

Factors Affecting Bacteria Count of Raw Milk

By C. Jensen¹ and Emily Plath²

There is a general relationship between the number and types of microorganisms in milk and its quality. Milk with a high bacteria count is more likely to possess flavor defects than milk of low count.

Microorganisms gain entrance to milk from two main sources, interior and exterior of the udder. The number of bacteria entering milk in the udder of normally healthy cows is usually much lower than in milk from cows affected with diseased udders. Ordinarily, the number of bacteria entering milk while within the udder are relatively small compared with contamination from external sources.

This report deals with the influence of certain factors responsible for variation in bacteria count of raw cows' milk. The experimental work was carried out preliminary to a study of the influence of various methods of washing and germicidally treating cows' udders and teats, and milking machine inflations, on the bacteria count of raw milk from the North Dakota Agricultural College dairy herd. A report of the latter work will be published in a later bulletin.

Variation in Individual Cows

To what extent can one expect the bacterial count of milk³ to vary over a period of time? In order to answer that, samples of milk were obtained from a number of cows in the college herd. The utensils, including milking machines, pails, and sampling dippers were clean and practically sterile, and the cows' udders and teats were carefully washed with a bactericidal solution containing 200 parts per million of the active germicide. Samples of milk from each complete milking were taken from the milker pail after removal of the milker head. The trials cover two test periods: (a) from October 6 to 16 and (b) from February 24 to March 12. Table 1 shows a pronounced spread between the high and low bacterial counts, both in the different samples from each cow, and as between the various cows in the group. In the (b) period, for example, the high cow averaged a count of 16,300, the low cow averaged 3,570. In the same period one cow's trials varied from a low count of 1,000 to a high of 16,500, and another from 2,000 to 23,000. With respect to average values, milk from nine of these cows gave higher counts in the (b) period, while milk from one cow had a greater average bacterial count in the (a) trial period. Prevalence of higher bacterial counts

¹Dairy technologist.

²Laboratory technician.

³The standard method of reporting the number of bacteria in a sample of milk is to express it in numbers of bacteria per milliliter of milk. A milliliter, the very small unit of volume used in the metric system, is equal to 0.061024 of a cubic inch.

Table 1. SHOWING THE BACTERIAL COUNT OF MILK FROM TEN COWS IN TWO DIFFERENT PERIODS OF TEST

(Counts expressed as numbers of bacteria per milliliter of milk)

Bacterial Counts								
First Test Period—Oct 6 to (The "a" Period) Oct. 15					Second Test Period—Feb. 24 to (The "b" Period) March 12			
Cow	No. of Trials	High Trial	Low Trial	Avg. of 5 Trials	No. of Trials	High Trial	Low Trial	Avg. of All Trials
385-1	5	6,000	1,600	3,300	7	32,000	7,500	13,800
386	5	5,000	2,800	4,040	7	25,000	1,500	12,140
400	5	6,000	2,700	4,480	7	8,000	2,500	4,640
401	5	16,000	1,400	5,460	7	5,000	2,000	3,570
402	5	8,000	1,600	4,224	4	7,500	1,000	5,075
411	5	4,000	1,000	2,460	7	23,000	2,000	10,000
503	5	10,500	4,500	7,700	7	34,000	7,000	16,300
517	5	5,500	500	2,860	4	7,500	2,000	5,000
521	5	8,000	2,500	4,140	7	16,500	1,000	5,210
547	5	12,000	500	3,820	7	6,000	1,000	4,570

in the (b) period may possibly be related to chronic mastitis in some of the cows in the experiment. It is generally known that a flareup of mastitis in a cow's udder is accompanied by an increase in the bacterial count of her milk, and this count drops with disappearance of the infection.

Method of Sampling and Bacterial Count

Sampling of milk for bacteria count from the milker pail poses a problem of possible accumulation of bacteria in the milker unit when several cows are milked with it and when it is not given bactericidal treatment between cows. In order to test the influence of this factor on the bacterial count, milk samples were drawn from a convenient section of the milker tube (of milking machine) during milking, by means of a sterile needle type syringe inserted through a sterilized section of the tube wall. A companion sample was obtained from the milker pail after a cow was completely milked, and bacterial counts were made of both samples. Data representing 18 samples from the tube and 18 from the milker pail are given in Table II.

Table 2. INFLUENCE OF THE METHOD OF SAMPLING ON THE BACTERIAL COUNT OF MILK

	Bacterial count of milk per ml. (av. 18 samples)
Milk samples drawn from milker pail.....	5040
Milk samples drawn from milker tube.....	3300
Difference in average count.....	1740

Results show higher bacterial count in the milk sampled from the milker pail than in samples drawn from the tube. The average difference in count with the two methods was 1740 bacteria per ml.

While the tube-drawn samples gave somewhat lower average counts, the milk was drawn intermittently during the milking and may not have been fully representative of the entire milking.

Variation in Different Quarters

Investigations have shown wide differences in the bacterial count of milk aseptically drawn from different quarters of the udder. In order to check this factor, five cows from the college herd were selected at random for the test. The milk was drawn from each quarter by means of a sterile catheter and run directly into a sterile sampling tube. Data representing the milk from five cows in the college herd are given in Table III, and show wide differences in bacterial counts of milk from each cow and also from the individual quarters of each cow. With cow No. 504-1 the bacterial count ranged from 150 to 3468 per ml. per quarter, while the milk from cow No. 519 showed less than 10 bacteria per ml. in each of the four quarters. With cows No. 502-1 and 423 the counts were less than 10 per ml. in the two front quarters and from 116 to 1142 per ml. in the rear quarters.

Although no data was obtained on the relative quantities of milk obtained from the different quarters, in some cases these differences were considerable.

Table 3. VARIATION IN THE BACTERIA COUNT OF ASEPTICALLY DRAWN MILK FROM DIFFERENT QUARTERS OF THE UDDER

Cow No.	No. Trials	Average bacterial count per ml. of milk drawn aseptically from quarters:			
		Left front	Right front	Left rear	Right rear
504-1.....	20	810	1130	3468	150
502-1.....	12	40	10*	500	890
519.....	4	10*	10*	10*	10*
423.....	4	10*	10*	116	1142
528.....	4	50	10*	10*	30

*Signifies less than 10 per ml.

The five-year decline in the number of milk cows which ended in 1949 left it the lowest in history compared with the population. However, consumption per person of all dairy products, except butter, was well above prewar. Consumption of several products such as evaporated milk, cheese and nonfat dry milk solids is at or near record levels. Record milk production per cow and more complete utilization of nonfat ingredients of milk has partly offset the decline in the number of cows.—USDA.

WHERE IT ALL CAME FROM

The drainage area of the Red River of the North at Fargo, North Dakota is 6800 square miles; its drainage area at Wahpeton is 4,010 square miles. The Wild Rice River near Abercrombie has a drainage area of 2,710 square miles. The Maple River at Mapleton has a drainage area of 1,480 square miles. (Data from Water Resources Review, USGS, March, 1950).