborns receive colostrum within two or three hours of birth. It is advisable to check each udder at lambing/kidding and assist every newborn with its first meal. This should be followed up by careful scrutiny of ewes/does and lambs/kids two or three times a day until the newborns are off to a successful start.

Recognition of Starvation: Starvation typically occurs during the first three days of life. A lamb/kid will stand with its head down, ears drooping back, or it may be too weak to stand. The

stomach would be empty upon palpation. Shivering, shaking and hypothermia may follow. Figure 1 shows the way to check whether a lamb/kid has consumed feed.

Treatment of Starvation: Treatment should begin with revival if the lamb/kid is too weak to suck. In this case, feeding with a stomach tube may be necessary.

Intensive Care: Lambs/kids that have been severely stressed by hypothermia or starvation will require a day or two of intensive care. It is not easy to return to the dam a lamb/kid that is still weak after treatment.. It will not suckle and is at risk of being injured. The ewe/doe may also fail to accept a young lamb/kid that was kept away from her for a significant length of time.

A disposable cardboard box or an 18 to 22 centimeter partition in the corner of the lambing/kidding pen prevents injury but allows the dam to smell the lamb/kid. A source of heat should provide enough heat to warm the newborn. Small frequent feedings by a stomach tube may be necessary until the lamb/kid gains enough strength to nurse.

5. Care for the young lambs/kids

Lambs/kids require warm, dry conditions in cold or wet weather and adequate shade in hot weather. Sheds must be warm, dry and well ventilated. Raised slatted floors either wooden or woven wire mesh are recommended. Avoid overcrowding as it increases the risk of infection and spread of disease. Small permanent lamb/kid pens accumulate a high concentration of infectious organisms, particularly when occupied for long periods. So, rotation of pens is recommended.

Health: Lambs and kids should be regularly observed for normal health and body functions. They should be playful and alert, having normal bowel movements. Check a lamb/kid closely if it appears depressed or sluggish. Check temperature and determine if they are eating. It is best to isolate sick animals so that any potential disease condition does not spread to the rest of the flock. Give good nursing care, shelter and dry bedding. Lambs/kids that have consumed sufficient colostrum during the first 24 hours after birth should have sufficient antibodies to protect them from many diseases for three to four months. There is less resistance to some diseases, such as pasteurellosis, and a vaccination program should be started to provide resistance to such diseases. Contact an animal health officer for advice on needed vaccinations.

Weaning: The time of weaning should be determined based on the amount of feed and water the lambs/kids are consuming. The most important consideration when deciding when to wean a lamb/kid is whether or not the average daily consumption of feed is adequate for growth and development to continue in the absence of milk. The rumen is not fully developed and operating until two months of age. Weaning and feeding procedures are presented in detail in ESGPIP technical bulletins No. 15 and 34. Weaning stresses the lambs/kids and makes them susceptible to various diseases. Therefore, special attention should be paid to the health of weaned animals. They should be closely inspected for signs of disease and prompt actions taken to minimize losses. Graze lambs/kids on clean/safe pasture at weaning.

6. Flock health management

Health management of the entire flock has considerable impact on mortality of lambs and kids. The flock should be routinely vaccinated against diseases known to be prevalent in the area. Strategic treatments against internal parasites should also be considered.

Sick animals must be isolated from the rest of the flock to establish the cause and prevent disease spread. Many diseases can be controlled and treated if they are diagnosed and proper treatment is commenced early enough. Inform animal health professionals as soon as disease is suspected. New animals coming to the flock must be managed separately to prevent introduction of diseases.

Poor nutrition, inadequate shelter, poor hygiene and internal or external parasites greatly increase susceptibility to disease. Corrective measures should, therefore, be taken to mitigate their effect.

7. Specific diseases affecting lambs and kids

7.1. Pneumonia

Pneumonia is one of the most important causes of lamb/kid morbidity and mortality in Ethiopia. It is an infectious disease of young lambs/kids especially those born and reared in confinement. . The causative organisms exist in the respiratory and digestive tract of many normal sheep and goats. Most newborn lambs/kids are exposed, but do not develop the disease because of antibodies in received through colostrum that help control the infection.

Malnutrition (during the dry season when grazing deteriorates both in quantity and quality), long distance trekking, poor housing (exposing the animals to cold, wind, rain and irritating gases such as ammonia) , dust and damp bedding compromise disease resistance and natural defense mechanisms, allowing pneumonia to develop. Excessive heat, tight buildings with inadequate ventilation, weakness from difficult birth, inadequate intake of colostrum, and other stresses all contribute to the incidence of pneumonia in nursing lambs/kids.

Young lambs/kids that develop pneumonia may have fever with temperature of 40 to 41°C. Moist, painful cough and difficulty in breathing along with nasal and ocular discharge may also be observed. Acute or sudden death occurs in affected animals. Affected animals commonly lose weight and fail to nurse (loss of appetite).

Treatment: Treatment must be based on early identification of affected individuals. Antibiotics such as tetracycline, tylosin, florfenicol, tulathromycin and ceftiofur are most commonly used for pneumonia. Attendants should make sure that sick lambs/kids are nursing, or receive supplemental milk via stomach tube. In serious outbreaks, it is often advisable to treat all exposed lambs/kids with a therapeutic dosage of antibiotics for several days.

Prevention and control: Correction of predisposing factors such as overcrowding, malnutrition, long distance trekking and poor housing can greatly reduce the incidence of pneumonia in a flock. Do not keep the lambing/kidding quarters tightly closed and warm. Healthy lambs can tolerate cold other than exposure to heavy drafts very well.

In addition to the above mentioned management measures a systematic vaccination of the entire flock with *P. multocida* - *M. hemolytica* vaccine is advisable. New animals should be quarantined before introduction into the existing flock/herd.

7.2. Enterotoxaemia (Overeating Disease)

Enterotoxemia is one of the most common and costly disease problems in the sheep and goat industry worldwide. Although there is lack of report on the status of the disease in Ethiopia, lamb/kid dysentery is associated with considerable losses in the country. Preventative measures are recommended to minimize unnecessary losses.

Enterotoxemia is caused by bacteria normally found in low numbers in the gastrointestinal tract of all sheep and goats. Most commonly, the change that most commonly triggers disease is an increase in the amount of grain, protein supplement and/or milk. These feeds are rich in starch, sugar, and/or protein. When unusually high levels of these nutrients reach the intestine, the causative bacterium (*Clostridium perfringens*) undergoes explosive growth, increasing its numbers rapidly within the intestine. As the organism grows in number, it releases toxins (bacterial poisons) that harm the animal. These toxins can cause damage to the intestine as well as numerous other organs. This can result in fatalities, particularly in the non-vaccinated animal or in the newborn lamb/ kid whose dam has not been vaccinated.

Enterotoxaemia type D usually affects weaned lambs that are consuming large amount of grain per day. In contrast, enterotoxemia type C most often affects nursing lambs within the first few weeks of life, causing bloody diarrhea.

Frequently, animals with enterotoxaemia are found dead without symptoms. When symptoms are observed, the animals may abruptly go off feed; may show signs of stomach pain such as kicking at their belly, repeatedly lying down and getting up, laying on their sides, panting, and crying out; diarrhea may develop. In some cases, there is blood visible in the loose stool. Animals may lose the ability to stand, lay on their sides, and extend their legs, with their head and neck extended back over their withers. This posture is due to the effects of the toxins on the brain. Death commonly occurs within minutes to hours after this sign is observed.

Treatment and prevention: Treatment of enterotoxaemia may not be effective in severe cases. Give antitoxins either orally or by injection. More severe cases may require intravenous fluids and antibiotic therapy such as penicillin. Prevention of enterotoxaemia is, therefore, far more likely to be successful than trying to treat the disease. The following are some preventive measures:

- **Vaccination:**
 - Vaccination is the cornerstone to prevention of enterotoxaemia. For sheep and goats, there are multiple vaccines available that induce immunity to the toxins generated by *Clostridium perfringens* types C and D. Because tetanus is also an important disease to prevent in sheep and goats, many veterinarians recommend that sheep and goats be vaccinated with a vaccine that also induces protection against tetanus. These vaccines are often termed “three-way” vaccines because they induce protection against the three bacteria involved: *Clostridium perfringens*

type C (enterotoxaemia), type D (enterotoxaemia) and *Clostridium tetani* (the bacterium that causes tetanus).

- Adult sheep and goats: All enterotoxaemia/tetanus vaccines require two doses to induce effective immunity. These doses are usually administered 10 to 14 days apart. Once each adult sheep or goat has received these two doses, repeat vaccination should occur at least once per year. If the diet is mainly grain, they need to be vaccinated more than once a year. It is recommended that ewes and does be vaccinated roughly one to two months ahead of the anticipated birthing date, in order to maximize the amount of antibody present in the colostrum (first milk) – this helps to protect the neonate against enterotoxaemia.
 - For juvenile and adult sheep or goats fed diets rich in grain or allowed to graze lush pasture, more frequent vaccination for enterotoxaemia may be warranted; some producers immunize these higher-risk animals two to four times per year to achieve adequate protection.
 - Keeping the mothers well-vaccinated is the best way to protect newborn animals against this disease, as the antibodies to the bacterial toxins are transferred to the newborns in the colostrum (first milk). Growing lambs/kids are typically vaccinated for the first time at 6 to 10 weeks of age; and one to two repeat (booster) vaccinations are typically given afterwards.
- **Feeding Strategies:**
 - When feeding high-risk feedstuffs, divide the daily allotment for each animal into as many small feedings as is feasible (say, three to four feedings), rather than providing such feeds in a single, large meal. It is also advisable to feed roughages such as hay before feeding concentrates. helps to limit the possibility of overeating on high-risk feedstuffs, such as grain.
 - Feed changes should always be made in gradual increments over several days to give time for adaptation to the bacteria in the stomach. Make sure that you watch your animals for signs of dominance by one or more individuals – they can boss the others away from the grain and overeat; alternatively, the shy animals can hold back from feeding and become so hungry that they overeat. Divide your herd or flock as necessary, and make sure to provide an adequate number of feeding sites or feeder space to enable all animals an equal chance to eat.
 - Heavily milking dams may need to be fed more roughage and less concentrate to limit the excessive milk production that might endanger their offspring. Keep the feed schedule consistent to lactating does and ewes to limit fluctuations in milk volume for their nursing offspring.

7.3. Coccidiosis

Coccidiosis in sheep and goats is caused by coccidia of the genus *Eimeria* that invade the cells of the intestinal wall. The developing stages of the parasites live in the lining of the intestine and destroy parts of it. This causes diarrhea, or scours, which may or may not be bloody. Severely affected animals become unthrifty, fail to grow, and may die. Sheep and goats acquire coccidiosis by ingesting feed and water contaminated with the droppings of infected animals. As a result, prevalence of clinical coccidiosis in young lambs and kids increases under conditions of intensive husbandry.

Young or previously unexposed sheep/goats are the most susceptible, particularly at times of stress—for example, at weaning. Sheep/goats appear to develop resistance to coccidia with age, but stressful

conditions can cause this resistance to break down. Poor nutrition, lack of shelter, overcrowding and excessive handling are predisposing factors. Overcrowding in damp conditions, where feed and water are liable to fecal contamination, make coccidiosis outbreak more likely.

No specific chemical treatment of proved reliability is available for coccidiosis of sheep and goats. Sulfonamides, especially sulfaguanidine, sulfamethazine, and sulfasuxadine, have been used advantageously in several instances. At the proper time and in proper amounts, they may destroy some of the intestinal stages and help the animal withstand the injurious effects of the parasites. Since the developing stages of coccidia injure the lining of the intestine and make it easier for bacteria to invade the intestinal wall, these drugs may be of help in stopping invasions by certain bacteria.

Control of coccidiosis of sheep and goats rests largely on the use of management practices that help to keep the animals from contaminating their feed and water with droppings. It is also very important to reduce stress to the lambs/kids. The following measures help to control and prevent outbreaks:

- Use feed and water troughs in which animals cannot defecate.
- Ensure that water troughs do not overflow.
- Avoid overcrowding on damp pastures.
- Provide good, well drained shelter.
- Avoid mixing young lambs/kids and older sheep/goats.
- Maintain good health by good nutrition and worm control.

7.4. Helminth parasites

Sheep and goats are affected for the most part by the same parasites. The most deadly internal parasites to small ruminants in Ethiopia are the gastrointestinal roundworm *Haemonchus contortus*, and the liver fluke *Fasciola hepatica*. Other helminth parasites that affect sheep and goats are those of the *Trichostrongylus* genus (particularly *Trichostrongylus axei*), *Teladorsagia circumcincta* and lungworms.

7.4.1. *Haemonchus contortus*: *Haemonchus contortus* is a blood sucking parasite that can cause severe anemia, protein loss and death in goats and sheep-especially in lambs and kids, and thus is the most important to control. However, by developing a parasite control plan aimed at *Haemonchus*, the majority of other dangerous nematode parasites will be controlled as well. The *Haemonchus* adult female can lay up to 5,000 eggs per day, yet another reason why *Haemonchus* is so difficult to control and so dangerous to sheep and goats. The eggs are expelled from the body via the feces. Under favorable conditions, the eggs develop in to larvae. Once the larvae reach the infective stage, they climb up onto blades of grass where they wait to be ingested by a grazing animal. Young animals that are on continuous permanent pasture are the most susceptible to parasites. These animals have very low levels of immunity and thus extremely susceptible to infection from parasites on pasture. The lambs and kids will begin to develop some immunity to parasites around six to eight weeks of age, provided they do not reach pathogenic levels of parasites in their system before this time.

In acute haemonchosis, anemia and edema are key symptoms. Anemia develops due to blood sucking habits of the worms. Each worm removes about 0.05ml of blood per day by ingestion and seepage from the lesions. Anemia is most easily identified in small ruminants by the color of the

mucous membranes, particularly those in the lower eyelid. A normal animal will have healthy, red mucous membranes, while one heavily burdened with *Haemonchus* will exhibit light pink or white membranes. Edema may also occur in animals heavily burdened with *Haemonchus*. This accumulation of fluid will be most obvious as a swelling in the lower jaw, a condition known as “bottle jaw”. In hyperacute cases, sheep die suddenly from hemorrhagic gastritis. Chronic haemonchosis is associated with progressive weight loss and weakness, neither severe anemia nor gross edema being present.

When an acute outbreak has occurred the sheep should be treated with one of the benzimidazoles, imidazothiazoles, and macrocyclic lactones (ivermectin/milbemycin) and immediately moved to clean pasture. When the original pasture is grazed again, prophylactic measures should be undertaken, as enough larvae may have survived to institute a fresh cycle of infection.

Control : The main goal in attempting to control *Haemonchus* and other internal parasites is to break the life cycle. Control of internal parasites in animals usually involves appropriate use of anthelmintics and pasture management.



- **Pasture management:** Pasture management is a key aspect in breaking the life cycle of internal parasites. The grazing habits of sheep make them much more susceptible to parasites than other species. Sheep tend to graze much closer to the ground than other animals, and show little aversion to grazing in areas with high fecal contamination drastically increasing the numbers of larvae that sheep are exposed to and the number that they are likely to ingest. The goal of pasture management is to allow the pastures enough time to rest so that lower numbers of infective larvae will not be a problem to the grazing animals. The best way to avoid pasture related parasite problems is to avoid overgrazing areas of pasture, and to implement a rotational grazing system. Parasite contamination can be reduced if cattle or horses grazing can be incorporated into the grazing system.
- **Anthelmintics:** helminth parasites occur seasonally. This suggests the possibility of strategic use of anthelmintics for control of parasites. However, it must be born in mind that the agro-climatic conditions widely differ from place to place in Ethiopia. Therefore, knowledge of the local epidemiology of parasites is essential to devise appropriate control strategies. Generally, flocks (including lambs and kids) should be treated at the beginning of the rainy season to remove adult worms and larvae to reduce pasture contamination during the rainy season, when external environmental conditions are favorable for the development and survival of eggs and larvae. Animals need also be dewormed at the end of the rainy season to remove worms picked during the rainy season to protect animals from the effect of the parasites during the dry season that is characterized by feed shortages. *Ewes and does* should also be dewormed prior to breeding and approximately two weeks prior to lambing or kidding to help combat the peri-parturient egg rise. Lambs and kids should be dewormed and grazed on safe pasture at weaning.

There may also be a need for treatments throughout the rainy season (every 2 to 4 weeks) or treatment of animals case by case depending on the specific situation of the flock. However, there is a risk of development of anthelmintic resistance and high cost associated with frequent use of

anthelmintics. There is, therefore, a method developed to identify animals that need treatment. This method, called FAMACHA, is described in detail in the ESGPIP technical bulletin No.3).

Proper use of anthelmintics in conjunction with pasture management can help reduce the challenge of parasites to the flock. Alternate use of anthelmintics, annually, from different class may also help to prevent anthelmintic resistance development.

7.4.2. Liver flukes (*Fasciolosis*): Liver flukes are important causes of morbidity and mortality in lambs and kids especially in the highlands of Ethiopia. There are two species of liver fluke in Ethiopia: *Fasciola hepatica* is common in the highlands of Ethiopia while *F. gigantica* is prevalent in the mid-altitude areas. Liver fluke infection in lambs and kids is characterized by anemia, edema, weight loss and death. The life cycle of liver flukes is an indirect one-involving snail intermediate host. The minimal period for completion of one entire life cycle of *F. hepatica* is 17-18 weeks. The signs of fasciolosis depend on the type. Fasciolosis may be acute, sub-acute or chronic.

- **Acute fasciolosis:** Outbreaks of acute fasciolosis are generally presented as sudden death usually at the end of the long rainy season in the highlands of Ethiopia. On clinical examination affected lambs/kids are weak, with pale mucus membranes indicating anemia and in some instances have palpable enlarged livers associated with abdominal pain.
- **Subacute fasciolosis:** The subacute disease, is presented as a rapid and severe hemorrhagic anemia and if untreated, can result in a high mortality rate. However it is not so rapidly fatal as the acute condition and affected sheep may show clinical signs for 1-2 weeks prior to death; these include a rapid loss of condition, a marked pallor of the mucus membranes, an enlarged and palpable liver. Submandibular or facial edema and ascites may be present. Subacute disease occurs 6-10 weeks after ingestion of approximately 500-1500 metacercariae.
- **Chronic fasciolosis:** Chronic fasciolosis is characterized by a progressive loss of condition and the development of anemia which can result in emaciation, pallor of the mucous membranes, submandibular edema and ascites. More than 0.5ml blood per fluke can be lost into the bile ducts each day. It occurs 4-5 months after the ingestion of moderate numbers, 200-500, of metacercaria. This form is usually seen in sheep in the highlands of Ethiopia in the dry season.

Treatment: Triclabendazole, a flukicide effective against all stages over 1 week old, is a drug of choice especially when acute fasciolosis is suspected. Other drugs are rafoxanide, closnatel and nitroxylnil, which will remove flukes over four weeks old. Albendazole at higher dose rate is also effective against adult liver flukes.

Control: Control of fasciolosis may be approached in two ways; by reducing populations of the intermediate snail host or by using anthelmintics.

- **Reduction of snail populations:** The best long-term method of reducing snail intermediate hosts is drainage, since it ensures permanent destruction of snail habitats, but this method incurs a lot of cost. When the snail habitat is limited a simple method of control is to fence off this area or treat annually with a molluscicide. Currently copper sulphate is most widely used. **Use of anthelmintics:** The prophylactic use of flukicides is aimed at:

- ❖ Reducing pasture contamination by fluke eggs at a time most suitable for their development-presence of moisture and intermediate snail hosts. This time extends from August to October under Ethiopian highland conditions.
- ❖ Removing fluke populations at a time of heavy burdens or at a period of nutritional and pregnancy stress to the animal. To achieve this objective under Ethiopian highland conditions, it is recommended to treat animals in the dry season (November to January).

7.4.3. Lungworms: Lungworms of sheep and goats (*Dictyocaulus*, *Mullerius* and *Protostrongylus*) are prevalent in the highlands of Ethiopia. *Dictyocaulus*, the most important lungworm of sheep and goats, is commonly associated with a chronic syndrome of coughing and unthriftiness that usually affects lambs and kids during the long rainy season that lasts between June and September.

Where outbreaks occur, the affected animals or the whole flock should be treated with a suitable anthelmintic and then, if possible, moved to fresh pasture. The routine de-worming of the flock at the beginning of the rainy season may help prevent outbreaks through reducing pasture contamination. De-worming of lambs and kids at weaning and grazing them on clean pasture is advisable.

8. References

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