

Milk; Its Nature, Composition
and Yield

by

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Milk: Its Nature, Composition and Yield.

Milk is a fluid opaque in color and composed of water and certain solid constituents, part in solution and part in suspension. There is 11.5 per cent of total solids found in milk 8.5 per cent of these are solids, not fat, while the remaining 3 per cent are fat. Chas. Cameron, the public analyst never found the total solids in ripened milk to fall below 12%. There are many variations due to a number of different causes. Among them may be individuality, breed of the cow, period of lactation and the feeding. In choosing milk cows, choose a good milking breed. Many give large quantities, but do not give rich milk. It may be also that the cow gives a large yield of milk and it may be of good quality.

The Jersey and the Guernsey have been tested, and have been found to give the largest and richest yield of any breed. The Guernsey give a heavy flow

of milk which is highly colored and shows a large percent of butter fat. It is undisputed today among the dairy-men that the Guernsey butter has the highest natural color of any breed and that they are the most economical butter producers.

A good dairy cow should give at least five thousand pounds of milk during the period of lactation, the yield of fat is better to go by, than the milk given during period of lactation. Three-fourths of a pound of butter fat a day is considered a good yield. Many dairy farmers aim to have their dairy cows produce a pound of butter a day, or on an average of a pound for every day in the year. To do this a cow's milk must test 4 % and give an average of three gallons for every day for the year round. Seldom a cow milks during the whole year. The period of lactation varies with the different breeds. In some very rare cases the cow has been known to give milk the year round. As a

general rule, cows give milk for about eight months. In some cases, the cow ceases to give milk in a very short period after calving. Our American expert who has made a special study of this, says "that on an average, cows give the thinnest milk after calving; it becomes slightly richer during the next two weeks and then it holds almost uniform in quality for four or five months after which it gradually increases in richness as the cow comes near calving again, and by the ninth month from the last calving is only about one-fourth richer than it was during the early months." We see from this that the difference in milk during this period varies only in fat, the total solids not fat remaining exactly the same.

The feeding is mentioned as a condition influencing the quantity and yield of milk. This does not receive the attention it should, and it is for this reason that our Kansas dairymen do not make it a success. The importance of having

a properly adjusted diet for milk cows is very great, and unless the cows are properly fed they cannot be expected to yield their maximum quantity of milk. There are three food nutrients; the albuminoids, fats and non-nitrogenous bodies. The first named has by far the most important influence upon milk. An insufficient amount of albuminoids will have the effect of diminishing the yield of milk. The fat and non-nitrogenous substances have not so much influence on yield of milk. So far as experiments have shown, the fat has the effect of the production of milk.

The feed of the cow should be perfectly clean. A cow should have a mixed diet. She will give a much larger quantity of milk if she can have some palatable food. An abundant supply of water should be near at hand, so that the cow can drink at any time she chooses. This is necessary to the highest production of milk. The water should be as clean and free from as that which we

drink. In one of the cities of the United States, there were many cases of typhoid fever, and every means was taken to find the source. After testing the water supply and examining the sewerage they almost gave the cause up. One of physicians of the city happening to pass by saw the cows standing in a stagnant pool. On examining the water, it was found full of typhoid fever germs; the cows carried them and they got of the cow on the milk and were carried in that way. Cows should be fed five or six hours before milking. When cows are stalled and well fed between 6 A.M. and 8 P.M. the evening's milk is produced under excellent conditions. But standing without food for a long night, until morning, the quantity yielded may be larger owing to the long period over which the secretion has been undisturbed, but the quality can be scarcely so good. The health of the cow often affects the yield of the milk, and any real derangement affects the composition. The milk under such conditions often

contains a great deal of water, and very little butter fat. Normal milk is secreted by only by well fed and healthy animals; which treatment renders them docile and contented. If these conditions are changed, and the cows subject to furious driving, brutal treatment and fright, its composition changes, and it is no longer fit to use in any way. Some one says "cows giving milk should never be excited or abused, should not be driven faster than a walk and should be sheltered from heat in summer and cold in winter."

Many experiments have been made as to the quality of the first and last milking. It is said that the milk of the first portion of any single milking is relatively poor and increases in richness to the strippings which are relatively rich.

The New York Experimental Station found in the case of five cows that the first pint of milk contained .3% of fat while the last pint contained 6.85

percent, and the whole averaged 2.5%. A cow's milk may vary daily. Milk of the same cow differs both in composition and yield from day to day. Babcock says that the milk may vary in yield fifteen percent, and the amount of fat as much as five percent.

There is generally a marked difference in the percent of fat between the nights and mornings milk. If farmers would see that when their cows were milked twice a day, the intervening period between the milkings was exactly the same, and have other conditions similarly favorable, there will be no practical difference as to the quantity and quality. If however the intervening period be unequal, it will be found that the milk contained after a longer interval is greater in quantity but poorer in quality than that obtained after the shorter interval.

With our experience we have seen that the time between the milking, the food and the treatment of the cow makes the greatest difference. Many farmers have been

suspected of being dishonest, and the farmers have in turn accused the creamery of cheating them when their milk did not test good. The cause was with the farmers. Their milk very early in the morning, and work all day, which causes the milking to be done late in the evening. Under these conditions, the evening's milk contains the largest per cent of fat. The quantity of milk yielded by a cow depends upon the activity of the milk glands in the udder. The cow has the power of what is known as "holding up her milk". When a cow is milked oftener than twice a day she will give more and richer milk. It is well not to change milkers for this will tend to retard the secretion of milk. If a cow loves her milker, she will let her "milk down", and she will give a larger quantity and a better quality.

The specific gravity of milk when carefully taken assists in determining its purity, and to a smaller extent, its quality. It may be taken by weighing

but as this is very hard to do we use an instrument called a lactometer. As milk varies in quality, its specific gravity cannot always be the same. Fat is lighter than water but the remaining constituents are heavier; so if the cream is removed the specific gravity is raised. If cream is added to the whole, the specific gravity of the milk is reduced. The specific gravity of average milk varies between 1.029 and 1.032. If it is over 1.033 or under 1.028 it may be suspected.

The various constituents of milk may be classified as, water, fats, albumoids, sugar and ash. Excepting the water they are known as milk solids. All the milk constituents vary more or less in quantity, and may vary widely. Therefore it is not possible to make a statement of the average percentage composition of milk that will give more than a general idea. The following are given by Babcock, Water, 87.17; fat, 3.69; casein, 3.02; Albumen, .53 Sugar, 4.88; and Ash, 7%.

When a cow is unwell, she very often falls away in her milk, and the microscope shows the presence of colostrum corpuscles. In order to understand this, we must find out what colostrum is. Dairy writers differ widely in their opinions. Dr. Bird states that the colostrum of a cow is yellow, mucilaginous and is occasionally mixed with blood. It merely contains traces of butter fat and albumen appears to be one of its chief constituents. This does not turn sour like milk, but putrefies. Another writer says that it gives butter a very yellow color, and when heated gives it an odor, like the white of an egg. After four or five days after calving, the milk loses its colostrum character, and takes on its normal condition. The change is a gradual and progressive one, depending some what upon the health of the cow. When milk is given in this condition, it is in no way fit to use.

The fat of milk, or butter fat as it is commonly called, consists chiefly of an

intimate mixture of the glycerides of fatty acids, among which are oleic, palmitic, stearic and butyric. The fats are of two kinds, volatile and non-volatile.

The volatile fats are the ones that give the odor and flavor to the milk. They make up only a small portion of the total fat of milk. The chief volatile fats are butyric, capric, capricole and nutter. Of these butyric is the most important. It gives flavor to the milk and butter. Butyric readily decomposes and forms butyric acid, which is the chief element in the rancid taste that butter acquires after long standing. There are a large number of volatile oils that are present in the food of the cow, and that impart to the milk the characteristic flavours of such foods. The volatile fats that are derived from the food may give either agreeable or disagreeable flavours to the milk. The strong flavours of food such as turnips, onions, garlic etc., very often taint the milk and are of much annoyance, but with proper precautions, the bad results

may be greatly lessened, and in time be entirely obliterated. Since these oils are volatile, they easily pass through all the tissues of the animal, and in a very short time we shall find them present in the milk as well as the other tissues. If sufficient care is taken as to the time of feeding, and milking, that the milk shall be drawn not less than ten or twelve hours after the undesirable food has been eaten, there will be slight danger of contamination of the milk by it. Also by feeding them on some dry food for three or four hours before milking, there will be a great deal less of annoyance from this source.

The non-volatile fats make up about ninety two percent of the whole amount of fat, and consist almost entirely of three fats, known as olein, palmitin and stearin. Olein is a liquid at ordinary temperatures, while palmitic and stearic are solids. Casein is the chief albumoid of milk, although there are always present small quantities of other constituents, containing nitrogen. Casein

is used in the manufacture of cheese, and is the chief constituent that goes to form curd when milk is used as a food. Casein is precipitated from milk by the action of rennet, and by dilute acids, it is not precipitated by heat. This distinguishes it from albumen which is precipitated by heat, and not by rennet or dilute acids. The fibrin of milk is present in extremely small quantities. Dairy writers differ much on this. It is assumed to be the same as blood fibrin, and coagulates upon exposure to the air, but does not form a clot. It is retarded by cold, and is prevented by rapid freezing. The coagulation, however, takes place again when it is warmed. It may be also prevented by certain chemical reagents.

Milk sugar is formed only in milk. It has the same chemical composition as cane sugar, but a very much less sweetening power. By the action of lactic ferment it is readily changed into lactic acid, the effect which is to coagulate the casein of milk. Milk

sugar does not readily undergo alcoholic fermentation.

The ash is the smallest and least variable constituent of milk. It is composed of the phosphates of lime and potash, the chlorides of potash and soda, and small amounts of phosphate of iron and magnesia. Most of these salts are in solution. Ash is the non-combustible part of plants and goes to make up the bones of the animal.