



Mastitis in Dairy Goats¹

J. K. Shearer & B. Harris, Jr.²

Mastitis is a general term which refers to inflammation of the mammary gland, regardless of cause. It is characterized by physical, chemical, and usually bacteriological changes in the milk and by pathological changes in the udder. Early recognition and prompt treatment are important for limiting tissue damage and production losses. However, since treatment is often unrewarding, emphasis should be on mastitis control and prevention.

MASTITIS DETECTION

Clinical mastitis (that which is observable) is characterized by visible abnormalities in the udder or milk. These may vary greatly in severity during the course of the disease. Clinical cases can be defined as subacute (mildly clinical) when symptoms include only minor alterations in the milk and the affected quarter such as clots, flakes, or discolored secretion. The quarter may also be slightly swollen and tender.

Acute mastitis cases are characterized by sudden onset, pain, heat, swelling, redness and reduced as well as altered milk secretion from affected halves. Abnormal secretion in the form of clots, flakes, or watery milk is the clinical sign most consistently observed. Depending upon severity and the causative agent, acute mastitis cases may have significant

systemic involvement characterized by fever, depression, and weakness. In its most severe form it can be fatal. Such cases call for immediate attention.

Subclinical mastitis is, as the name implies, less obvious and may only be detectable by measures of the milk's cellular content (somatic cells) (Figure 1). The predominant cells in milk are epithelial and white blood cells, the latter of which increase to tremendous numbers (millions/ml) whenever injury or infection of the gland occurs. Thus, by determining the number of cells present in a sample of milk from the mammary gland one can determine the likelihood of mastitis even though all other visible signs of inflammation are absent. However, it must be remembered that interpretation and methods for enumerating somatic cell counts in goat milk are different due to some unique and important differences between the milk of goats and that of cows. This form of the disease is important for the following reasons:

- It is 15 to 40 times more prevalent than the clinical form.
- It usually precedes the clinical form.

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2. Associate Professor and Professor, respectively, Large Animal Clinical Sciences, Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida, Gainesville FL 32611.

- It is of long duration.
- It is difficult to detect.
- It reduces milk production.
- It adversely affects milk quality.

standards for goat milk will remain at 1,000,000/ml. This is because somatic cell counts in goat milk may easily approach 750,000/ml and still be normal.

The milk secretory unit of the mammary gland is the alveolus. This microscopic anatomical unit is

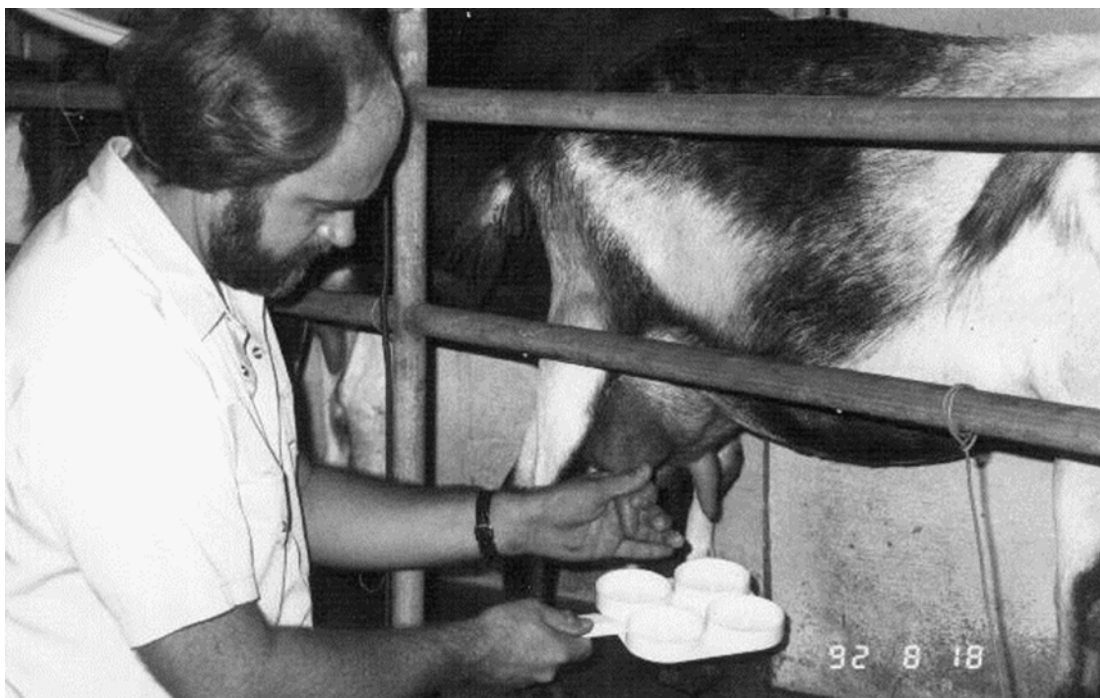


Figure 1. Using the California Mastitis Test (CMT) to examine for subclinical mastitis.

The subclinical form is also important because it constitutes a reservoir of microorganisms that lead to infection of other animals within the herd.

SOMATIC CELL COUNTS OF GOAT MILK

The white blood cells in milk, together with a relatively small number of epithelial cells from milk-secreting tissues, are known as somatic cells. These cells are an important part of the goat's natural defense mechanism. When udder tissue is injured or becomes infected, significant numbers of white blood cells accumulate in the milk. Normal goat milk has a higher cell count than normal milk from cows. This has long been a concern of goat owners because of regulatory standards and marketing problems. Current Grade A standards require that milk contain no more than 1,000,000 cells/ml. The SCC limit will be lowered to 750,000/ml for cow milk as of July 1, 1993. Despite this reduction for cow milk, regulatory

lined with epithelial cells which synthesize and secrete the milk components: fat, protein, and lactose.

The higher cell count of goat milk is in part caused by an increase in rate of sloughing of these epithelial cells (EC) and the presence of cytoplasmic masses (CM) which occur as a consequence of the apocrine secretory process.

Epithelial cell sloughing is a normal physiological process in the mammary gland. It is worthy of note that some have attributed conditions of excessive cell sloughing with infection by Caprine-Arthritis-Encephalitis (CAE) virus. Cytoplasmic masses are derived from the apocrine secretory process in which secretory products become contracted at the free end of the secreting cell and are dispersed from the cell surface along with a portion of the cell and its accompanying cytoplasm.

Electronic cell counters cannot accurately differentiate between EC, CM, or white blood cells. Consequently, when EC and/or CM are present in

high concentrations, cell counts may be artificially elevated if enumerated by electronic cell counters. This results in diagnostic difficulty and circumstances where normal milk would be inappropriately labelled unfit for sale. To circumvent this dilemma the National Conference on Interstate Milk Shipments in 1983 agreed to allow differential staining of goat milk samples for confirmation of somatic cell counts. By using this method, only nucleated cells (white blood cells) are counted thus yielding a more accurate measure of the somatic cell content of goat milk.

Somatic cell counts on milk samples from individual goats can be performed with reasonable accuracy using the California Mastitis Test (CMT). The CMT reagent reacts with genetic material of somatic cells present in milk to form a gel. Table 1 and Table 2 provide guidelines to interpretation of CMT and SCC results. In general, milk from noninfected glands will yield a negative (0), trace, or 1 \geq reaction. Scores of 2 \geq or 3 \geq are indicative of mastitis. Somatic cell counts in excess of 1,500,000/ml are suggestive of intramammary infection.

The scores are related broadly to the number of somatic cells in milk. Somatic cell numbers in milk tend to increase during milking, and remain high for a few hours afterwards. For reliable results, tests should be conducted just before milking after stimulating milk down and discarding the foremilk (Figure 2).

COMMON MASTITIS PATHOGENS OF GOATS

Numerous organisms have been associated with mastitis in goats. An attribute common to nearly all of them is an ability to colonize the streak canal through which mastitis causing organisms gain access to the gland. Improper milking techniques and poor milking hygiene are known to encourage infection.

Staphylococcus aureus is the most important mastitic pathogen in most herds. Symptoms vary from acute clinical to subclinical. In particularly severe cases the infection may progress to gangrene. It is characterized by the presence of a watery, dark red secretion which may be accompanied by gas bubbles resulting from secondary infection with gas

forming organisms (particularly *Clostridium* spp.). Death may be immediate or occur after several days. Some animals will recover and eventually slough away the necrotic tissue.

Other organisms including several species of Streptococci (*Streptococcus agalactia*, *Streptococcus uberis*, and *Streptococcus dysgalactia*) are commonly isolated from infected udders. *Pasteurella haemolytica* is also isolated from mastitic glands and is believed to be associated with suckling kids. *Corynebacterium pseudotuberculosis* is often isolated from infected udders where there is a herd problem with abscesses. Additional organisms less commonly isolated from mastitic glands include coliforms and *Mycoplasma* spp.

TREATMENT OF MASTITIS IN GOATS

Initially one should determine if there is significant systemic involvement as judged by the animal's attitude, appetite, and the presence of fever. In cases where the mastitis appears to be localized to the udder one may proceed with treatment by first "milking out" the affected gland. Occasionally this process can be aided with an injection of 2 IU oxytocin (avoid use of oxytocin if the animal is in the second half of gestation) followed by infusion of the affected gland with a commercially prepared intramammary infusion product. One half of the contents of a tube of bovine mastitis medication is sufficient. Systemic treatment is optional.

At least two problems are readily apparent at this stage: first, withdrawal times to prevent antibiotic residues in milk and meat are uncertain with respect to treatment of goats; and secondly, the tip of most bovine intramammary infusion products is too large to penetrate the goat's teat sphincter. Since surveillance of milk for antibiotic residues to protect the public health has increased, goat owners are advised to test milk from treated animals before readmitting them back into milking strings. Any one of several commercially prepared test kit systems will do as long as they are specific for the drugs used. (Figure 3)

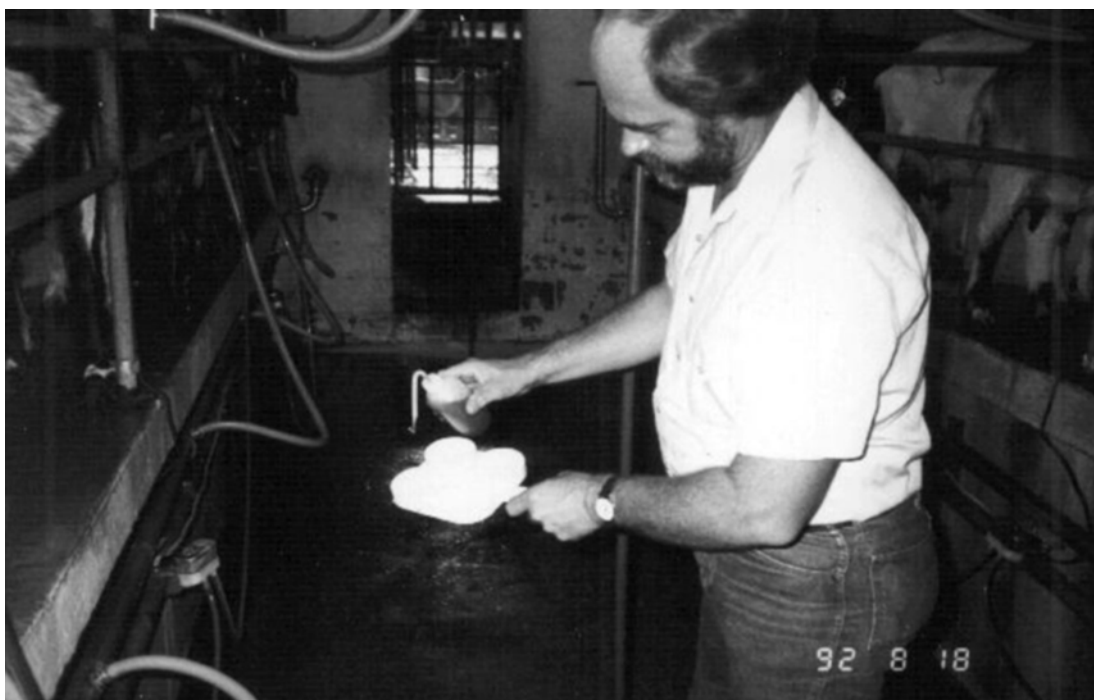


Figure 2. Adding the reagent to the sampled milk and rotating in the CMT paddle for evidence of mastitis.



Figure 3. Dairy does in milking parlor prepared for milking.

Relative to the technique of intramammary infusion, veterinarians usually will use a male cat catheter or an over-the-needle IV catheter which when attached to the medication tube end permits passage into or through the teat canal. Bear in mind

that recent research has determined that partial insertion of the canula into the teat canal may be preferable to complete insertion of the canula through the teat canal. Partial insertion tends to cause less disruption of the keratin lining of the streak canal

which represents the udder's first line of defense to infection.

In cases where the infection is systemic (throughout the body), treatment procedures should include the above described protocol for local inflammation involving the udder plus the intramuscular administration of antibiotics such as penicillin, ampicillin, erythromycin, or tetracycline. Antihistamines, anti-inflammatory agents, or fluid therapy may be required in severe cases. Owners are advised to consult their local veterinarian for specific advice on therapy under such circumstances.

MASTITIS PREVENTION IN DAIRY GOATS

While mastitis cannot be totally eliminated from the goat herd, incidence can be held to a minimum. Key elements in control are sound husbandry practices and sanitation. The barn, milking area, and exercise lots should be well-drained and ventilated, thus providing a clean and comfortable environment for the goat herd. There should be minimal trash and barbed wire littering the pasture area. All goats should be dehorned and have regular foot care, thereby reducing potential for traumatic injury to the teats and udder. Goats with open, draining abscesses should be isolated or preferably eliminated from the herd.

Milking procedures and hygiene also are important. Hair on udders and flanks should be clipped to avoid the accumulation of dirt and excess moisture. Teat and udder preparation should include washing of the teats and base of the udder with a warm water disinfectant solution using a single-service paper towel. This is designed to eliminate gross dirt and debris and stimulate milk letdown. Next the teats and udder should be dried with another single-service paper towel. This is followed by the examination of a foremilk sample on a strip plate (or strip cup) prior to the onset of milking. Milkers should be careful to keep their hands as clean and dry as possible. Rubber gloves are preferred by some as they are much easier to clean and disinfect than one's hands.

The CMT should be performed on all lactating goats monthly. This will help to identify goats which may be contributing to high cell counts and will also permit earlier detection of those goats with subclinical infections.

Major techniques for the control of bovine mastitis are: 1) post-milking teat dipping (Figure 4) and 2) therapy at dry off (end of the lactating period). A number of effective teat dip products are available, iodophors being one of the more common. Goat owners are advised to stick with a reputable brand and apply the dip after every milking. Teat dipping reduces colonization of bacteria at the teat end and is one of the most effective means of reducing the incidence of new intramammary infections.

Intramammary therapy at dry off has the two following functions: 1) elimination of existing infections and 2) prevention of the establishment of new infections. The use of at least one-half tube of a dry cow intramammary infusion product is sufficient. A multitude of studies in dairy cattle have established that the efficacy of therapy during the nonlactating period is superior to that which can be achieved during lactation.

Finally, chronically infected goats should be culled from the herd. Reasoning is that previous treatment has obviously failed and will likely continue to fail, thus leaving a less than optimally productive animal and one that serves as a source of infection for the rest of the herd. If sentimental attachment will not permit culling, then the animal should be segregated from other lactating does to reduce potential spread of infection.

Vaccination to prevent mastitis has been somewhat unrewarding in cattle and few, if any, well-controlled studies have been conducted in goats. At best, vaccination against staphylococcal mastitis (the most common type of mastitis in dairy goats) in cattle has been shown to reduce severity and possibly duration of infection by these agents. Their efficacy in goats is unknown.

SUMMARY

In conclusion, the identification of mastitis in goats is similar to that for cows and other animals.

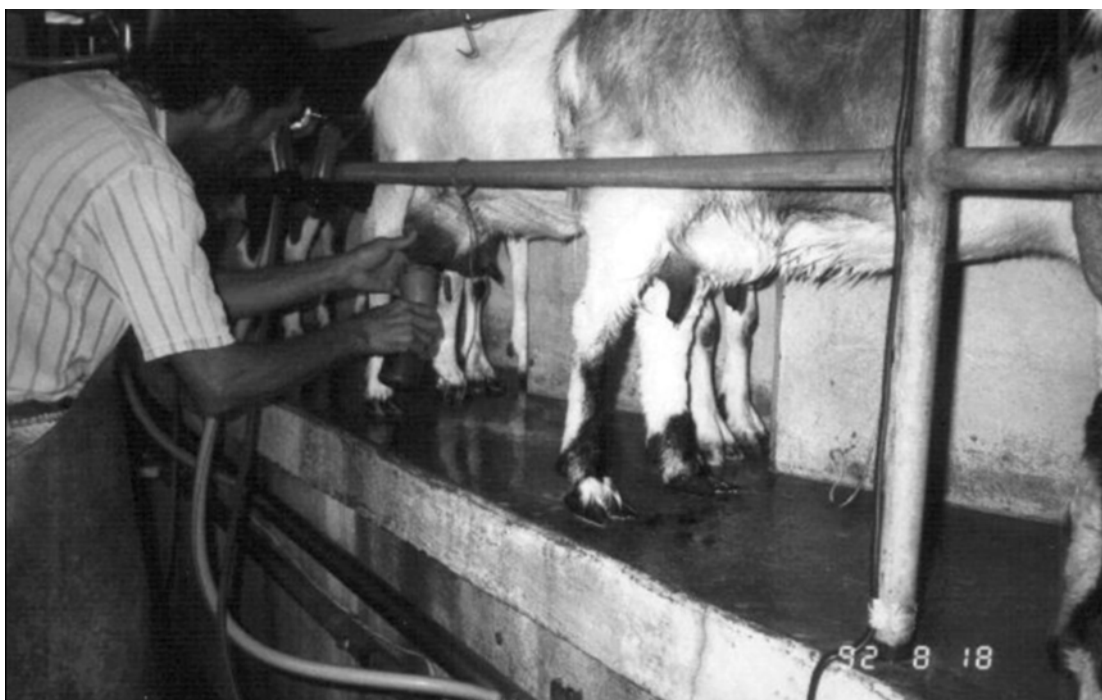


Figure 4. The teats are dipped with a disinfectant solution after milking.

However, subclinical mastitis, detectable by the monitoring of somatic cell counts, needs careful interpretation due to the higher rate of epithelial cell sloughing and the presence of cytoplasmic masses in goat milk. Regardless, prompt identification and treatment of mastitis in goats affords the best opportunity for a successful outcome when therapy is required. Far better is the prevention of mastitis through the establishment of good husbandry practices, sanitation, sound milking procedures including post-milking-teat-dipping and treatment during the non-lactating period, and culling of chronically infected does.

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Table 1. Interpretation of California Mastitis Test scores on goat milk.

CMT Score	Reaction	Mean no. neutrophils per ml
0	No reaction	68,000
Trace	Slight slime, tends to disappear with continued swirling	268,000
1	Distinct slime but without gel	800,000
2	Immediate gel formation; moves as a mass during swirling	2,560,000
3	Gel develops a convex surface and adheres to the bottom of the cup	$\geq 10,000,000$

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Table 2. Interpretation of somatic cell count (SCC) from individual goat milk samples.

SCC/ml	Interpretation
Less than 1,000	Healthy glands
500,000 - 2,000	Infection by weak pathogens
Over 1,500,000	Signals infection