BACTERIOLOGY OF MILK

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Its Status As a Carrier of Pathogenic Organisms—Methods of Preventing Contamination—Economic Importance

For ages it has been known that milk sours upon standing. The knowledge that bacteria were the cause of this was not discovered until 1867, when Pasteur, a French bacteriologist, made one of his important discoveries in the field of bacteriology. It was not until later that milk was proved to be a carrier of pathogenic bacteria. Pathogenic bacteria are those bacteria which are capable of producing disease within the human body. They differ from the others or non-pathogenic bacteria in that they are very sensitive to any slight variation of temperature from that of the normal temperature of man, and can, therefore, be readily destroyed by pasteurization (heating to 140 degrees Farenheit for thirty minutes). Their growth is checked by lowering the temperature below 50 degrees Farenheit, but the organisms are not killed at this temperature and will again become active if the temperature rises.

Many epidemics of infectious diseases have been directly traced to milk. There are two general sources of this contamination, namely, from material of human origin and directly from the cow. The former is the most frequent and common source and gives rise to such diseases as typhoid, cholera, diphtheria, and probably the yet undiscovered germ of sarcocae. Milkers and all others handling the milk before it is bottled are apt to contaminate it with any one of the above mentioned diseases if they have been a recent victim of the malady or are suffering from a mild attack at the time of handling. It is a known fact that some people are carriers of disease for years after an attack of it, or in some cases they may never have been sick. This fact alone proves that it is a good policy for every city to require medical examination at stated periods for all employees of dairies and milk depots so as to remove this possible source of contamination. Progressive dairymen should do this regardless of any such regulation as a matter of protection to his customers and as a business proposition as he can make this one of his strong sales arguments. The consumer is always willing to pay a little more for a product which he is sure is first class.

There has been much disagreement between bacteriologists as to whether the tubercle bacillus is transmitted to humans through milk. In the course of this disagreement much intensive study has been made on the subject. They have found that the bacillus causing human tuberculosis differs from that causing tuberculosis in cattle; consequently the two forms have been designated as human tubercle bacillus and bovine tubercle bacillus. The next and logical procedure was to see if one was capable of producing the disease in both humans and cattle. It has been definitely proved that the human tubercle bacillus is able to produce the characteristic lesions in cattle. There are also cases on record in which veterinarians have become accidentally infected with the bovine tubercle bacillus through wounds, resulting in a typical localized case of tuberculosis and while the milk from all infected cows is very dangerous, only those cows with tuberculosis localized in the udder are capable of contaminating the milk. However, this is not an argument for killing only those cows with infected udders as one cannot tell which cows have infected udders or when the disease is going to spread to the udder. Furthermore, an infected animal acts as a spreader of the disease to the entire herd.

Foot and mouth disease is probably the most readily transferred through milk, but since it is not very common in the United States it has been confined to localized districts. Arizona has so far been able to avoid any serious attacks of this disease.

The great variety of bacteria induced in milk by an inflammation of the udder known as mastitis or garget are of importance, not that they individually cause any particular disease in man, but that the whole group cause a general upset of the digestive system.

Other diseases of lesser importance coming direct from the animal are Actinomycosis and Anthrax from cows' milk and Malta Fever from goats' milk.

In addition to the Pathogenic bacteria milk contains many Non-Pathogenic or harmless bacteria. These non-pathogenic bacteria might be classified as pathogenic in regard to infants. They do not produce disease individually, but when in great numbers they give rise to summer complaint or infantile diarrhea. This is especially true when a child is given cow's milk while very young. The older the child the less the danger. The trouble always appears in the summer, the resistance of the child being cut down by the depressing effect of hot weather, and the effect of abnormal fermentation and putrefaction of the milk within the body. Harmful effects will result if the bacteria count runs over 1,000,000 per cubic centimeter, and the smaller the number the less chance there will be of complaint.

The non-pathogenic bacteria in vegetative or common form are killed by pasteurization. However, they have the ability to form spores which is a highly resistant stage having the
ability to go through periods of unfavorable temperature, etc. These spores have been kept in unfavorable environment for as long as twenty years, and when again placed in suitable conditions of temperature, moisture, food, etc., they grew and reproduced normally.

Pasteurization has its place in keeping down the number of bacteria in milk, but why not go back a step further and do all that is possible to prevent excess contamination of the milk? This can and is being done to a great extent by many dairymen. Many others who have not made a study of the matter are not doing it.

To begin with, milk is not absolutely free from bacteria when first drawn from a healthy udder, but the number of bacteria per cubic centimeter is so small that very little thought is given to them. It is while milking and during the process of handling that the most serious contamination is likely to occur. In the first place, dry hand milking should be practiced as any other method is very unsanitary, the udders and flanks of the cows should be brushed and wiped with a damp cloth to remove all dirt and straw. The use of covered top milking pails prevents a great deal of foreign matter from falling into the milk. In the milking barn and all other places where the milk is handled the air should be free from dust as it carries countless bacteria on every particle.

The use of a milking machine will cut down the contamination considerably—providing the operator cleans it thoroughly. Many have fallen down on this point and have caused the number of bacteria to increase rather than decrease.

Now that the number at the beginning has been cut to a minimum, the next problem is to keep them from multiplying. On the average each bacterium gives rise to two new ones every half hour and at this rate the total number at the end of only a few hours would be enormous. This, however is under favorable conditions, and upon this fact alone the milk producers have found a way to keep down the multiplication of bacteria. In the case of milk two methods are practiced, pasteurization or heating, and cooling to below 50 degrees Fahrenheit. The most important is probably pasteurization if it is immediately followed by cooling to below 50 degrees Fahrenheit. The other method is the cooling and holding of the milk below 50 degrees Fahrenheit.

In the first case the heating kills all but the spore forms and in both cases the cooling and holding at that temperature prevents any further growth. The cooling does not kill the bacteria, however. Cleanliness is a very important factor. One cannot conceive of good milk being produced in dirty surroundings, handled by dirty workmen, and coming in contact with dirty equipment. In fact it is impossible for one to be too clean, however, there is an extreme beyond which the dairyman ceases to make a profit on his outlay.

Besides playing an undesirable role in milk production, bacteria also have a very important part in production of milk by-products. Certain types of bacteria sour milk and cream by their action on the milk sugar, breaking it down into lactic acid. Others cause a partial digestion of the milk solids such as casein, whereby different kinds of cheeses are made. The Bacillus Bulgarinos, one of the types which causes milk to sour, is very important in combating intestinal putrefaction in humans.

A MILKER EQUIPPED AS IN THE ABOVE PICTURE IS ENTIRELY OUT OF PLACE ON THE MODERN DAIRY

Even though bacteria are very small in size, they are mighty in that they give man a great deal of trouble as well as aid in different processes vital to his welfare.

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