Screening Tests for Abnormal Milk

Cooperative Extension South Dakota State University

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Screening Tests for Abnormal Milk

COOPERATIVE EXTENSION SERVICE
SOUTH DAKOTA STATE UNIVERSITY
U. S. DEPARTMENT OF AGRICULTURE
Screening Tests for Abnormal Milk

by J. O. Young, professor of dairy science, and E. J. Kleen, assistant extension dairyman

An abnormality in the udder results in secretion of abnormal milk. When milk becomes abnormal its composition and characteristics more closely resemble those of blood. The lactose (milk sugar) is decreased resulting in a decrease in solids-not-fat and total solids. The total protein remains the same but there is a decrease in casein and a corresponding increase in serum (or whey) proteins. The fat percentage varies. The chlorides (one of many salts in milk) increase. The pH (degree of acidity or alkalinity) increases to approach that of blood and the number of leucocytes (white blood cells) increases.

These changes in milk composition and characteristics have been used for many years to indicate abnormalities in the udder. More recently the increase of leucocytes in milk has been used as the basis for most abnormal milk or mastitis tests. Leucocytes are present in blood to attack bacteria that may invade the body. Infections or irritation of the udder consequentially results in high leucocyte concentrations in the milk. Leucocyte numbers can be determined several ways.

**DIRECT MICROSCOPIC COUNT (DMC)**

A 0.01 ml sample of milk is spread over a one-square centimeter of glass microscopic slide; the smear is stained and the leucocytes are counted under a microscope. This is the most accurate method. It is used as a standard to check the accuracy of other tests.

**THE WISCONSIN MASTITIS TEST (WMT)**

This test is used in South Dakota for a monthly check on herd milk samples from all Grade A producers.

It is based on the fact that a thickening or gelling occurs when a strong detergent solution is added to milk containing high numbers of leucocytes. Two ml of WMT reagent are mixed with 2 ml of milk in a test tube. A metal cap with a small hole bored through it is placed on the test tube and the tube is inverted for 15 seconds. The tube is then set upright and the amount of mixture remaining is measured. The more remaining in the tube, the more viscous the mixture has become, indicating the present of more leucocytes.

**THE CALIFORNIA MASTITIS TEST (CMT)**

An equal volume of a concentrated detergent solution is added to a sample of milk (approximately two ml). As the sample is mixed gently, thickening or gelling of the mixture indicates the presence of excessive leucocytes. The greater the number of leucocytes, the greater the gelling.

The CMT was designed to use at the side of the cow to get an immediate check on each quarter of the animal. It is also useful for screening herd milk samples to indicate herds that have a number of cows producing abnormal milk.

The milk quality test (MQT) and other "paddle" tests are modifications of the CMT.

Complete procedures for the CMT are as follows:

**Equipment—**

1. a white plastic paddle with four shallow cups*
2. reagent*
3. a polyethylene squeeze bottle*
4. a plastic pail for discarding the used sample
5. a plastic pail filled with tap water to rinse paddle between tests

**Conducting the test—**

1. After discarding the first stream of milk, draw the next milk into the shallow cups on the paddle, keeping the milk from each quarter separate.

2. The ideal amount of milk is that which remains in the cup when paddle is tilted to an almost vertical position (about two ml).

3. Tilt the paddle as illustrated. Squirt test solution above the milk. Avoid making bubbles. Add at least the same volume of solution as that of milk.

4. Mix solution and milk by gently rotating paddle on horizontal plane, swirling the mixture. Positive reactions occur and can be graded during this rotary motion. Read within 15 seconds.

*These items usually can be purchased through a veterinarian.
**INTERPRETATION OF TESTS**

Bulk milk samples generally indicate udder health of the herd is good if they contain less than 500,000 leucocytes per ml. There still may be individual cows in the herd, however, producing abnormal milk from one or more quarters.

- A count of 500,000 to 1,000,000 leucocytes per ml indicates there are probably several animals in the herd secreting milk with excessive leucocytes.
- A count of 1,000,000 to 1,500,000 is a warning that the udder health of the herd is not good and that the herd definitely needs attention.

Counts exceeding 1,500,000 hopefully will be rare, but should they occur, demand immediate herd attention.

The WMT or CMT on herd samples screen out samples from herds needing attention. The CMT used at the side of the cow provides a means to identify individual cows and quarters that need attention.

In order for any screening program to be meaningful, run the test at least once a month. Record the results each time so a consistent pattern may be established for the individual cows, as well as for the entire herd.

**GRADING AND INTERPRETATION OF CMT**

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Suggested Meaning</th>
<th>Description of Visible Reaction</th>
<th>Interpretations*</th>
</tr>
</thead>
<tbody>
<tr>
<td>—</td>
<td>negative</td>
<td>Mixture remains liquid with no evidence of formation of a precipitate.</td>
<td>0—200,000 cells/cc</td>
</tr>
<tr>
<td>—</td>
<td>trace</td>
<td>A slight precipitate forms and is seen to best advantage by tipping the paddle back and forth and observing the mixture as it flows over the bottom of the cup. Trace reactions tend to disappear with continued movement of the fluid.</td>
<td>150,000—500,000 cells/cc</td>
</tr>
<tr>
<td>1</td>
<td>weak positive</td>
<td>A distinct precipitate but no tendency toward gel formation. With some milks the precipitate may disappear with continued movement of the paddle.</td>
<td>400,000—1,500,000 cells/cc</td>
</tr>
<tr>
<td>2</td>
<td>distinct positive</td>
<td>The mixture thickens immediately with some suggestion of gel formation. As the mixture is caused to swirl, it tends to move in toward the center, leaving the bottom of the outer edge of the cup exposed. When the motion is stopped, the mixture again covers the bottom of the cup.</td>
<td>800,000—5,000,000 cells/cc</td>
</tr>
<tr>
<td>3</td>
<td>strong positive</td>
<td>A gel is formed which usually causes a central peak which remains projecting above the main mass after the motion of the paddle has been stopped. Viscosity is greatly increased so that there is a tendency for the mass to adhere to the bottom of the cup.</td>
<td>Cell number generally over 5,000,000/cc</td>
</tr>
<tr>
<td></td>
<td>alkaline milk</td>
<td>This symbol should be added to the CMT score whenever the reaction is distinctly alkaline, as indicated by a contrasting deeper purple color.</td>
<td>An alkaline reaction reflects depression of secretory activity. This may occur either as a result of inflammation or in drying-off. Distinctly acid milk in udder is rare. It indicates fermentation of lactose by bacterial action within the gland.</td>
</tr>
<tr>
<td></td>
<td>pH 7.0 or over</td>
<td>Bromcresol purple is distinctly yellow at pH 5.2. This symbol should be added to the score when the mixture is yellow.</td>
<td></td>
</tr>
</tbody>
</table>

*Field experience indicates that it is difficult to distinguish a “one” score from a “two” score or a “two” score from a “three” score. For field observations it is generally satisfactory to record the reading as negative (—), trace (T), or positive (P).