

Meat Goat Herd Health – Common Diseases

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Unit Objective

After completion of this module of instruction the producer should be able to recognize signs and symptoms of diseases of reproductive system, muscular-skeletal system, skin, neurological system, urinary tract, gastrointestinal system, internal and external parasites, eye and toxicosis. The producer should be able to develop programs for prevention and provide treatment. The producer should be able to score a minimum of 85% on the module test.

Specific Objectives

After completion of this instructional module the producer should be able to:

1. State reasons why goat producers should take goat diseases seriously.
2. State the meaning of the term "zoonotic."
3. Select factors that may cause goats to abort.
4. Distinguish between true and false statements related to reproductive diseases.
5. Respond to statements related to muscular-skeletal diseases.
6. Distinguish between true and false statements related to skin diseases.
7. Identify causes of respiratory diseases.
8. Respond to statements related to respiratory diseases.
9. Respond to statements related to neurological diseases.
10. Distinguish between true and false statements related to urinary tract diseases.
11. Respond to statements related to diseases of gastrointestinal system.
12. Respond to statements related to internal and external parasite diseases.
13. Distinguish between true and false statements related to diseases of the eye.
14. Respond to statements related to toxicosis.

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Introduction

While goats are normally very healthy animals, they can succumb to disease just like other domestic livestock species. Diseases can be very serious and result in lost productivity, reduced reproduction, or even death. Some diseases are contagious and can spread quickly throughout a herd. Other diseases have the potential to be zoonotic, meaning they can be passed to humans. It is essential for goat producers to have basic knowledge of the diseases most likely to affect their animals. This knowledge should include how a disease is transmitted, its signs and symptoms, how it can be treated and, most importantly, how it can be prevented and controlled. While basic knowledge of diseases will assist a producer, your veterinarian is the correct person to provide proper diagnosis and to prescribe appropriate drugs and treatment regimes.

Reproductive Disease: Infectious Abortions

General

Of all the disease problems which can affect a herd of goats, those causing abortion and reproductive failure are always the most costly. Estimates for expected pregnancy wastage in goats are in the range of 5 to 8% per year and, in abortion epidemics, could reach greater than 80%. Abortions can be due to many factors including malnutrition, temperature, genetics, hormones, stress, and trauma. However, abortions due to diseases that may spread throughout the herd have the potential to be the most devastating.

When faced with an animal which aborts, it is imperative that appropriate procedures are followed if a diagnosis is to be made. Record the animal number, date, and any other important information about the abortion. Four samples (clearly labeled with animal number and date) always suggested to be taken include:

1. Fetus – fresh, chilled if delivery to a diagnostic lab is within 2 days, otherwise freeze.
2. Placenta - as above.
3. Blood collected at the time of abortion - if possible, allow blood to clot and collect the serum (pale yellow fluid that rises above the clot) and freeze.
4. Blood collected 2 to 4 weeks after the abortion – as above.

It is important to remember that many of the diseases causing abortion in goats are zoonotic diseases and can be transmitted to humans. Gloves should always be worn when collecting samples from the abortion and hands should be cleaned carefully after handling potentially infectious material. Pregnant women should not assist with kidding.

In general, it is safest to assume that all abortions are caused by contagious organisms. Always isolate the doe and dispose of all aborted material (fetus, placenta, and fluids) by burning or burying. Contact a veterinarian to determine a course of action and potential treatment programs.

Chlamydiosis

Chlamydia is a common cause of infectious abortion in goats. In chronically infected herds almost 50% of abortions are the result of infection with these bacteria (*Chlamydia psittaci*). The birth of weak kids may also be associated with Chlamydia. Chlamydia can cause conjunctivitis (pink eye), and polyarthritis (arthritis in multiple joints), though the exact strains of the Chlamydia bacteria causing these diseases differ from those causing abortion. Goats become infected orally from bacteria shed in the feces and uterine discharges of infected goats.

Signs and symptoms

A history of late term abortions, stillbirths, and birth of weak kids is always suggestive of Chlamydiosis. The aborted fetus may be fresh or decomposed in appearance. The time from infection to abortion may vary. Female kids infected with the organism at birth may abort in their first pregnancy. Does exposed to the bacteria in the first half of gestation may abort in the last trimester of that pregnancy. Does exposed in the last half of gestation usually abort in the subsequent pregnancy. Once abortion has occurred, does appear to have immunity as affected animals seldom abort more than once due to Chlamydiosis.

Treatment, prevention, and control

Remove aborting does from the herd for at least 3 weeks. Placentas and fetuses should be removed and burned or buried. To minimize exposure, ensure that all feed and water sources are protected from fecal contamination. Treating all does in an abortion outbreak with tetracycline may reduce additional abortions. Consult your veterinarian for drugs, dosage, and withdrawal information. There is a vaccine approved for sheep available as a single antigen or in combination with *Campylobacter*. Consult your veterinarian for potential use in goats.

Toxoplasmosis

Toxoplasma gondii is a protozoan parasite that can infect goats and is second in importance only to Chlamydia as a major cause of infectious abortion. Cats are the primary host for toxoplasmosis, becoming infected by eating infected rats and mice. The parasite matures in the intestine of the cat and infective eggs or oocytes are passed in the feces which can infect goats and other animals if consumed. Other than cat feces, the only source of infection for does is by consuming the infected placenta or birth fluids from aborting does. Younger cats are more of a threat to spread the disease than older cats. Cats develop immunity as they mature and persons who want cats should use neutered adult males as they are less likely to be a source of infection.

Toxoplasma can be transmitted to humans via drinking milk from infected does and from handling aborted material. Pregnant women should not assist with kidding or handle aborted material.

Signs and symptoms

Does infected early in pregnancy may reabsorb the fetus or abort a mummified fetus. Infections later in gestation can result in abortion and stillbirth. Diagnosis is usually made based on the appearance of the placenta. White to yellow focal "rice grain" lesions are typically found on the cotyledons. Another common finding is brain abnormalities in stillborn or weak kids.

Treatment, prevention, and control

Remove does which abort from the herd for a minimum of 4 weeks. Bury or burn all aborted material. During gestation, all cats should be kept away from pregnant does. Remove all feed which may have been contaminated with cat feces and prevent cats from defecating in feeders, on hay bales, etc. There are no vaccines available in the U.S. for toxoplasmosis. Feeding monensin throughout pregnancy has been shown to have some protective effect (Rumensin 60 made by Elanco fed at 20 grams monensin per ton of feed).

Properly cook all goat meat and pasteurize all goat milk to be consumed, particularly that fed to infants. Pregnant women should be careful when handling goats. Wear protective gloves when handling fetus and placenta.

Q-Fever

Q-fever is a bacterial infection (*Coxiella burnetti*) that causes fetal resorption, stillbirths, and late term abortions often with retained placentas. It is transmitted through the air and inhaled or is consumed via infected abortion material, urine, or grazing contaminated pastures. Tick bites may also be a source of transmission. Q-fever's primary significance is its zoonotic potential.

Signs and symptoms

Q-fever infects cattle, goats, sheep, and wildlife. Most infected goats will be carriers of the disease without showing any signs. Carrier animals will shed the disease in milk and at parturition. Signs include stillbirths and late term abortion. Some aborted goats will have a retained placenta.

Treatment, prevention, and control

Tetracycline is the drug of choice and may be used under veterinary supervision. The aborted placenta, fetus, and birth fluids should be buried or burned. Colostrum and milk also have high levels of organisms. There is currently no effective vaccine available. The organism is resistant to drying which means it aerosolizes and can be inhaled. This is a zoonotic disease meaning it can be contracted by humans so a mask should be worn when scraping manure or sweeping the area. Pasteurize all milk before drinking.

Brucellosis

Brucellosis is a bacterial disease of mammals that can affect goats causing abortions in does and inflammation of the testicles in bucks. While brucellosis in goats is usually caused by *Brucella melitensis*, they can also become infected with *Brucella abortus* which is the brucella of cattle. *Brucella melitensis* is not found in the United States at present; however, it is present in Mexico. *Brucella abortus* is rare in the United States. If brucella enters a herd there is usually an abortion “storm.” Brucellosis is an important zoonotic disease and is called “Malta fever” in humans. It is characterized by recurrent flu-like symptoms and high fever.

Signs and symptoms

Abortion in late pregnancy, stillbirths, and birth of weak, infected kids are all possible signs. Does may show fever, lameness, and sometimes nervous system signs.

Treatment, prevention, and control

There is no effective treatment and infected animals should be slaughtered. Burn or bury all aborted materials. Consult your veterinarian if brucellosis is suspected. Any brucellosis cases must be reported to state veterinarians. Additions to the herd can be tested for presence of the disease organism. This disease is spread to humans by direct contact or by drinking unpasteurized milk or consuming products made from infected milk. Wear protective clothing when assisting with birthing problems or abortions. Do not drink or use raw milk.

Other abortion-causing diseases

Campylobacter (vibriosis) and Leptospirosis are two other diseases that can cause late-term abortions; however, these diseases are rarely seen in goats. Campylobacter is spread orally via feces and the aborted fetus and placenta of infected animals. A common sign is a bloody, pus-like vaginal discharge before or after abortion. Leptospira is usually transmitted by the urine of infected animals that can be goats but more commonly are rodents. Ensure that feed and water sources are not contaminated with feces or urine. Control rodents and other animals that may be vectors for these diseases. Listeriosis, caused by *Listeria monocytogenes* can cause mid- to late-term abortions. It can also cause “Circling Disease” and is discussed later in this chapter. For these abortion diseases, consult a veterinarian for treatment regimes and possible vaccination protocols if deemed necessary.

Musculo-Skeletal Diseases

Caprine arthritis encephalitis (CAE)

Caprine arthritis encephalitis (CAE), caused by a retrovirus, can affect all breeds of goats but is most common in the dairy goat industry. Up to 80% of all dairy goat herds tested have infected animals compared with only up to 10% of meat goat herds. The CAE virus is transmitted from an infected adult goat to kids through consumption of colostrum and milk. There is also evidence to suggest that CAE can be transmitted directly from goat to goat possibly through saliva, nasal

secretions, urine, feces, venereal transmission from infected bucks, and mechanical transmission (needles, tattooing equipment, etc.). While generally not a deadly disease, CAE can result in lost production, particularly in older goats. CAE is not an important disease in most meat goat herds at the present time.

Signs and symptoms

There are four forms of the disease, a CNS or “central nervous system” form that affects kids, an arthritic form that affects adults, a pneumonia form, and a mastitic form. The arthritic form in older goats is most commonly seen.

In the CNS form, young kids (2 to 4 months of age) develop a weakness in the rear legs, stumble, and finally cannot rise. The unused leg muscles lose strength and terminally affected kids are unable to sit up and can only lie on their sides. Throughout the course of the disease, kids remain bright and alert and will continue eating and drinking with assistance.

In the arthritic form, goats will have one or more swollen joints. The knee joints are most frequently affected followed by the hocks and stifles. Lameness results and goats may eventually walk on their knees. Affected goats gradually lose weight and condition, have poor hair coats, swollen knees, and have signs of joint pain particularly during cold weather.

The pneumonia form is usually seen during advanced pregnancy when the animal is stressed. The mastitic form occurs in adult does and is also known as "hard bag." At the time of parturition the udder is swollen, firm, and hard but contains very little milk.

Treatment, prevention, and control

There is no treatment. Infected animals can be assisted by good nutrition, nursing care, and pain relief with anti-inflammatory drugs.

Prevention and control consist of purchasing CAE-free animals, culling infected animals, raising CAE-free kids, and preventing potential goat-to-goat transmission. Blood tests can detect CAE and animals can be tested prior to purchase. Periodic blood testing is required to monitor herd CAE status as animals will seroconvert (meaning they will blood test positive for the disease) at different times. An animal may test negative and three months later test positive. Once an animal tests positive, it will not revert to negative status. Repeated annual or biannual testing and strict culling is necessary to keep a herd CAE-free.

To raise CAE-free kids, remove them from affected dams at birth and feed pasteurized colostrum and milk, feed bovine colostrum and milk, or feed artificial products. Colostrum can be heat treated by raising the temperature to 133°F [56°C] for 60 minutes or 165°F [74°C] for 15 seconds. Milk is pasteurized by treating at 145°F [63°C] for 30 minutes or 165°F [74°C] for 15 seconds. The temperature is critical for colostrum because a higher temperature will denature colostrum proteins that provide disease immunity and a lower temperature will not kill the virus. Pasteurization can be

accomplished using a water bath heated by an electric frying pan or by equipment purchased for the task. It is probably not safe to feed unpasteurized milk from test negative does.

Finally, because there is evidence that any body fluid from an infected goat is a possible source of the disease, separation of infected and uninfected animals is important. Disinfect anything that could transmit body fluids (milk, saliva, feces, blood, or nasal discharges) between goats. This includes milking machines, tattoo needles, etc.

Contagious footrot

Footrot 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). Footrot can occur throughout the U.S. but is particularly prevalent in the southern states. The source of *D. nodosus* is the hooves of chronically infected carriers that occur in approximately 10% of affected small ruminants. Because of *D. nososus*' 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 footrot occur only when pastures are continually wet and mean daily temperatures are above 50°F [10°C]. Wet conditions soften tissues surrounding the hoof and can lead to infection or dermatitis making the skin more permeable to infectious bacteria. In an outbreak, 70 to 90% of all animals in the herd will be affected. About 10% of the animals will remain infected for life and 20% will remain uninfected. Those animals infected early in the course of the outbreak tend to stay infected for long periods of time; those infected late in the outbreak typically recover spontaneously in a short period. Resistance can be enhanced by selective breeding for footrot resistance, vaccination, maintaining feet in a dry condition, routine foot trimming, and administering zinc to animals deficient in that element.

Signs and symptoms

Both a mild (benign) and a severe (virulent) form of footrot may occur. In the mild form, often called foot scald, skin between the hooves will be inflamed, swollen, and damaged. There may be some secretions and the skin may have a "cooked meat" appearance. Lameness is mild and the problem responds readily to treatment and usually disappears spontaneously when the feet are exposed to dry conditions. Usually only a few animals are affected.

Severe, or virulent, footrot is caused by strains of the bacteria which rapidly digest the keratinized tissues found in the hoof wall. Initially, the foot is red, swollen, and moist and the goat experiences moderate lameness. As the infection progresses, the layers of the hoof separate and exude a dark, foul-smelling pus. Walking on the affected foot causes movement of the separated hoof layers resulting in severe pain. The animal will limp or walk on its knees. An affected 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, foot trimming, and possibly vaccination. The use of injectable antibiotics is highly effective and penicillin, erythromycin, florphenicol, or oxytetracycline can be given under the advice of your veterinarian. Treated goats should be kept in a dry environment for at least 24 hours following treatment. In dry environments, topical treatment of antibiotics (5% tincture of tetracycline) or antiseptics (10% zinc sulfate, 10% copper sulfate solution) is adequate for benign footrot where small flocks of animals are involved or when routine foot trimming is being done. These can be applied with a brush or spray. Some commercial products for good hoof health are also available. Ensure good, prolonged contact with infected tissues.

Foot baths

Large goat herds are treated more practically with foot baths. In an outbreak, goats should be treated weekly for four weeks. Separate infected from noninfected animals, treat, and then place on separate pastures. Preventive use of foot baths during the transmission season is recommended for herds with endemic footrot. Troughs 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. Goats are adept at walking on small ledges so sides should be smooth. As goats can jump long distances, foot baths should be at least 8 to 10 feet long (~ 3 meters). Provisions should be made for drainage and proper solution disposal so as to prevent environmental contamination.

Copper sulfate (5%) and zinc sulfate (10%) are commonly used foot bath chemicals. Zinc sulfate is generally preferred as it does not stain hair and has less toxicity concerns than copper sulfate. Zinc sulfate is also not decomposed by organic matter to the extent seen with copper sulfate meaning that the solution need not be changed as frequently. 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 footrot. 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 pare the feet adequately to expose infected areas when topical disinfectants are used. Do not trim so severely as to cause bleeding. Blood stop powder can help stop bleeding.

Eradication

Eradicating footrot can be difficult, particularly in wet, moist environments. A typical program includes:

- Trim and examine the feet of all animals. Clean and disinfect hoof shears between animals by using alcohol, dilute iodine, or chlorhexidine.
- Separate infected from noninfected animals.
- Run both groups through a foot bath, standing in the solution for a minimum of 30 minutes, then place on clean pastures.
- Repeat treatment weekly for two to four weeks.
- Cull those animals that do not respond to treatment.
- Consult your veterinarian on a potential vaccination regime.
- Select breeding animals that are less affected.

Once the program has been completed, monitor the herd on a monthly basis and remove relapsing animals. New additions to the herd should be checked for lesions and treated appropriately. Animals returning from shows should be foot bathed prior to re-entry into the herd.

A multivalent vaccine for footrot (Footvax) is available and can decrease the duration, severity, and incidence of footrot. However, its effectiveness is highly variable and repeated injections may be needed to maintain resistance.

Nutritional muscular dystrophy, white muscle disease

White muscle disease is caused by a deficiency of the mineral selenium and(or) vitamin E. Kids from does consuming a selenium-deficient diet are most affected. Selenium deficiency can occur when animals graze or are fed feedstuffs grown in low selenium-containing soils. White muscle disease affects both heart and skeletal muscle, usually in young, fast-growing animals under 6 months of age. Both selenium and vitamin E protect cell membranes from oxidation and to a certain degree act together and substitute for one another. A deficiency of one or both will overwhelm the abilities of the remaining compound(s) to protect body cells.

Signs and symptoms

Animals with the heart muscle affected will show signs of weakness, respiratory distress, rapid heart beat, and sudden death, particularly after exercise. Animals with the skeletal form will be stiff, stand with difficulty, and reluctant to move. Muscles, particularly in the hind legs, will be hard and painful. Upon necropsy (autopsy), the heart and skeletal muscles may have white streaks.

Treatment, prevention, and control

Treatment consists of injections of a product containing selenium and vitamin E such as Bo-Se. This can be repeated 24 hours later.

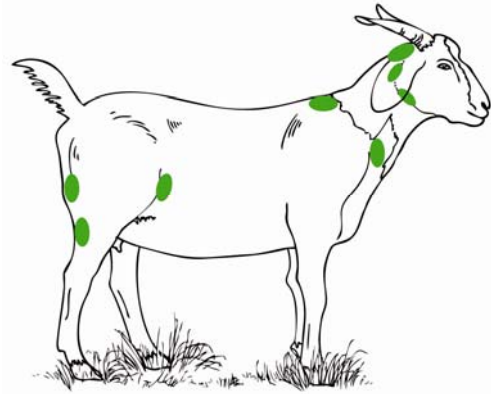
White muscle disease can be prevented by providing supplemental selenium and vitamin E, particularly if soils in your area are deficient. Supplements can be fed as additions to the regular diet or in a mineral mixture. Dietary concentrations of Se should be no more than 0.1 to 0.3 parts per million (ppm). Follow recommended guidelines on selenium feeding.

For additional protection, or in animals with an unknown history, Bo-Se may be injected subcutaneously shortly prior to kidding at 2.5cc/100 lbs live weight.

Skin Diseases

Caseous lymphadenitis, pseudotuberculosis, abscesses

Caseous lymphadenitis (CL) is an extremely common disease of goats that is usually ranked as the most important disease goat owners have in their herds. CL is characterized by one or more abscesses involving lymph nodes, typically associated with nodes in the head and neck. Occasionally, the organism will involve internal lymph nodes and result in a wasting syndrome. CL is transmitted orally and through direct contact with skin. Some goats within a herd appear to be very resistant to CL while others are very susceptible. The causative agent, *Corynebacterium pseudotuberculosis*, can live for long periods of time in soil and, thus, is extremely difficult to eradicate. Once a goat is infected, it remains infected for life.



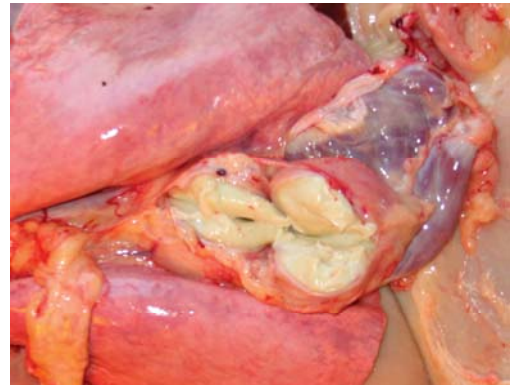
*Location of lymph glands.
Drawing by K. Williams.*

Signs and symptoms

The most commonly seen sign is an enlargement of one or more of the lymph nodes. The enlarged lymph nodes are very thick-walled and filled with thick, greenish pus.

Treatment, prevention, and control

Antibiotic use is not successful in the treatment of this disease. Affected animals should be isolated and abscesses opened and drained away from the herd and grazing areas. All pus and discharge should be caught and burned or buried. This disease can affect humans so gloves should be worn. For proper procedure, see the lancing abscesses section of the Meat Goat Herd Health Procedures and Prevention chapter. The affected goat should be isolated from the herd until the opened abscess is completely healed over. Goats with multiple abscesses should be culled.



Internal CL abscesses near the lungs.

The best prevention is to maintain a closed herd or to carefully screen new additions to the herd by performing a blood test and by examining for the presence of abscesses or scars from old abscesses. All affected animals should be isolated from the herd or culled. Once this disease has entered a farm, it is difficult to eradicate. There is a vaccine available for sheep which will decrease the incidence and severity of the disease. It is a killed vaccine which requires 2 doses initially and an annual booster. The vaccine has no efficacy in animals which are already infected. Custom vaccines can be made from the organism found in your herd.

Contagious ecthyma, sore mouth, orf

Sore mouth is a highly contagious disease of goats most prevalent in young kids within a few weeks of birth or weaning. It is caused by a poxvirus. Some strains of the orf virus cause more severe and extensive symptoms than others. People can get this disease so gloves should be worn when treating animals or giving vaccines.

Signs and symptoms



The virus causes sores to develop, usually around the mouth, that can spread throughout the lips and occasionally to the inside of the mouth. Lesions may also develop on the teats, vulva, face, and legs of affected goats. Lip lesions are extremely painful and inhibit the willingness of the kid to nurse or eat while does with teat sores may be unwilling to let kids suckle. This combination means that without special attention affected kids will succumb to simple starvation. Infection is spread by direct and indirect contact from infected animals or by scabs or saliva from infected animals. Immunity following disease is for less than 1 year. However, subsequent outbreaks are usually less severe.

Treatment, prevention, and control

Treatment is to reduce pain of affected animals and prevent spread of the virus. Lesions are carefully cleaned and coated with antibiotic ointment. It is crucial to make sure that affected kids continue to eat and that affected does don't develop mastitis. The virus has the ability to live in scabs that fall from an animal for at least a year thereby being a source of later infections. Producers with infected herds may wish to vaccinate annually against the disease. The vaccines are modified live viruses which are inoculated topically on scarified skin (like the old smallpox vaccine in the U.S.).

Dermatophilus, streptothricosis, rain scald

Dermatophilus is a common contagious skin condition caused by the bacterium *Dermatophilus congolensis*. It is usually seen in moist, humid, wet conditions. The organism enters the body through skin abrasions and injury and can penetrate moist skin after prolonged contact. 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 mild cases, goats are not too itchy but in severe cases 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. Chronic ear infestation of some animals may also spread the disease. This disease is zoonotic so care should be taken when handling affected animals.

Signs and symptoms

Dermatophilus starts with scabs forming around the ears, face, nose, lower legs, or tail. These will later form crusty, scaly lesions that can spread over the back and flanks of the animal. The affected areas are also susceptible to secondary bacterial infection. Lesions around the mouth may be confused with contagious ecthyma (orf). Infection of the feet with formation of large crusts is called strawberry footrot.

Treatment, prevention, and control

Antibiotics such as Procaine penicillin G (20,000 to 70,000 units/kg body weight for 4 to 7 days) or oxytetracycline (LA 200 at 9 mg/50 kg or 4 to 5 cc/100 lbs) can be injected. Topical treatment options include 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.

Ringworm

Ringworm is caused by one of several fungi. The infection is commonly seen on the face, ears, and neck. Goats commonly acquire it by direct contact with infected animals or from the environment such as by rubbing on wooden posts or mangers contaminated with fungal spores. Young animals and animals living in dark, damp environments or having nutritional or other debilitating diseases are most at risk. Ringworm is a zoonotic disease so care should be taken when handling affected animals.

Signs and symptoms

Goats will be itchy and have typical circular patches of hair loss on the face, ears, or neck.

Treatment, prevention, and control

Treatment can limit spread in the herd and can reduce environmental contamination. Topical compounds such as 2% iodine, 3% captan, 2% chlorohexidine, and 2% lime sulfur are effective. Prevention practices include disinfecting equipment used on goats.

Caprine Respiratory Disease

Respiratory diseases can affect goats of all ages. Causes of respiratory disease include various viral or bacterial infections, irritants to the nasal passages, injury to the throat or trachea, and some flies and parasites. In kids, respiratory diseases are usually from infectious agents. Post-weaning, a variety of risk factors for the development of respiratory disease occur. These include:

- Changes in nutrition,
- Transportation,
- Commingling of animals of different groups,
- Loss of maternal antibodies,
- Exposure to new pathogens,
- Adverse housing conditions, and
- Crowding.

Dusty conditions and exposure to moldy/dusty hay or gaseous irritants (such as ammonia in a poorly ventilated barn) can lead to widespread nasal and tracheal irritation. When inspecting housing facilities for irritants, make sure the inspection is done at the level of a goat's nose, i.e., low to the ground. Respiratory problems due to trachea injury can arise from improper use of balling and drenching guns.

There are two generalized areas of concern for respiratory diseases, lower tract diseases and upper tract diseases. Lower tract diseases usually result from a disease-causing agent. Upper tract diseases are normally associated with inhaling foreign bodies or irritants, or injury to the trachea although viral and bacterial diseases can occur.

Lower Respiratory Tract Diseases

Blood-borne infections

Most respiratory disease problems of baby kids are due to septicemia or blood-borne infections. While these diseases involve all systems of the kid, respiratory symptoms often predominate. Commonly, these infections are due to inadequate colostrum consumption and housing in an environment with heavy bacterial loads. Some organisms responsible for these infections include *E. coli*, *Mannheimia haemolytica*, *Pasturella multocida*, *Mycoplasma*, and *Streptococci*.

Signs and symptoms

These diseases generally occur where wet, unsanitary, and crowded conditions exist. The onset is sudden with kids becoming weak and depressed, refusing to eat, running a fever, and breathing rapidly. Sometimes, sudden death is the only sign. Large numbers of triplet or quadruplet litters may increase incidence.

Treatment, prevention, and control

Kids exhibiting these signs are in a medical emergency. Treat using antibiotics having a gram negative/gram positive spectrum to counteract a wide variety of organisms. A veterinarian may prescribe ceftiofur (Naxcel), florfenicol (Nuflor), or oxytetracycline. Anti-inflammatory drugs will help alleviate signs and symptoms. Provide fluids and ensure the kid is eating.

Proper management of dams and kids can prevent occurrence. Late gestation dams should be in good body condition (3 – 3.5). Maternity pens and kidding pens should be clean and adequately ventilated. Ensure navels are dipped in iodine at birth and that kids consume adequate colostrum.

Enzootic pneumonia

Enzootic pneumonia is the end stage of infections by a variety of primary agents (mycoplasma, chlamydia, adenovirus, syncytial virus, IBR, PI-3, Caprine herpes virus) or by the various stresses experienced in intensive weanling management, most notably coccidiosis. This pneumonia is usually a herd problem in goats raised in confinement or under intensive management. Predisposing conditions include crowding, inadequate ventilation, and high humidity.

Signs and symptoms

Animals will have a moist, soft cough, increased respiratory rate, nasal discharge, watery eyes, and decreased gains. When listening to the lungs, crackling and wheezing is heard.

Treatment, prevention, and control

Many of the pathogens associated with caprine pneumonias are not susceptible to certain drugs. Products that may be effective include tetracyclines, tylosin, Lincocin, Nuflor, and Spectagard given under the supervision of a veterinarian. Reduce stress and overcrowding, maintain adequate ventilation and sanitation to reduce incidence.

Pasteurella

Pneumonic pasteurellosis (pasteurella) is a killer pneumonia in all livestock species affected. Pasturella pneumonia is caused by either *Mannheimia hemolytica* that causes sudden death or *Pasturella multocoda* that causes respiratory signs with pneumonia. *M. hemolytica* is blood-borne and outbreaks usually occur in feedlot conditions where animals are stressed, transported, and commingled. Usually several animals will be involved. They will be noticeably sick and off by themselves. Commonly, nutritional management, ventilation, and parasite control are less than ideal.

Signs and symptoms

Typically, the first animal is found dead followed by signs of pneumonia noticed in herdmates. Affected animals will be off feed, have a moist cough, and appear depressed. The lungs will

typically make a wheezing or crackling sound. *P. multocoda* is capable of entering the blood stream and causing arthritis and mastitis (Blue bag mastitis).

Treatment, prevention, and control

Antibiotics such as Naxcel, Nuflor, and others can be used in treatment. There are no pasteurella vaccines made just for goats. While there are a variety of bovine pasteurella vaccines available, their effectiveness in goats has not been conclusively proven.

Mycoplasma pneumonia

The Mycoplasma species are commonly involved in pneumonias of goats, although usually more of a problem for dairy goat than meat goat producers. In general, they cause a "cuffing" pneumonia with bronchitis that is commonly seen as a form of Enzootic Pneumonia. Pleuropneumonia is a specific disease caused by *Mycoplasma mycoides* and is a significant cause of sickness and death in does and kids. In kids, the organism is transmitted orally through contaminated milk or colostrum. Outbreaks often occur when animals are stressed, such as in overcrowded conditions and up to 80 to 90% of affected kids die or are euthanized as a result of permanent joint damage. The mycoplasma organisms are commonly isolated from the ear canal of goats. It is postulated that ear mites (*Psoroptes cuniculi*) may be involved in transmission.

Signs and symptoms

The disease is highly contagious and usually involves multiple animals in the herd. Signs include fever, cough, respiratory distress, joint damage and lameness, nervous system disorders, and/or mastitis. Young animals are usually involved with outbreaks of the pneumonic or polyarthritic forms. Three clinical syndromes seen in goats include:

1. Peracute illness characterized by high fever and death within 12 to 24 hours.
2. Central Nervous System syndrome with neurologic signs and death within 24 to 72 hours.
3. Acute to subacute syndrome with high fever, multiple joint arthritis, mastitis, and pneumonia.

Treatment, prevention, and control

Antibiotics must have a mycoplasma spectrum of activity. Penicillin, amoxicillin, and cephalosporin may not be effective. Products such as tylosin, tetracycline, erythromycin, and Nuflor may be effective. Consult your veterinarian. Treatment can assist in relieving symptoms of the disease but affected animals may shed the organism for life. Some animals may appear to respond to treatment but will relapse and be chronically poor performing.

The organism is spread by direct contact, through the air, milk, and ear mites. Control is by the following program.

1. Separate groups by age (adults and weanlings).
2. Maintain all-in-all-out flow of animals or quarantine all new arrivals.
3. Pasteurize milk prior to feeding.
4. Control earmites with Ivermectin.
5. Optimal sanitation and air quality for housed animals.

Verminous pneumonias

Verminous pneumonia is a common infection of small ruminants on pasture caused by certain types of lungworms (e.g., *Dictyocaulus filarial*, *Muellerius capillaries*, and *Protostrongylus rufescens*). Young grazing animals (weaners) are most commonly affected. These parasites prefer low lying, moist pastures. Some of the parasites, *Muellerius* and *Protostrongylus*, for example, require snails or slugs as intermediate hosts in their life cycle. Heavy pasture contamination with these parasites can occur from high stocking densities.

Signs and symptoms

Signs usually consist of a persistent, chronic coughing in a herd or flock. Animals will have increased respiration rate and lose weight. The most severely affected animals will be young animals on their first full season of grazing.

Treatment, prevention, and control

It is unclear how effective treatment is for this condition. Anthelmintics will stop parasite egg production but may not effectively remove the parasite. Prevention strategies include avoiding low, wet pastures, particularly during the early morning hours or at night. Clean up piles of wet, rotting vegetation where snails may live. Avoid mixing different age groups of animals or having young animals graze on pastures contaminated by adults. Frequent deworming with certain anthelmintics can also help control the parasite. However, this is not recommended as frequent, herd-wide use of anthelmintics will increase the rate of drug resistance by other internal parasites such as *Haemonchus contortus* (barberpole worm).

Upper Respiratory Tract Diseases

Irritants, trachea injury

Constant or long-term inhalation of irritants, such as dust or ammonia, and trachea damage through incorrect use of balling or drenching guns can cause respiratory problems.

Signs and symptoms

The predominant sign is coughing and sneezing. Animals may have nasal discharge. With simple inflammation of the respiratory passages due to inhaling dust or other irritants, animals appear healthy other than the annoying cough and sneeze. In the case of pharynx injury, the animal may be in severe respiratory distress and may make a snoring sound when exhaling. Other signs would include foul odor to the breath, off feed, cough, and nasal discharge.

Treatment, prevention, and control

Remove all sources of respiratory irritants from the environment. Dispose of moldy hay, shake dusty hay away from animals, or wet the hay. Environmental dust can be eliminated by wetting the area. Clean bedding to remove urine and feces. Ensure good ventilation and maintain as clean an environment as is possible. Follow proper procedure when using balling and drenching guns. For more information on using these instruments, refer to the Meat Goat Herd Health – Procedures and Prevention chapter.

Nasal bots

Nasal bots (*Oestrus ovis*) are uncommon in the deep southern portion of the United States but are common elsewhere. Sheep are the primary host; however, goats are readily infected. The gadfly deposits eggs on the nostril of sheep and goats. The larvae migrate to the frontal sinuses and are expelled by sneezing. Human cases have been reported.

Signs and symptoms

The main symptom is violent sneezing in the late summer. Affected animals have a copious nasal discharge that may be tinged with blood. Some animals may make a snoring sound due to nasal obstruction. During larval deposition, animals are very agitated and run in circles, and flock under trees or buildings. Animals may also not exhibit breeding behaviors, hence, the name *Oestrus ovis*.

Treatment, prevention, and control

Ivermectin will kill the larvae at any stage. Other treatments include Ruelene sprayed in each nostril in the fall or winter.

Neurologic Diseases

Tetanus

Tetanus is an important and highly fatal disease of goats. It occurs commonly in all ages of unexposed and unvaccinated farm animals with the horse most susceptible and the cow the least. The causative agent, *Clostridium tetani*, is found in soil and feces (particularly of horses) and is capable of surviving in soil for prolonged periods of time. *C. tetani* usually enters a body through deep puncture wounds and, following an incubation period, produces a neurotoxin that travels to the

central nervous system. Some management practices that may increase the chance for tetanus infection include castration, ear tagging, dehorning, vaccinating, and banding. Elastrator bands are particularly dangerous in predisposing animals to tetanus.

Signs and symptoms

Following an incubation period of 1 to 3 wks (up to several months) the following signs develop:

- Muscular stiffness/tremor.
- Jaw clenching, lockjaw.
- Unsteady gait due to stiffness of the limbs.
- Stiff tail.
- Bloat/constipation/retention of urine.
- Difficulty in eating.
- Anxious expression of the face.
- "Sawhorse" stance.
- Lying down with convulsions.
- Death in 3-10 days by asphyxiation (unable to breath).

Treatment, prevention, and control

Wounds should be cleaned and open to the air to keep them aerobic (exposed to oxygen). Any dead tissue should be removed and the wound flushed with hydrogen peroxide. Give penicillin and tetanus antitoxin injections (15,000 IU twice daily, preferably in the vein, for 2 days for an adult goat). Convulsions and seizures can be controlled by sedatives given under the supervision of a veterinarian. Tetanus antitoxin is used for treatment, before surgical procedures, or after any wound. Tetanus toxoid is used for vaccinations.

Prevention consists of good hygiene and vaccination. Pens and barns should be clean. Routine vaccination with tetanus toxoid must be incorporated into the herd health program (see the Vaccination Schedule for Meat Goats in the chapter on Meat Goat Herd Health – Procedures and Prevention) and should include:

- Does - third trimester of pregnancy to increase tetanus antibodies in colostrum.
- Kids - 4 and 8 weeks of age.
- All animals - annual booster.

Polioencephalomalacia, PEM, cerebrocortical necrosis

Polioencephalomalacia (PEM) is a common nervous disorder of small ruminants caused by inadequate thiamine (vitamin B₁) in the animal. Thiamine is a necessary component of several enzymes involved in carbohydrate metabolism. Normally, the bacteria in the rumen produce enough thiamine for an animal's needs. However, under certain conditions thiamine production may decrease and(or) available thiamine may be destroyed leading to a deficiency and the appearance of PEM signs. While outbreaks can be seen following any major dietary change, animals at the highest risk for PEM are young goats, usually 2 months to 3 years of age, who have just begun consuming

high concentrate rations or grazing lush pasture. Up to 25% of groups of feeder goats may be involved.

There is little evidence to show any one factor as being "the cause" of PEM and probably a variety of factors are involved including:

1. Inadequate thiamine in the diet.
2. Inadequate microbial synthesis of thiamine in the rumen.
3. Presence of thiaminase (compounds that breakdown thiamine) activity in forages such as moldy hay.
4. Presence of thiaminase producing bacteria in the rumen (*Bacillus sp.* and *Clostridium sporogenes*).
5. Ingestion of pyrimidine containing structural analogs of thiamine (amprolium) that compete with thiamine in metabolic systems.
6. Increased tissue demand for thiamine in the brains of young animals on high carbohydrate rations.
7. High levels of sulfates in the diet.
8. Deworming with levamisole may predispose animals to PEM.

Signs and symptoms

Signs include stargazing, sudden loss of appetite, depression, decreased rumen motility, head pressing, aimless wandering, blindness, grinding of teeth, muscle tremors, and hyper-excitability. Typically, there is no fever and pulse and respiration are normal.

Treatment, prevention, and control

Thiamine HCl (10 – 20 mg/kg body weight [BW] intramuscular injection) is given every three hours for a total of five doses. Early cases respond within 6 to 8 hours with complete recovery in 24 hours. Absence of response in 6 to 8 hours may suggest the need for emergency slaughter. Animals not recovered by 72 hours will never fully recover but with good nursing care may make satisfactory pet animals. During an outbreak all animals should be considered at risk and treated appropriately.

Avoid sudden dietary changes. Thiamine may be added to feed at a minimum rate of 3 mg/kg of feed. During an outbreak all susceptible goats should receive a dose of thiamine 10 mg/kg BW.

Floppy kid syndrome

Floppy kid syndrome often refers to any kid that is normal at birth but then develops a sudden onset of muscular weakness early in life, generally from 3 to 10 days of age. This syndrome is increasingly seen in normal, healthy Boer goat kids that suddenly develop the disease and do not recover. The cause is unknown. While several kids may be affected simultaneously, it is not known if an infectious agent is responsible.

Signs and symptoms

Affected kids are normal at birth and develop a sudden onset of profound muscular weakness and muscle incoordination at 3 to 10 days of age. Some kids are described as “looking drunk.” Cases seem to occur most commonly late in kidding seasons. Affected kids are depressed and cannot use their tongues to suckle but can swallow. The kids have acidosis and an abnormal acid base balance. They do not suffer diarrhea, respiratory disease, or show other signs.

Treatment, prevention, and control

Early detection and correction of the electrolyte imbalance as well as good supportive care are critical. Less severe cases are most commonly treated by owners with oral bicarbonate or Pepto-Bismol at the onset of signs. Two teaspoons of baking soda and a half a teaspoon of common salt in 1 liter (1 quart) of water can be mixed and 2 to 3 ounces given orally 2 to 3 times a day. Kids may need to be fed milk by stomach tube.

Listeriosis, circling disease

Listeriosis is caused by the bacteria *Listeria monocytogenes* that can affect all mammals including humans. In goats it is called “Circling Disease” because affected animals commonly walk compulsively in a circle. It can also cause mid- to late-term abortions. The bacteria are found in the environment, especially in rotting vegetation such as poorly prepared silage. Infection is usually caused by ingesting the organism through environmental or fecal contamination of feedstuffs. There is the possibility of venereal transmission. The disease is mostly seen during cool weather. It is also a disease of refrigerated foods causing serious disease and abortions in humans.

Signs and symptoms

Early signs are depression, decreased appetite, decreased milk production, and fever. There are two clinical forms seen:

1. *Encephalitic Form (in the brain)*: In this form, the bacteria enter through breaks in oral mucosa and migrate to the brain. Signs include incoordination, circling in the same direction, seizures, hind limb paralysis, facial nerve disorders (facial paralysis, ear droop, excessive salivation, slack jaw, impaired swallowing), keratitis (cornea inflammation), and a very high mortality rate.
2. *Septicemic Form (blood-borne)*: The bacteria enter through the intestines. The signs are diarrhea, abortion, and death.

Treatment, prevention, and control

Successful treatment requires detection early in the course of the disease. Large doses of antibiotics such as penicillin and tetracycline are generally given. The goat should be given fluids, electrolytes, and appropriate nursing care.

Does that abort should be isolated and all aborted materials burned or buried. Kids should only be fed pasteurized colostrum or milk. Suspect recently introduced animals. Stop feeding poor quality silage and clean floors and pens. No vaccine is currently available.

This disease is zoonotic so take appropriate precautions. Human infection could result from consumption of unpasteurized milk and milk products and from handling the placenta, fetuses, or even newborn kids of infected animals. Precautions include using gloves when handling aborted material and only consuming milk products from pasteurized milk

Scrapie

Scrapie is a progressive, degenerative, fatal disease of the central nervous system that affects sheep and, rarely, goats. The route of transmission appears to be both horizontal (from goat to goat) and vertical (from doe to kid in the uterus). The incubation period for the disease is very long and the disease is usually not seen before two years of age. Scrapie is a reportable disease, meaning that authorities must be notified when affected animals are discovered. Scrapie is a member of the family of transmissible spongiform encephalopathies of which Bovine Spongiform Encephalopathy (BSE), commonly called Mad Cow Disease, is the most well-known. The zoonotic potential (transmission to humans) is unknown.

Signs and symptoms

Initial signs of scrapie are non-specific and include behavior changes, excitability, lethargy, and weight loss. As the disease progresses the behavioral changes become more pronounced. Tremors of the head, neck, or whole body, high-stepping with the front legs, excessive salivation, apparent blindness, and other changes will occur. Death will follow.

Treatment, prevention, and control

There is no treatment. If scrapie is suspected, contact a veterinarian immediately. There is a [National Scrapie Eradication Program](#) for goat producers. More information can be found in the chapter on [Biosecurity](#).

Urinary Tract Disease

Obstructive urolithiasis, urinary calculi, stones

Obstructive urolithiasis, urinary calculi, or stones is a disease where crystals are formed in the bladder, usually the result of deviation from the desired dietary ratio of calcium (Ca) to phosphorus (P) of two to two and one-half parts Ca per part P (2:1 to 2.5:1). The crystals can lodge in the urethra of male goats preventing them from urinating. Female goats are largely unaffected and the disease is most commonly seen in male goats consuming large amounts of concentrates, such as pet goats. It is virtually non-existent in animals that receive little to no grain with the exception of animals grazing western pastures with high silica content.

Types of urinary calculi

Stones regularly associated with calculi formation in goats include silicate, calcium (calcium carbonate, calcium oxalate), and phosphate (magnesium ammonium phosphate called struvite). While calculi can form in any geographical region, silicate stones are generally limited to goats grazing forages grown on western pastures that have excess soil silica content.

Calcium carbonate stones result from feeding rations very high in calcium, typically high legume diets (clovers and alfalfa) such as seen in the major alfalfa producing areas of the U.S. Legumes contain 1 to 2% calcium and have very high ratios of calcium to phosphorus (Ca:P of 6:1 to 10:1). Calcium oxalate stones form as a result of diets high in calcium and in oxalates. Certain plants are oxalate accumulators (rape/kale family, rhubarb, sugar beet tops, pigweed).

Phosphate or struvite stones occur when feeding rations having a disproportionate ratio of Ca to P (< 2:1) or high levels of magnesium and phosphorous. In general, grasses are low in magnesium, Ca, and P but are balanced in terms of Ca:P ratios (1.5:1 to 2:1). Thus, grazing goats rarely experience urinary stone problems. Rather, affected goats typically are fed high levels of grain and/or pelleted feeds. Grains are high in P and low in Ca and have Ca:P ratios of 1:4 to 1:6.

Most P in grains is bound in phytates and cannot be absorbed by non-ruminants (horses, pigs, etc.). In ruminant animals, bacteria in the rumen produce enzymes (phytase) that break down phytates freeing the P for absorption. This is the reason why dietary P requirements for ruminants are lower than those for monogastric animals and why diets for monogastric animals generally have high P concentrations. Thus, feeding swine or horse rations to ruminants is a bad idea from the standpoint of Ca and P because of the high amount of P in the feed. Every feedstore has an "All Stock Pellet" which they claim can be fed to any animal. These mixes are not appropriate for prolonged feeding to male goats.

Contributing factors

There are several factors that can contribute or predispose an animal to suffering from urinary calculi. These include early castration, the pH of the urine, and inadequate salt intake. Early castration of ruminants results in decreased diameter of the urethra, the passageway for urine, increasing the chance of blockage. If castrated male goats will be kept into adulthood, castration should be delayed until puberty (3 to 4 months of age).

The normal alkalinity found in ruminant urine favors the formation of urinary stones. Reducing the pH to acidify the urine reduces the likelihood of crystal formation. To acidify urine, goats receiving high grain or concentrate diets can be fed ammonium chloride up to 2% of the total ration (200 to 300 mg/kg diet/day) or ammonium sulfate at 0.6 to 0.7% of the ration. Ammonium chloride is unpalatable and higher levels will reduce intake. Alternately, feed ¼ lb/head/day of Bio-Chlor, a highly palatable protein supplement with high levels of chlorine and sulfate that is used in the dairy cow industry. Urine should be acidic within one week.

Ensure that animals have access to salt and fresh, clean water. The chlorine in salt helps prevent crystal formation. Salt also acts to increase water consumption and subsequent urination that keeps the bladder flushed. Goats are finicky drinkers and will not drink dirty, tepid, algae-infested water, etc. Hard water can be a source of calcium and magnesium. Keep fresh, clean, chlorinated water available at all times.

Signs and symptoms

The main sign is a male goat persistently straining to urinate but passing little to no urine. Urine may be blood-tinged. Drops of urine and blood or urine crystals may be seen on the hair of the sheath. Affected animals will be restless, switch their tails, and kick at their bellies. As the blockage progresses, some goats will vocalize in pain. The bladder will be enlarged with possible swelling around the sheath. Some goats will eventually pass the stone but are likely to have continual problems.

Severe blockage can lead to the rupture of the urethra or bladder. Initially, this will alleviate the discomfort felt by the animal. However, due to urine inside the body, the animal will quickly go off feed, become weak, depressed, and eventually die.

Treatment, prevention, and control

There are varying levels of treatment that can be attempted. Acidifying the urine, increasing salt content of the diet, and Vitamin C may help dissolve the calculi. If the calculi or stones are lodged in the urethral process (the whip-like structure at the end of the penis), the process can be removed. Gritty, sandy material present in the urethral process can sometimes be successfully milked out without removing the process itself.

If the stones are lodged in the urethra, tranquilizers may help relax the muscles of the urethra and facilitate natural expulsion of the stone by the pressure of attempted urination. A catheter could be passed into the urethra to permit infusion of sterile saline in an attempt to enlarge the urethra and dislodge the offending stone. For severe cases in valuable animals, surgical methods may need to be used. For some animals, salvage slaughter may be chosen but must be done prior to bladder rupture.

Dietary management is the key to controlling and preventing urinary stones. Maintain a Ca:P ratio of 2:1 to 2.5:1 in the diet. Do not feed excess grain supplement to goats. If a high grain diet is fed, include products such as ammonium chloride, ammonium sulfate, or Bio-Chlor to acidify urine and(or) increase the salt content. Ensure an adequate supply of clean, fresh water. Delay castration until puberty if planning on keeping the animal as an adult or do not keep early castrated males older than one year. Provide a free-choice loose mineral mix with 2:1 Ca:P ratio.

Diseases of the Gastrointestinal System

Diarrhea, scours (Neonatal Diarrhea Complex)

Diarrhea or scours is the most common cause of disease and death in kids 1 to 30 days of age. Diarrhea is usually associated with intensive rearing of goats under conditions of overcrowding and poor sanitation. Extreme weather conditions during the kidding season can predispose young kids to diarrhea. While diarrhea can affect meat goats, it is more common in dairy kids that are weaned early, group penned, crowded, and housed in a damp, dirty environment. Diarrhea causes a loss of body water and electrolytes and can result in death if not treated quickly.



Major causes of diarrhea are bacterial (*E. coli*, *Clostridium perfringens* type C, *Campylobacter jejuni*, Salmonella); parasitic (coccidia, cryptosporidia, giardia, strongyloides); viral (coronavirus, rotavirus); and noninfectious (milk replacer, antibiotics). While the cause is often assumed to be a specific bacteria (*E. coli*), surveys of diarrhea in young kids have consistently failed to identify specific causes in the majority of cases.

Cryptosporidia seems to be the most common cause of diarrhea in kids less than a month old. Cryptosporidiosis can occur alone or in conjunction with other pathogenic bacteria, viruses, and protozoa. Cryptosporidia is difficult to treat because there are no drugs available to control it. Infection is usually from consuming fecal matter from infected animals, even from a different livestock species. A fuller discussion of Cryptosporidiosis is in the section on Internal and External Parasites later in this chapter.

Older kids (>1 month) are prone to diarrhea caused by coccidia and other internal parasites (Giardia). Nutritional causes of diarrhea in young kids are often associated with husbandry and feeding practices, mainly seen in dairy kids due to overfeeding, milk replacers, etc. Under most circumstances, outbreaks of diarrhea are probably not caused by any one factor but by a combination of factors, hence, the name “Neonatal Diarrhea Complex.”

Signs and symptoms

Affected kids develop a loose stool. The consistency can vary from pasty to watery. Kids quickly become dehydrated from loss of body fluid and electrolytes and become progressively weaker. Terminally, kids are severely dehydrated, lie on their side, have cool extremities, and are unwilling to drink.

Treatment, prevention, and control

With increasing fluid loss, the kid goes into progressive shock, cannot maintain body temperature, and dies. Causes of death in uncomplicated cases of neonatal scours are dehydration, electrolyte losses, and hypothermia. Treatment consists of supplying the kid with fluids to restore normal fluid and electrolyte levels. Commercially available electrolyte and alkalizing products are available. Initially, milk can be removed from the diet and electrolytes given. Milk is then gradually reintroduced to the kid in small feedings alternated with electrolytes. Electrolyte solutions should continue to be used until the stool returns to a near normal consistency. Injectable antibiotics such as Naxcel or Exenel can be given to prevent the infection from becoming blood-borne. Oral antibiotics are commonly used to treat diarrhea and scours but their efficacy is not well proven. Be aware that feeding electrolytes alone for more than 2 days will result in a significant caloric deficit. It is critical that the goat be kept warm.

The keys to preventing scours are to reduce exposure of kids to pathogens causing the disease and to increase resistance of kids to the disease-causing agents. To reduce exposure to pathogens, ensure that kidding takes place on fresh pasture and a clean, dry area. Assist with kidding if necessary and ensure that all navels are dipped in iodine. Monitor nursing behavior and force feed colostrum if no nursing is seen within 6 hours of birth. Avoid congregating kids to prevent overcrowding conditions. Use separate kidding and nursery areas. Resistance can be strengthened by optimum pre-kidding maternal nutrition and following a prescribed vaccination schedule. This will strengthen antibody production in the dam and improve resistance gained by the kid through colostrum. If deemed necessary, oral *E. coli*, corona and rota virus vaccines can be given to newborn kids before they nurse the doe.

Enterotoxemia, overeating disease

Overeating disease is an important and highly fatal disease that mostly affects young kids. It is not caused by overeating but by the toxin produced by the bacteria *Clostridium perfringens* Type C or Type D. *C. perfringens* is found widely in the environment and in the intestinal tract in normal quantities. Under certain conditions, the organisms proliferate in the intestine and produce toxin in lethal quantities. This most commonly occurs when goats have a sudden exposure to grain or large increases in the quantity of milk consumed. At these times, the passage rate for food through the intestinal tract is slowed, providing ideal conditions for *C. perfringens* to grow.

Signs and symptoms

A typical history is of a young, vigorous kid found dead. The affected kid has a consistent history of nursing a heavy milking doe or being on full feed. Animals have actually been observed to drop to the ground, convulse, and be dead within a matter of minutes.

Adults appear to be more resistant to the disease as a result of continuous exposure; however, the resistance can be overwhelmed. A typical history for an older animal dying from overeating disease is that the animal was sick and off feed from some other disease (e.g., parasitism). As the animal recovers it quickly increases feed intake resulting in a mild grain overload. This allows the proliferation of *C. perfringens* and ultimately the death of the goat.

Treatment, prevention and control

There is usually no opportunity to treat animals with enterotoxemia. Specific antitoxin (CD&T) is available for treatment and should be given according to label directions. Affected animals should be treated with high levels of penicillin (6 cc/100 lbs) and fluids.

All goat herds need to have a regular vaccination program for overeating disease. This includes annual vaccination of does roughly 30 days prior to expected parturition to protect the newborn for the first 1 to 2 months of life. Kids are given a series of two vaccinations at 4 and 8 weeks of age. A booster dose is given at the time of weaning or when going on full feed. See the Meat Goat Vaccination Schedule in the Meat Goat Herd Health - Procedures and Prevention chapter.

Milk fever, parturient paresis, hypocalcemia

Milk fever is a disease more commonly associated with dairy goats. It is not a fever but is due to inadequate amounts of calcium available in the blood stream for use in milk production during early lactation. This usually occurs in does with high milk production and ones fed high levels of calcium in late pregnancy. In milk fever, the doe cannot mobilize calcium from her bones as quickly as it is needed for milk production necessitating the use of blood calcium. When blood calcium levels drop too low, milk fever occurs. High levels of dietary calcium fed in late pregnancy prevent the doe's metabolic system from becoming accustomed to mobilizing bone calcium. Does having triplets or quadruplets may be more prone to milk fever

Signs and symptoms

Milk fever usually occurs close to kidding, up to about 3 weeks after birth, but can occur before kidding. Animals will show a wobbly gait, foot dragging, and muscle incoordination. Some animals will be unable to stand and, if prior to kidding, be too weak to deliver.

Treatment, prevention, and control

Treatment consists of intravenous calcium therapy with 50 to 100 cc of 25% calcium borogluconate. Some veterinarians prefer to give an additional 50 to 100 cc subcutaneously after the intravenous treatment. Oral calcium preparations are used in mild cases. Prevent milk fever by feeding a low calcium diet the last month of gestation. This prepares the doe's metabolic system to mobilize calcium from its skeleton.

Paratuberculosis, Johne's disease

Paratuberculosis or Johne's disease is a chronic wasting and diarrhea disease of ruminants caused by the bacteria *Mycobacterium avium* subspecies *paratuberculosis* (*M. johnei*). The organism is capable of living on infected premises for up to a year and the same bacterial strain can infect any ruminant. This means that goats sharing pastures with infected cattle are susceptible.

The primary mode of transmission is via the fecal oral route with kids most susceptible to infection. In general, it is safe to assume that if the doe is infected her kids will also be infected. Infected animals shed the bacteria for months or years prior to developing clinical signs. This results in heavy contamination of pastures before it is known that the disease is present.

Signs and symptoms

Signs rarely occur prior to 1 year of age with peak incidence of disease at 2 to 3 years of age. Goats will show weight loss, loss of appetite, depression, and general wasting. Watery diarrhea is seen in cattle but is a rare finding in goats. As the disease progresses, anemia and bottle jaw (swelling of tissues under the jaw) may develop. Affected goats also seem to become more susceptible to internal parasites such as the barberpole worm (*Haemonchus contortus*).

Johne's disease is suspected whenever a goat is losing weight for unknown reasons. The diagnosis may be confirmed by biopsy, necropsy, bacterial culture, or one of several serologic (blood) tests.

Treatment, prevention, and control

There are no treatments available for Johne's disease. Prevent by not allowing infected ruminants (cattle, goats, sheep, etc.) on your premises. Purchase animals from farms with no history of Johne's disease and blood test all incoming ruminants. Remove any that test positive. There is a vaccine licensed for use in the prevention of paratuberculosis. It is apparently effective but produces large swellings at the injection site that last for years. Vaccination will also cause hypersensitivity to the tuberculosis test. In order to use the vaccine you must to obtain permission from your State Veterinarian.

Eradication of Johne's disease is difficult. Identification of animals in your herd is problematic in that blood tests will give both false positives and false negatives. Fecal culture or DNA probe testing will not give false positives; however, these tests may miss up to 50% of infected animals. Multiple tests or several different tests are required. A second problem is the contamination of pastures and housing. These should be free from diseased animals for at least 12 months before housing disease-free goats. Ensure that kids are not exposed to the feces of infected adults by housing them separately and have fecal-free feed troughs, boots, and clothes at all times.

Pregnancy toxemia, ketosis

Ketosis, pregnancy disease, pregnancy toxemia, or twinning disease usually occurs during the last few weeks of gestation and is caused by the competition for glucose between the doe and her rapidly growing fetus(es). It is more commonly seen in does carrying more than two kids or overly fat does, although very thin animals can be affected. Because the uterus, fetuses, placenta, and other pregnancy tissues take up an increasing amount of abdominal space there is less and less room for feed consumption. If a doe is overly fat, she also has less room to hold feed. Thus, feed intake decreases and the doe is forced to break down fat stores for energy. Ketones are a chemical by-product of fat breakdown. While the body can use small amounts of ketones, excessive amounts cause the appearance of ketosis.

Signs and symptoms

Does with pregnancy toxemia are depressed, weak, and have poor muscle coordination. They may also star gaze and grind their teeth. Animal may have a strong smell of ketones (sweetish smell) on their breath.

Treatment, prevention, and control

Treatment consists of 2 to 3 ounces of propylene glycol twice a day. If the does are too weak to stand, treatment may not be successful in getting them up until they deliver their kids. Induce parturition around 145 days in gestation to have live viable kids. Have a veterinarian perform a Caesarian section if they are close to term to try and save the doe and kids.

Prevent by not letting does get overly fat early in gestation. Feed good quality grains or grain by-products and good quality hay. If a particular doe is very large or has a history of having more than two kids, increase her energy intake.

Acidosis, carbohydrate engorgement, grain overload

Goats frequently fall victim to the disorder called grain overload that leads to acidosis. This is a condition which affects all ruminants and results from the over consumption of highly fermentable carbohydrates such as cereal grains and many pelleted diets. The bacteria in the rumen are responsible for digestion of the majority of what a goat eats. Under normal conditions of a steady diet these bacteria become very specialized at their task. If the diet is changed very quickly, rapid, dramatic, and often fatal changes occur within the rumen. As the excessive carbohydrates are metabolized, they are broken into small particles which draw water into the rumen resulting in dehydration. As they are fermented, the rumen pH decreases from a normal of 6.0 to 7.0 to very low (acid) levels (pH of 3.5 to 4.5). This acid solution kills many of the ruminal bacteria and damages the wall of the rumen itself.

These rapid dietary changes occur from improper feeding often as a result of two facts of goat husbandry. The first is that some goat owners extrapolate principles of human nutrition to their goats. While knowing that humans do not suffer from eating too much corn, flour, and the like, they do not realize that this can be fatal to goats. The second reason is the inquisitive nature of goats and their skill at getting into places where they should not be. This allows them to gain access to grain stores and consume them free-choice.

Signs and symptoms

Affected goats become dehydrated, their rumens become distended with fluid, and in the later stages of disease they develop diarrhea. The ruminal inflammation due to the acidic conditions is painful and goats act uncomfortable, grind their teeth, and may vocalize. Generally, signs develop 6 to 12 hours after the overconsumption of carbohydrates.

Death can result from the dehydration, acidosis, and electrolyte disturbances associated with the disease. Alternatively, during the course of the grain overload, a large amount of undigested food travels to the intestinal tract. This provides an ideal environment for *Clostridium perfringens* to proliferate and produce deadly toxins causing overeating disease (enterotoxemia). As a sequel to acidosis, the rumen can be damaged severely enough that bacteria gain access to the liver and cause liver abscesses. This will cause ill thrift and chronic weight loss in affected goats.

Treatment, prevention, and control

In mild cases, goats should be given hay and not fed any grain or concentrate. The grain or concentrate feedstuffs can then be reintroduced into the diet gradually. Alkalinizing agents such as oral antacids (10 to 20 grams or 0.7 ounces magnesium oxide, 50 grams or 1.75 ounces magnesium hydroxide, or 20 grams or 0.7 ounces sodium bicarbonate) can be given or a solution of 2 to 4 teaspoons of baking soda in a quart of water can be used. However, if too much feed is in the rumen these will act only temporarily.

In severe cases, goats should be given intravenous fluids containing 5% sodium bicarbonate. Large amounts of oral fluids should be avoided because they will not be absorbed and may actually increase rumen distension and discomfort. A stomach tube can be passed into the rumen and the contents washed with water and the fluid removed. Alkalinizing agents can be used as in mild cases. In very severe cases, surgery must be done to remove the consumed feed. Thiamine (500 mg IM, three times daily) has been shown to be helpful in recovery. Anti-inflammatory drugs can be given to make the goat more comfortable.

Normal rumen bacteria flora can be reestablished by transferring some rumen contents from a healthy goat, or cow, into the rumen of the sick goat. This may be done by tubing the animals though it would be wise to consult a veterinarian. Various probiotics (e.g., Biosol) or live culture yoghurt will have some beneficial effect. The diet for the recovering goat should be forages only for at least 3 weeks.

Prevention is by gradual adaptation of the rumen to changes in diet. This process should take a period of 3 weeks of gradually increasing grain intake. At high levels of grain intake (feedlot or dairy goats), feed frequent small meals rather than fewer larger ones. Maintain a rigid feeding time to avoid simple rumen upset. All stored grains must be kept in well secured goat proof buildings.

Bloat, ruminal tympany

Bloat is the accumulation of free gas or froth in the rumen due to the inability of goats to rid themselves of gas produced by ruminal microorganisms during the breakdown of feedstuffs. This condition is always an emergency.

There are two causes of bloat but both have the same symptoms and effects. Frothy bloat can be caused by feeding on rapidly growing legumes and small grain pastures (wheat, barley, oats, rye). This occurs most often when goats are suddenly changed to grazing these types of pastures with no adaptation period. Frothy bloat can also occur when animals consume too much finely

ground grain. Free gas bloat is caused by consumption of a diet that causes excessive gas production, such as a high grain diet, or blockage of the esophagus due to choking, a foreign object, swollen lymph nodes, nerve damage, etc.

Signs and symptoms

The gas trapped in the rumen causes the left side of the animal, where the rumen is just under the skin, to swell. The goat will experience pain, discomfort, and have difficulty breathing. If left untreated, the internal pressure will make it increasingly difficult to breath and the animal will die from a lack of oxygen.

Treatment, prevention, and control

Treatment consists of relieving the pressure caused by the gas. For mild cases, a stomach tube can be used to free the trapped gas. If this is not effective, remove the tube and look for the presence of froth at the end. Frothy bloat can be treated by orally giving through the stomach tube:

- a) Poloxalene (Therabloat), 30 ml or 1 ounce,
- b) Diocetyl sodium sulfosuccinate (DSS), 30 ml or 1 ounce,
- c) Detergent, such as liquid hand soap or dishwashing soap, 10 ml in 1 to 2 ounces of water, or
- d) Mineral or vegetable oil, 3 to 4 ounces or 1 to 1 ½ cups.

Severe bloat should be treated using a trocar and cannula or very large gauge needle to pierce the left side of the animal releasing the gas. This should only be done in extreme emergencies as animals treated in this way may later encounter problems due to infection that can lead to death. If performed, antibiotics should be administered.

Prevent bloat by avoiding sudden dietary changes. If animals will graze lush pastures, feed hay or forage prior to grazing to prevent goats from gorging themselves. In cases where frothy bloat may be a problem, poloxalene can be provided in a mineral supplement. Ionophores such as monensin, lasalocid, or decoquinate can be fed. Free gas bloat can be prevented by slow adaptation to high grain diets allowing ruminal microbes to adapt.



Two types of trocar and cannula.

Internal and External Parasitic Diseases

Coccidiosis

Coccidiosis is a diarrhea disease caused by any of a number of protozoan parasites of the *Eimeria* species. Coccidiosis is likely the most common cause of diarrhea in young kids but can affect older animals. Stress, weather changes, weaning, diet changes, and kidding can all bring about the onset of this disease. Young kids 1 to 4 months of age appear most susceptible.

The coccidia causing diarrhea in goats are host specific meaning that they rarely infect other animal species. Thus, coccidia that affect goats will not infect sheep and vice versa. Transmission is oral. The coccidia shed eggs or oocysts in the feces that must sporulate outside of the animal to become infective. Sporulation occurs under moderate temperatures and moist conditions. The oocysts can survive a wide range of temperatures and live for years in the environment. The life cycle for coccidia under ideal conditions is two to three weeks.

Constant exposure to low levels of coccidia can confer some level of immunity to the animal. However, consumption of large numbers of coccidia at one time can overwhelm the immune system. Further, each individual species of *Eimeria* is independent of the others and there is no cross-immunity. An animal with immunity to one type of *Eimeria* can still develop coccidia from exposure to a different species.

Signs and symptoms

Coccidia enter the body and destroy cells lining the intestinal tract causing that animal to develop watery diarrhea, usually without blood. Other signs include straining to defecate, decreased appetite, dehydration, weight loss, and anemia. Some animals may suffer rectal prolapse. In acute cases, kids can die in 1 to 2 days and losses can be severe. Older animals may have diarrhea for up to 2 weeks before recovering. Some animals suffer chronic infection having intermittent diarrhea and poor growth. Coccidia can be seen when performing a fecal egg count but presence of coccidia does not mean the disease is occurring.

Treatment, prevention, and control

Treatment includes giving fluids and coccidiostats. Coccidiostats have little effect upon the existing infection but can reduce the spread of the disease. In addition to preventing coccidiosis, coccidiostats also confer the advantages of increased feed efficiency and enhanced growth. However, continuous feeding of coccidiostats increases the risk for drug resistance to develop. Coccidiostats are normally fed during periods of extreme stress and wet conditions. If feeding coccidiostats for prolonged periods, fecal exams should be done to evaluate the drug's efficacy.

Coccidiostats approved for use in the U.S. include decoquinate (Deccox, 0.5 mg/kg body weight or 13 – 91 grams/ton feed) and monensin (Rumensin, 10 – 30 grams/ton feed). Amprolium (Corid, 50 mg/kg body weight per day) is not approved for use in goats and can only be used in the context of a valid veterinarian-client-patient relationship. Amprolium should only be fed for periods of 3 to 4

weeks. Prolonged feeding can predispose kids to polioencephalomalacia (PEM). Lasalocid (20 – 20 grams/ton feed) is approved for sheep but not goats. Be aware that both lasalocid and monensin are toxic to horses.

Prevention is accomplished by improved sanitation, not overcrowding animals, minimizing stress, and a good nutrition program.

Cryptosporidiosis

Cryptosporidiosis is a protozoan-caused diarrhea disease in kids. Occurrence is more common in kids raised in a barn or in confinement than kids raised on pasture. The infective agent is *Cryptosporidium parvum*. Unlike coccidia that need to sporulate outside the animal to become infective, cryptosporidium sporulate inside the animal. This means that the protozoa can be self-sustaining in the animal resulting in severe disease. This also means that the feces of infected animals contain sporulated eggs that can directly infect other goats thereby quickly spreading the disease. Further, the disease is zoonotic and people can become infected from handling feces.

Signs and symptoms

Affected kids are usually less than two weeks of age. Diarrhea is bright yellow and watery and can last from 2 to 14 days. Kids are dehydrated, have decreased intake, poor growth, and depression. The diarrhea ranges from self-limiting to very severe and fatal. Recovered animals frequently suffer relapses.

Treatment, prevention, and control

Kids should be isolated, provided fluids, and kept warm. Any pens holding diseased animals should be cleaned. The organism survives in the environment and is resistant to many disinfectants; however, a 5 to 10% ammonia solution is effective. Proper sanitation and reduced fecal contamination of feed and water are preventive measures. Decoquinate (Deccox) at 2.5 mg/kg orally may be useful in prevention.

Stomach and intestinal worms

There are a number of stomach and intestinal worms that can affect goats. The most common and devastating in terms of death, lost productivity, and cost is the barberpole worm (*Haemonchus contortus*). A complete discussion of this and other internal parasites as well as chemical and other control methods can be found in the chapter on [Internal & External Parasites](#). Anthelmintic drugs and dosages and procedure to perform a fecal egg count can be found in the [Meat Goat Herd Health – Procedures and Prevention chapter](#).

Mange

Mange is caused by mites feeding on the skin of affected animals. Three types of mange that affect goats in the U.S. are psoroptic, demodectic, and chorioptic. Psoroptic mange (ear mange) is caused

by the mite *Psoroptes cuniculi* and usually infests the ears but can spread to the head, neck, and body. Demodectic mange is caused by *Demodex caprae* that infests skin glands and hair follicles of the limbs, face, and back. Chorioptic mange is caused by the mite *Chorioptes caprae* and usually affects the scrotum, lower limbs, and abdomen. Transmission is usually from animal to animal though these mites can live in the environment for limited periods of time, up to 3 months for *C. caprae*, for example. Some goats may be unaffected carriers of the mites. Saliva from mite bites causes intense inflammatory reactions in the skin resulting in skin lesions and hair loss.

Signs and symptoms

In demodectic and chorioptic mange, goats will develop blisters or scabs on areas affected by the particular mange mite. Hair loss is common and the skin on the back, sides, and limbs of the animal may become crusty in appearance. Goats will scratch removing scabs and leaving a wound that is susceptible to secondary bacterial infection. In psoroptic mange, animals will shake and scratch their head, sometimes using their hind foot. Hair loss around the ears is common. Mange occurrence is most severe in fall and winter. In all cases, animal productivity will decline.



Chorioptic mange.

Treatment, prevention, and control

Isolate affected animals. Topical treatments include dips or thorough sprays (coumaphos 0.3%, lime sulfur 2%, and phosmet 0.15 to 0.2%) that should be done at weekly intervals. Commercial products are available that contain these ingredients. Ivomec or Cydectin injections (0.2 mg/kg body weight) can be done at weekly intervals. For psoroptic mange, any products approved for sheep will work with goats. Another alternative is to use a louse or ear mite external medication, such as used with dogs. Lactating dairy goats should be treated only with lime-sulfur solution. If necessary, the animals can be treated using sprays or dips containing organophosphates (diazinon, metrifonate, propetamphos) or pyrethroids (deltamethrin, flumethrin) as permitted.

Lice

Lice infestation is most common in winter months when animals are closely quartered due to outside temperature and the feeding practices used. Both biting lice (*Bovicola caprae*, *B. limbatus* and *B. crassipes*) and sucking lice (*Linognathus stenopsis* and *L. africanus*) affect goats. *L. africanus* is probably the most important sucking louse for goats, attacking anywhere on the body. Lice suck blood and can cause severe anemia. They are spread by direct contact or by contact with contaminated areas of the environment.

Signs and symptoms

Goats will be itchy, have patches of bare skin from hair loss, lose weight, and suffer from anemia in severe cases. Lice can be seen crawling on the skin of the animal.

Treatment, prevention, and control

Treating the environment surrounding the goats to try and rid the area of lice is difficult. Treatment of affected animals includes using dips, sprays, or dusts. Commonly used products are coumaphos (0.125% spray or 0.5% dust), malathion (0.5% spray or 4% dust), and permethrin sprays or pour-on products. Ivomec or Cydectin injections (0.2 mg/kg body weight) can be used against sucking lice. They have limited effectiveness against biting lice. Treat animals at 2 week intervals for at least 2 treatments to ensure that lice emerging from eggs are killed.

Diseases of the Eye

Pinkeye, infectious keratoconjunctivitis

The term pinkeye is often used to refer to any condition resulting in watery, red, or cloudy eyes in goats. There are many causes of eye irritation including 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. Common infectious agents causing pinkeye include mycoplasma, chlamydia, and listeria. 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.

Signs and symptoms

Signs of goats suffering from pinkeye include watery eyes, redness of the eye, swelling of the eyelids, sensitivity to light, and a cloudy cornea. The onset of this disease is quick and it can spread through animal to animal contact.

Treatment, prevention, and control

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

Toxicosis

There are numerous toxicities that can be caused by consumption of certain plants. Goats are generally not as susceptible to plant toxicities as other livestock because of their grazing habit. Goats are browsers and normally consume a wide variety of forage species daily thereby avoiding overconsumption of any one plant. For a plant to be poisonous it must be consumed in sufficient quantities to cause illness in a natural grazing setting. In goats this may happen when forage is

limited, such as during drought, and goats are forced to overconsume plant species not normally eaten. Some ornamental plant species can also cause toxicity.

Plant toxicities can cause a variety of signs and symptoms from mild irritation to central nervous system disorders to abortion and death. Most do not respond well to treatment and prevention is best. Activated charcoal given to adsorb toxins is recommended for many toxicities. Others can be treated by chemicals that usually only a veterinarian would carry. Most plant toxicities can be avoided by supplying hay or grain during drought, not overstocking pastures, and preventing access to ornamental plants and clippings. Examples of plant species causing various toxicities are listed.

Azaleae, rhododendron, laurel poisoning

Azaleas, rhododendrons, and laurels are members of the *Ericaceae* family. These plants contain a toxin which causes anorexia, salivation, vomiting, abdominal pain, weakness, staggering, and death. Death usually occurs after several days of illness. Affected goats typically vocalize and vomit. Relatively small doses of these plant species are effective in causing clinical signs. For a mature goat, a cupful of leaves would be toxic. Goats that have consumed and recovered from eating these plants may repeatedly ingest them in large and often fatal quantities. Treatment is non-specific in nature. Mineral oil and activated charcoal may be given orally to adsorb residual unabsorbed toxin. Fluids and relief of pain are given as needed.

Fescue toxicity

Fescue toxicosis is caused by consumption of tall fescue infected with the endophyte *Acremonium coenophialum*. Affected animals show poor growth. In cooler months, the mycotoxin can cause gangrene or death of extremities like the tail and feet. Goats appear to be less sensitive to fescue toxicity than cattle. Do not feed tall fescue to pregnant animals. If feeding to other classes of animals, dilute with other forage.

Hydrocyanic acid poisoning

This condition is most commonly associated with Sudan grass, Johnson grass, sorghums, and white clover. Under conditions of drought or frost the plants release cyanide. Cool growing conditions and use of nitrate fertilizers are also implicated. Animal symptoms include muscle tremors, labored breathing, and sudden death, often within minutes of consuming a fatal dose. The blood of affected animals is bright red as the cyanide prevents hemoglobin from releasing oxygen. Prevent by limiting access to pastures in the conditions listed above. Plants can be most toxic during early regrowth. Sorghum at least 2 feet tall is generally safe. Some plants found on range or pasture such as choke cherry and oleander can also cause this problem. Contact a veterinarian for treatment.

Nitrate poisoning

Nitrates are essential for plant growth and normal concentrations are not high enough to cause problems. However, the increased use of nitrogenous fertilizers has raised the potential for nitrate poisoning to occur from not only nitrates in plants, but through contamination of water supplies.

Nitrate poisoning is usually associated with sorghums and Sudan grass but can also occur when grazing sugar beet tops, kale, Italian ryegrass, white clover, and oats. Drought, recent fertilization, and retarded plant growth can cause nitrates to accumulate in plants. Highest nitrate concentrations are found in stems and leaves in the cool, early morning. The nitrate does not allow the blood to exchange oxygen. Signs include weakness, tremors, increased heart rate, collapse, and sudden death. Contact a veterinarian for treatment.

Selenium toxicity

Certain plants can accumulate high levels of selenium. If an animal consumes a large amount of these plants, acute poisoning can occur with damage to the liver, kidney, and lungs. Animals become weak, have difficulty breathing, experience bloating, and can die from respiratory failure. Some plants that accumulate selenium include broomweed, desert aster, princess plume, and saltbush.

Photosensitization

Photosensitization is a condition where photodynamic chemicals accumulate under the skin and react to sunlight on unpigmented areas of the skin. Capillaries in the skin are damaged resulting in skin death and sloughing. Liver damage can also occur in some instances. Skin around ears, eyes, and muzzle is usually affected and becomes red, swollen, and irritated. Secondary infections can occur. Remove the plant causing the photosensitization and protect the animal from the sunlight. Prevent or treat secondary infections. Some plants known to cause photosensitization include St. John's wort, buckwheat, wild carrot, *Lantana*, ragwort, rape, and kale.

Abortions and fetal defects

Some plants contain toxic substances called teratogens that can cross placental membranes and cause fetal deformities, fetal resorption, abortion, or stillbirth. Teratogens may cause different defects depending upon the stage of gestation and amount consumed. The first trimester of pregnancy is when the fetus is most susceptible. Usually, restricting pregnant animals from pastures containing these plants during the first third of gestation is sufficient; however, plants such as milk vetch and locoweed should be avoided throughout pregnancy. Other plants known to have these reproductive effects include broomweed, lupine, tobacco, desert tobacco, and *Veratrum californicum* called false hellebore, skunk cabbage, or corn lily.

Liver damage

The liver can be vulnerable to toxicosis due to its role in detoxifying substances in the body. Some plants consumed in excess can cause liver damage. Signs are usually non-specific and overlap with signs of other toxicities and include vomiting, diarrhea, and going off-feed among others. Some plants that can cause liver damage include cocklebur, crotalaria, *Lantana*, sneezeweed, bitterweed, rubberweed, St. John's wort, blue-green algae, horsebrush, oak, rhubarb, castor bean, and mistletoe.

Kidney damage

Kidneys can be damaged due to plant toxicosis with renal failure resulting in extreme cases. Signs are non-specific and include depression, off-feed, going down, and death. Plant species implicated include lambsquarter, pokeweed, Russian thistle, pigweed, rhubarb, oak, and Ponderosa pine.

Central nervous system effects

There are many plant toxicities that have central nervous system signs. These signs differ for different plant species but include one or more of the following: paralysis, muscle convulsions, tremors, incoordination, vomiting, depression, weakness, coma, and death. Plants causing these symptoms include locoweed, larkspur, Indian hemp, milkweed, lupines, Jimson weed, water hemlock, poison hemlock, nightshade, false hellebore, death camus, sneezeweed, greasewood, horsebrush, rubberweed, rhodendron, mountain laurel, azaleas, castor bean, and horse chestnut. Treat animals that have consumed these plants with one pound activated charcoal to adsorb the toxin.

Aflatoxins

Aflatoxins are produced by a number of fungi that contaminate grains and soybeans. Affected animals will go off feed, may experience bleeding, tremors, weakness, and death. Abortions and liver damage can also occur. Drought or excessively warm and moist conditions are factors in occurrence. Identify toxins in feed and feed toxin-free diets.

Genetic Conditions

Intersex condition, hermaphrodite

The intersex condition is the most important genetic anomaly of goats. This condition is particularly prevalent among polled goats and results in offspring which are female in appearance but develop portions of the male reproductive tract including testicles. The kids have decidedly male behavioral characteristics beginning at the time of puberty. The actual mechanism of the development of intersex is unknown. During fetal development, the intersex kid is exposed to high levels of endogenously produced testosterone. This results in a masculinizing effect on the kid's genotypic female reproductive tract. This condition has been reported to be as high as 22% of all offspring in certain lines of goats.

Signs and symptoms

Kids should be carefully examined for abnormalities in external sex organs. Testicles in intersex kids are often confused with the developing mammary gland. The depth of the vagina can be checked for normality. Usually, by the time of puberty behavioral attributes clearly suggest that the goat is an intersex. Additional tests would include measurement of serum testosterone levels and chromosomal typing.

Treatment, prevention, and control

There is no treatment. The existence of the intersex trait is the primary reason why goat breeders select against the polled trait. The polled trait is dominant to horns meaning that horned goats may be homozygous for the horned trait and almost always free of the intersex trait.

Zoonotic Diseases

Transmission and susceptibility

Contact among humans results in the transmission of infectious agents. If you have a cold and don't take precautions you may give your cold to others. For some diseases, contact between humans and animals can result in the transmission of infectious agents. Diseases that can sicken both humans and animals are called zoonotic diseases. This is a two-way street in that some human diseases can infect goats while some goat diseases can infect humans.

Zoonotic diseases can be transmitted from animals to humans via feces, urine, saliva, blood, milk, meat, fetuses, and uterine discharges. Infection can occur by breathing in aerosolized pathogens, ingesting them, or by direct contact with skin or mucous membranes. Touching animals and then eating before washing your hands puts you at risk of eating fecal material. Similarly, if you rub your eyes while working with your animals, bacteria may pass from your fingers to the membranes surrounding your eye.

Exposure to animal pathogens is a common occurrence for persons raising livestock. In almost all cases, our body's immune system protects us from the pathogens we encounter. However, the very young and the very old are persons at higher risk of possible infection with a zoonotic disease. Young children are highly susceptible to disease. The *E. coli* 0157:H7 found in animal manure commonly produces a fatal disease in young children but rarely is a serious disease in adults. Elderly people need to be conscious of zoonotic diseases because immune systems lose some ability to ward off disease as a person ages. Pregnant women need to be very careful around diseased animals as some diseases can affect the human fetus. In addition to age and pregnancy status, other factors or conditions such as a compromised immune system may affect an individual's ability to fight off disease. For example, Cryptosporidia that only causes diarrhea in normal people can be fatal to persons suffering from HIV.

Prevention

Practice a little common sense and follow some simple rules when working with animals. Wash your hands after being with animals and particularly prior to eating or putting anything into your mouth. Wear gloves when you are handling potentially infected material including diarrhea kids, aborted fetuses, etc. A "mudroom" where your work clothes and boots stay and never enter the house where a toddler may be crawling will help prevent the entry of pathogens into your home. If possible, install a washer and dryer in the mudroom room so that your farm clothes never come in contact with household clothes.

Cuts and lacerations offer an immediate opening for bacteria to enter your body. Cover all cuts with a waterproof bandage and wear latex gloves if the cut is on your hand. Keep very young children out of livestock units. When they are old enough to enter, make sure they understand the concepts of sanitation. Help young children who handle animals to wash their hands or use disinfectant wipes. Explain and follow these procedures with visitors to your farm.

If you work with animals and become ill seek medical help. Inform your physician that you work with animals. Physicians often have very little knowledge of zoonotic diseases and you may need to help them figure out what you have.

Some important zoonotic diseases of goats

Anthrax

What is it?	Bacterial disease found in the soil in certain areas and in dead carcasses.
How do you get it?	Ingestion, inhalation, or skin contact.
What does it cause?	Gastrointestinal form, respiratory form, and skin form.
How do you prevent it?	Avoid contact with infected/contaminated animals, hides, and soil.
How do you treat it?	See a physician. Antibiotic treatment.

Brucellosis

What is it?	Bacterial disease spread by cows, horses, and goats.
How do you get it?	Direct contact or ingestion. Often via handling an aborted fetus or placenta, via urine or vaccine injection.
What does it cause?	Abortion, inflammation of the testicles, undulant fever, headaches, weight loss.
How do you prevent it?	Vaccinate all cattle if needed. Test all new entries. Wear protective clothing when dealing with dystocias and aborted animals. Take special care with vaccine.

Campylobacteriosis

What is it?	Bacteria causing diarrhea, fever, and abortion in livestock.
How do you get it?	Fecal to oral transmission.
What does it cause?	Diarrhea with fever and vomiting. Mucus and blood in stool.
How do you prevent it?	Avoid getting feces from livestock in your mouth. Wash hands after handling livestock or raw meat.
How do you treat it?	Fluids, antibiotics.

Caseous lymphadenitis

What is it?	Bacterial disease causing abscesses of lymph nodes especially in sheep and goats.
How do you get it?	Contact with pus from abscesses.
What does it cause?	Abscesses of lymph nodes both external and internal.
How do you prevent it?	Remove infected animals from the herd. Use gloves to handle pus and contaminated surfaces.
How do you treat it?	Antibiotics. This can be very difficult to cure.

Chlamydia trachomatis

What is it?	Rickettsia causing abortions, conjunctivitis, polyarthritis, and pneumonia in sheep and goats.
How do you get it?	Oral transmission.
What does it cause?	Miscarriage, respiratory disease.
How do you prevent it?	Don't handle aborted fetus, placenta, or doe.
How do you treat it?	Antibiotics.

Cryptosporidiosis

What is it?	Protozoa similar to coccidia that can infect almost any animal.
How do you get it?	Ingestion of feces.
What does it cause?	Diarrhea.
How do you prevent it?	Hand washing. Sanitation.
How do you treat it?	Self-limiting in normal people, fatal in immune suppressed individuals.

Giardiasis

What is it?	Flagellated protozoa that can infect almost any animal.
How do you get it?	Ingestion of feces.
What does it cause?	Diarrhea.
How do you prevent it?	Hand washing. Sanitation.
How do you treat it?	Metronidazole.

Leptospirosis

What is it?	Bacteria which can infect the kidneys of goats.
How do you get it?	Ingestion, through mucous membranes, and cuts in skin.
What does it cause?	Renal (kidney) disease, hepatic (liver) disease.
How do you prevent it?	Avoid aborted fetuses and urine of animals.
How do you treat it?	Antibiotics.

Orf

What is it?	Parapox virus causing skin lesions in sheep and goats.
How do you get it?	Direct or indirect contact.
What does it cause?	Skin lesions.
How do you prevent it?	Do not handle goats with lesions on their lips or elsewhere without protective gloves.
How do you treat it?	No treatment. Self-curing in one month.

Q fever

What is it?	Bacteria <i>Coxiella burnetti</i> .
How do you get it?	Inhaling aerosolized organisms.
What does it cause?	Abortions in goats and humans, liver disease. Can be fatal.
How do you prevent it?	Test your goats. Don't handle aborted fetus or placenta.
How do you treat it?	Antibiotics.

Rabies

What is it?	Viral disease of all mammals.
How do you get it?	Direct contact with an infected animal.
What does it cause?	Neurologic disease with paralysis.
How do you prevent it?	Avoid handling animals with suspicious behavior.
How do you treat it?	Anti-serum and hospitalization. Usually fatal.

Salmonellosis

What is it?	Bacteria which can infect all animals. Generally causing diarrhea.
How do you get it?	Oral ingestion of feces.
What does it cause?	Severe, often bloody diarrhea.
How do you prevent it?	Protective clothing when handling goats with diarrhea.
How do you treat it?	Antibiotics.

Tuberculosis

What is it?	Bacterial disease.
How do you get it?	Ingestion and inhalation.
What does it cause?	Various symptoms including pneumonia, weight loss, weakness, fever, chest pain.
How do you prevent it?	Avoid contact and close proximity to infected/contaminated animals. Do not drink unpasteurized milk.
How do you treat it?	See a physician.

Yersinia enterocolitica

What is it?	Bacteria which can cause diarrhea in goats and other animals.
How do you get it?	Oral ingestion of feces.
What does it cause?	Severe diarrhea.
How do you prevent it?	Hand washing. Sanitation.
How do you treat it?	Antibiotics.

Conclusion

The aforementioned diseases are by no means an exhaustive list of all the ailments that can afflict goats. A good relationship with a qualified veterinarian is essential in maintaining the health of a goat herd and in devising a comprehensive herd health strategy. Producers should always call a veterinarian when a disease outbreak is suspected.

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