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Tests for Mastitis

J. O. Young and Willard Dillon
Extension Dairymen

Mastitis is a complex disease caused by physical injury or bacterial invasion of one or more quarters of the cow's udder.

Severe clinical mastitis is easily recognized by a sudden swelling of the infected quarter, which is hot, hard and sensitive. Milk appears abnormal and production drops. Infected cows may develop a fever, rapid pulse, weakness and loss of appetite.

Mild forms of clinical mastitis usually cause visible changes in the milk such as flakes or clots but swelling or pain in the udder is slight or absent.

The third form of mastitis is subclinical—there is no swelling of the udder and no gross abnormality of the milk. Special screening tests are needed to detect mastitis in this form.

The three forms of mastitis are interconnected. A healthy quarter can gradually become subclinical, then mildly infected, then severely infected. Or, the severe form may develop overnight from an apparently normal quarter. Treatment can sometimes reduce the damage done by a severe attack and allow the quarter to return to a near normal condition. But, those quarters with subclinical mastitis form a pool from which most of the mild and severe cases of mastitis can develop. Success in reducing mastitis to a manageable level depends upon reducing this subclinical pool with the consequent reduction in the mild and severe infections.

Mastitis detection may be accomplished by; physical examination, screening test to detect abnormal milk and identification of causative organisms.

Physical Examination

Severe cases of clinical mastitis can usually be detected by swollen, hot or sensitive quarters. Mild clinical mastitis can sometimes be found by palpation of the udder immediately after milking. Observe the udder for balance in shape and size and palpate to detect excessive connective tissue. Use a strip cup to examine the milk for clots and to detect other abnormalities.

Detection of Abnormal Milk

As mastitis progresses, milk composition changes to more closely resemble that of blood. The pH (degree of acidity or alkalinity) of milk from an abnormal udder also approaches that of blood.

<table>
<thead>
<tr>
<th>Milk component or characteristic</th>
<th>Change resulting from abnormalities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fat</td>
<td>Variable</td>
</tr>
<tr>
<td>Lactose (milk sugar)</td>
<td>Reduced</td>
</tr>
<tr>
<td>Protein</td>
<td>Total remains the same but casein is decreased and serum proteins increase</td>
</tr>
<tr>
<td>Chlorides</td>
<td>Increased</td>
</tr>
<tr>
<td>Leucocytes</td>
<td>Increased</td>
</tr>
<tr>
<td>Catalase</td>
<td>Increased</td>
</tr>
<tr>
<td>Solids-Not-Fat</td>
<td>Reduced</td>
</tr>
<tr>
<td>Total Solids</td>
<td>Reduced</td>
</tr>
<tr>
<td>pH</td>
<td>Increased</td>
</tr>
<tr>
<td></td>
<td>Increased</td>
</tr>
<tr>
<td></td>
<td>Reduced</td>
</tr>
<tr>
<td></td>
<td>Increased (more alkaline)</td>
</tr>
</tbody>
</table>
Some of the changes in milk composition or characteristics are utilized to detect udder abnormalities.

1. pH determination (on the farm and dairy plant tests)

The pH of normal milk is 6.7, that of blood, 7.35. pH can be determined by an indicating dye that changes color with a change of pH. The dye bromthymol blue is usually used in mastitis screening tests. Cards are available with spots of the dye dried on them. A drop of milk is placed on the dye spot and color changes are observed. Brom cresol purple is used in the California Mastitis Test reagent to indicate changes in milk pH.

2. Chloride concentration (dairy plant test)

Milk normally has a chloride content of about 0.10%, blood about 0.50%. As lactose decreases during mastitis, chlorides increase. Chloride content can be estimated by a laboratory colorimetric titration or by electrical conductivity.

3. Leucocyte (white blood cell) concentration (dairy plant test)

Leucocytes attack microorganisms that invade the body. Infection or irritation of the udder results in high leucocyte concentrations in the milk. Several methods may be used to estimate the number of leucocytes in milk.

a. Direct microscopic count (dairy plant test)

A 0.01 ml sample of milk is spread over a 1 sq. cm. area of a glass slide, the smear is dried and the leucocytes counted under a microscope.

b. The Whiteside Test (dairy plant test)

A sodium hydroxide solution (lye solution) is mixed with milk. If excessive leucocytes are present they will clump together and show lumps or stringiness.

c. The California Mastitis Test (CMT) (on the farm test)

A concentrated detergent solution is added to milk and excessive leucocytes will show clumping or gelling. The CMT reagent may change color if the pH of the milk is abnormal. The milk quality test (MQT) is a modification of the CMT.

d. Catalase Test (dairy plant test)

Catalase enzymes are associated with leucocytes. This enzyme is capable of breaking down hydrogen peroxide to oxygen and water. In performing the test, hydrogen peroxide is added to the milk sample, the sample is then incubated to permit the catalase to work and the oxygen gas is measured. The amount of oxygen liberated is proportional to the amount of catalase present which in turn gives an estimation of the number of leucocytes present in the milk.

Tests for Causative Organisms

Since microorganisms are involved in those cases of mastitis where an infection is present, several tests have been devised to identify causative organisms in the milk.

1. Direct Microscopic Examination (dairy plant test)

Some causative organisms, particularly the long-chain streptococci, can be identified under a microscope. The sample is prepared in the same manner as for direct count of leucocytes.

2. Blood Agar Plate (dairy plant test)

Many of the organisms causing mastitis will attack blood cells. When a milk sample is plated on agar containing blood, these hemolytic organisms will produce a clear zone around the colony as they grow, making them easily identifiable.
3. Hotis Test (dairy plant test)

When bromcresol purple is added to a milk sample and the sample incubated, yellow spots will appear where acid producing organisms are growing, producing acid and changing pH. This test is specific only for those organisms capable of producing acid in milk, generally long-chain streptococci.

4. Specific Isolation Techniques (dairy plant test)

Methods for isolation and identification of specific organisms are sometimes necessary for treatment in herds with a high incidence of infection. Precise laboratory methods are required. Testing and treatment must be under the supervision of a veterinarian.

Interpretation of Tests

Interpretation of tests is sometimes difficult. Factors other than mastitis, such as other diseases and early or late lactation, may cause milk composition changes which result in false positive tests.

Any test needs to be used on a routine, periodic basis to be of maximum benefit. The CMT or other "paddle" tests appear to be the best tests for producers to use. They are easy to run, can be done in the barn during milking and provide a good index of the leucocyte concentration.