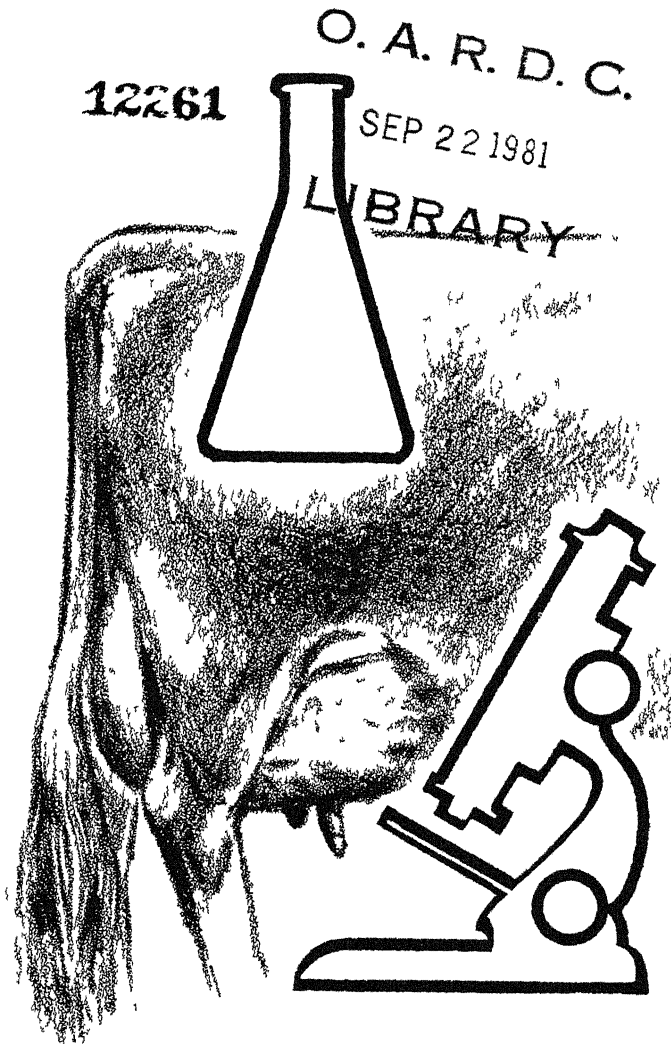


SOMATIC CELL COUNTS

(Leucocyte Counts)

A STANDARD OF MILK ACCEPTABILITY



COOPERATIVE EXTENSION SERVICE
THE OHIO STATE UNIVERSITY

SOMATIC CELL COUNTS (LEUCOCYTE COUNTS)

A Standard of Milk Acceptability

by

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Within recent years regulatory and marketing agencies have been increasingly aware of the importance of somatic cells (leucocyte) levels as an indicator of some types of abnormality in milk.

Discussions on the following topics contain information designed to help the dairyman understand what the concern for somatic cells (leucocytes) will mean to him:

1. What are somatic cells and what affects their numbers?
2. What regulations will be applied by state regulatory agencies?
3. How are the numbers measured by marketing and regulatory agencies?
4. What tests can dairymen use to keep milk with high cell counts from the supply?
5. What losses are experienced by dairymen milking cows that produce high cell numbers?

These topics deal with an explanation of the nature of somatic cell counts and how milk with high counts can be eliminated from the supply. A reference is also made to the decreased production associated with quarters with a large number of cells. However, the prevention of this loss is the result of maintaining healthy udders.

What Are Leucocytes and Somatic Cells?

Leucocytes are white blood cells and are normally found in the circulating blood and milk. However, if the white cell or leucocyte count of either blood or milk rises above the normally accepted level, it indicates a disease problem is present or developing. (Between 100 and 500 thousand leucocytes per milliliter of milk is considered normal). An increase in leucocyte count may be caused by almost any irritant. A blow, bacterial infection, chemicals, sudden or drastic changes in temperature and many other stress factors are all contributors to the increase in leucocytes.

For many years, medical people have used the leucocyte count as an indicator of disease. It has proven especially helpful in cows since this is the first signal of developing trouble or disease in the udder. The leucocytes increase in number and can be counted or measured often before any other signs of disease are evident.

The dairy industry desires to market a product that is above reproach. Milk is and should be the normal secretion of a cow. Very early in lactation and late in

lactation, the leucocyte count may go above "normal limits." This milk cannot be considered normal and should not be marketed.

The leucocyte count is accepted by most authorities as a good indicator of the "normalcy" of milk. It is true that a leucocyte count is not 100% effective in detecting every change in the cow's udder. However, used in conjunction with other procedures a leucocyte count is a good way to assure the consumer of an excellent safe, normal food.

The term somatic cells includes leucocytes but is a broader term and encompasses most nucleated body cells. Milk contains epithelial or secretory cells of the udder that are sloughed during the milk making process. Most tests cannot differentiate among cell types. Therefore the term somatic cells is being used to replace leucocytes when referring to cells that are a part of milk.

What Is Ahead in the Control of Milk with High Somatic Cell Counts?

The Ohio Program

The Abnormal Raw Milk Program is under the supervision of the Ohio Department of Health and the following applies to all raw milk for pasteurization:

1. Laboratory examinations for the presence of unwholesome, altered mammary secretions, whether of an inflammatory, infectious, physiological or environmental origin, in raw milk for pasteurization, shall be made at the same frequency as specified for bacteriological tests in Regulation HE 23-07, Ohio Sanitary Code.
2. The milk producer shall be notified of all test results.
3. The test shall be conducted by an approved laboratory. At the present time Ohio laboratories are approved to run the Direct Microscopic Somatic Cell Count and the Wisconsin Mastitis test.
4. Whenever the confirmatory count (i.e. Direct Microscopic Somatic Cell Count) indicates the presence of greater than 1,500,000 somatic cells per ml., the following procedures shall be followed:
 - a) A warning letter shall be sent to the producer notifying him of the excessive somatic cell count. The letter shall also list the more likely causes of high somatic cell counts.
 - b) Following the second confirmatory count of greater than 1,500,000 somatic cells per ml., within any consecutive 6 months, an inspection shall be made by the health commissioner or a person designated by him.
 - c) A third milk sample shall be taken after a lapse of three days and within 14 days of the inspection required under "b" above. If three of the last five samples indicate a count greater than 1,500,000 somatic cells per ml., the health commissioner or a person designated by him shall, if he deems it necessary,

require the producer to obtain expert advice on the correction of his problem which may include:

1. Having milking equipment analyzed by competent personnel.
2. Have individual animals examined by a veterinarian and have cows producing abnormal milk, milked separately and the milk withheld from the milk supply.

When inspections are made by the health department due to high somatic cell counts, and violations of the milk regulations are found, which would cause such high counts, orders with specific time limits are to be issued. A reinspection will be made to determine compliance with the order. In the case of failure to comply with such order, license action would be initiated using the high somatic cell counts as collaborative evidence.

Interstate Milk Shipments Program

The Ohio Abnormal Raw Milk Program meets all of the requirements of the Abnormal Milk Program for Interstate Milk Shipments.

How Do We Detect or Count Somatic Cells and What Does the Count Mean?

The most accurate way to measure the number of somatic cells in milk is to make a smear on a microscope slide, stain the smear, and then actually count the number of cells.

Many other procedures have been developed in addition to the direct microscopic count. There are advantages and disadvantages to the various screening procedures in common use. These are well outlined in a publication of the U. S. Department of Health, Education and Welfare entitled "Screening and Confirmatory Tests for the Detection of Abnormal Milk." This publication may be obtained by writing: Superintendent of Documents, U. S. Government Printing Office, Washington D.C. 20402, and requesting Public Health Service Publication No. 1306.

The screening tests mentioned above which include the California Mastitis Test, the Catalase test, Modified Whiteside and Wisconsin Mastitis test as well as the direct microscopic count are presumptive tests only and are not the whole solution to recognizing udder disease and diagnosing mastitis. The tests mentioned above with the exception of the California Mastitis test, are not ones that are of practical value to the dairyman, but he should be aware of their use.

Another procedure not mentioned in the above publication and which can be very useful to the dairymen is the strip plate.

There is no absolute number of somatic cells in a cow's milk which indicates normalcy. There is a range of count, however, in which a healthy cow would fall. Between 100 and 500 thousand somatic cells per milliliter of milk would be considered normal. Between 500 thousand and 1,000,000 is a suspicious zone.

This is a sign of potential trouble. With a count exceeding a million, some action should be taken—disease is present and active. Regulations permit a maximum count of 1,500,000 in order to reasonably allow the dairyman to correct the deficiency. However, in time this limit will become more stringent and lower levels do indicate trouble.

What Test Might the Dairyman Use?

The dairyman has two very important responsibilities. One is to the consumer who uses his product. The other is to himself. Early detection of any change in the milk secretion is important to keep all abnormal milk out of the market supply. Second, early recognition of disease is a prime requisite in a health and disease prevention program. Disease found early can often be satisfactorily treated. A delay of 12 hours may be the difference between successful recovery or permanent udder damage.

For these reasons it is recommended that the dairyman examine the secretion of each quarter each time the cow is milked.

One of the simplest and quite satisfactory methods of doing this is by use of a strip plate. A strip plate consists of a flat piece of plastic with a container to collect the milk. Some plates are fastened to a cup for convenience. The conventional screen strip cup is not satisfactory because it is not sensitive enough and only detects gross clumps and flakes. Important early changes may be missed if the screen strip cup is used. Some of the advantages of the strip plate are:

1. It allows for early disease detection.
2. Stimulates "let down" of milk.
3. May lower total bacterial count—first streams contain relatively large numbers of bacteria.
4. Least expensive test available.

To supplement the strip plate, a dairyman can use the California Mastitis test (CMT). This test is more sensitive than the strip plate. If there is any suspicion or question about the strip plate results, it is important to check with CMT. The CMT is slower, more expensive, and more complicated than the strip plate. However, because of its greater sensitivity the CMT would be a more reliable means of determining if a cow's milk has returned to normal.

How To Use A Strip Plate

With a little practice, it is easy for a dairyman to use a strip plate. The procedure is as follows:

1. Gently squeeze a small stream of milk from the first teat on the flat plate so that it forms a puddle.
2. Gently squeeze a small stream from the second teat so that it hits at the edge of the first puddle. The milk from the second quarter should slowly and gently be allowed to mix and run into the first puddle.
3. There must be good light and the dairyman must observe closely to detect slight changes.
4. This procedure is repeated for each of the four teats using the milk of the third in that of the second, etc. Milk from the tested teat must be used to rinse the previous milk from the plate.

- a. Any watery, flaky, clotty or ropy material means the milk is abnormal and that the cow needs immediate attention. The milk should probably not be saved. One small flake may not be significant.

Second and perhaps even more important, one may not observe the above mentioned changes. However, by gently allowing the milk from two quarters to mix, we observe that abnormal and normal milk will not mix (similar to oil and water). If one quarter is normal and the other slightly abnormal, the two will not mix. If both are normal, the two samples blend together. Beginners just starting to use these procedures would find it helpful to start with one obviously bad quarter and one good and gradually work toward more difficult to detect differences. When starting this procedure, a CMT is helpful to pick good and bad quarters. Practice, as in anything else, improves proficiency. This is a simple, quick, inexpensive procedure. In addition to discovering abnormal milk, a dairyman could also locate sick cows and treat them before extensive damage is done to the udder.

The use of CMT in the DHI Program

The California Mastitis test (CMT) for abnormal milk is available in conjunction with the Dairy Herd Improvement Program.

The present procedure is usually applied by the DHI supervisor using the first milking unpreserved butterfat sample as the source of milk for CMT. Thus the test is made using a composite sample from four quarters of each cow for one milking.

Each herd receives a summarization of reading by age of cows in the herd. A monthly state summary by age is presented in the following table.

Percent CMT Reading by Lactation

	N* & T**	1	2 & 3
Lactation 1	83	10	7
Lactation 2	70	18	12
Lactation 3	61	20	20
All	70	16	14

*Negative **Trace

This summary indicates that 1st lactation animals are scored "2" and "3" less frequently. The fact that 14% of all cows are producing high somatic cell milk suggests that much loss exists. The level of "2" and "3" cows that may be reached in a herd before the mixed milk in the bulk tank becomes unsaleable has not been determined. Regardless of lack of pressure from regulatory agencies or lack of clinical "flare ups" of mastitis, the harboring of high somatic cell-producing cows is related to lost production.

The most frequent question asked is what action should be taken on cows showing high leucocyte readings. If the herd health is under the control of a veterinarian, then these cows should have immediate attention by the veterinarian. These cows should also be evaluated at the end of lactation for possible dry treatment. Whether or not the CMT is sufficient information on which to base treatment without bacteriological examination has not been resolved. One research effort¹ revealed that if CMT were the only basis for treatment, some uninfected quarters would be treated and some infected quarters would be missed. The probability of each event happening can be estimated from the following:

- 5% of "3" quarters had no bacteria present
- 8% of "2" quarters had no bacteria present
- 17% of "1" quarters had no bacteria present
- 70% of "0" quarters had no bacteria present

Economic Significance to the Dairyman of Cows Producing Abnormal Milk

Economic loss to the dairyman resulting from abnormal milk falls into the two following categories:

1. Reduced milk production from quarters secreting a high level of somatic cells.
2. Exclusion of milk from quarters secreting high numbers of somatic cells in order that the total production will be acceptable to the market.

The loss caused by the second will be apparent to each dairyman as he is forced to discard all milk that will lower the quality of milk in his bulk shipment. The loss resulting from reduced production from abnormal quarters is not so readily apparent. Several workers have studied the association between the somatic cell level and milk production.

An approximation of the losses incurred from quarters with various levels of somatic cells is as follows:

Somatic Cell Category (Quarter)	% Prod. Loss	Lbs. of Milk Lost Per Day (Quarter)
150,000 to 500,000	10%	1 lb.
500,000 to 1,000,000	20%	2 lbs.
1,000,000 to 5,000,000	32%	3.2 lbs.
Above 5,000,000	45%	4.5 lbs.

An approach to the problem of high somatic cells might be one of having a short range and a long range objective. The short range objective would be to identify the cows producing abnormal milk so that they could be eliminated from the milk supply. This would permit the marketing of the milk from normal cows. The long range objective would be to eliminate the factors that cause cows to produce milk with high cell counts. Attaining this objective would be doubly profitable in that it would permit cows to produce more milk and it would make it possible for all milk to be marketed.

¹Wm Philpot, 1969 Journal of Dairy Science 52 708

Summary

All Grade A milk marketed in Ohio will be sampled for somatic cells.

Producers having in excess of 1,500,000 somatic cells per milliliter will receive a notification letter.

A second unsatisfactory count within a six month period will result in an inspection by a representative of the health department.

If three of the last five counts exceed 1,500,000, the health commissioner shall require the dairyman to have his milk equipment checked and an examination of his cows by a veterinarian.

Inspections revealing violations of the milk regulations, which would cause high counts, will cause the issuance of orders of compliance within specific time limits.

Failure to comply with orders will initiate appropriate license action.

Compliance with Ohio's program will insure that dairymen qualify under the Interstate Milk Shipments Program.

Somatic Cells are white blood cells and udder cells are found in normal milk.

High counts of somatic cells indicate abnormal function of the udder and a modified secretion (above 500,000 suggests abnormality).

Common laboratory tests for somatic cells include Direct Microscopic Count, Catalase, Modified Whiteside, and Wisconsin Mastitis Test.

"Cow side" tests useful to dairymen are California Mastitis Test and Strip Plate or Cup with plastic top. (Not strip cup with screen top).

Milk revealed as abnormal by strip plate should be excluded from the market.

CMT through DHI is being used in Ohio as a guide to mastitis control.

CMT summaries on a herd can be used to monitor the success or failure of the mastitis control program.

CMT can help screen cows and locate the ones that need veterinary attention.

Cows with persistent "2" and "3" readings through lactation should be considered for dry cow treatment.

Continuing high CMT readings can be considered as a factor in culling decisions.

Quarters of udders secreting high somatic cells produce less milk than normal quarters.

Identification of quarters secreting high somatic cell milk and the discarding of this milk will permit the marketing of milk from normal cows.

The prevention of high somatic cell secretion by cows is a long range objective and depends upon a sustained udder health program.

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