THE STORY OF EVAPORATED MILK

WITH SUGGESTED EXPERIMENTS FOR CLASSROOM USE
THE STORY OF EVAPORATED MILK

A STUDY TOPIC

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Some Necessary Definitions

Evaporated Milk, also called "unsweetened Evaporated Milk," is just good rich milk, twice as concentrated as ordinary milk. Nothing has been added to the natural cow's milk from which it is prepared and nothing taken away except water, 60% of which has been removed by evaporation. It has been sterilized so that it is free from any bacteria that might cause it to change from its original condition of freshness.

Two other important forms of concentrated milk are the following:

Condensed Milk, sometimes called "sweetened Condensed Milk," is just as concentrated in milk as is Evaporated Milk, but it differs from Evaporated Milk in that it contains cane sugar which is added to preserve it.

Dry Milk, also called "Powdered Milk," is as its name implies, without more than a trace of water. Nothing has been added.
The Story of Evaporated Milk

I—Historical

"The use of milk of animals as food by man goes far back of all recorded history."—Rogers.

We know that the milk of cows, goats and other animals has been employed as food for thousands of years. The Old Testament mentions the use of milk in forty-four places. In the 18th Chapter of Genesis, it is recorded that Abraham while being visited by three Angels "took butter and milk and the calf which he had dressed and sat it before them; and he stood by them under the tree and they did eat."

Probably very soon after the ancients became acquainted with the food value of milk, they tried to find ways to keep it from spoiling. Soured milks and fermented milks gave some success in this direction, and we know that several attempts were made to produce, by evaporation, milk pastes and powders. It was, no doubt, through efforts to keep the food substance of milk for a longer time than fresh milk would keep, that led to the making of butter and cheese. Butter was used by the Hindus as early as 2000 B.C., both as a food and in their religious ceremonies, and it is mentioned by the early Hebrew, Greek and Roman writers.

Butter and cheese, while food articles of tremendous importance, contain only part of the food substance of milk. In butter, practically the only part that is retained is the fat. In cheese, the casein, fat and much of the mineral part are conserved but the lactose (milk sugar), most of the albumin and much of the minerals are lost. The real need throughout the ages has been for milk with permanent keeping quality and with none of its food constituents lacking or impaired.

Some Important Discoveries

When France, under Napoleon, was fighting the other nations of Europe, food for the French armies was one of the greatest problems. The French Government, as a military measure, offered a prize of 12,000 francs—a good deal of money in those days—to any one who could find a satisfactory method for preserving food. A man by the name of Nicholas Appert set out to win the prize.

After fifteen years, in 1810, he announced that he could preserve food by first heating it and then sealing it in an air-tight container. This was the beginning of the art of canning. Appert was given the prize and is called the "Father of the Canning Industry." At that time attempts were
made to preserve only fruits and vegetables; it did not occur to anyone that milk might be kept in the same way.

To Nicholas Appert, then, belongs the credit for a very important discovery. Yet, strange as it may seem, he had no idea as to why it was that food heated and sealed in air-tight cans would not spoil. The French Government assigned the task of finding the reason to another investigator. This was the famous scientist, Gay-Lussac. His conclusion was that canned food remained wholesome because the air was kept from it. This was a remarkable conclusion to have been reached in those days, but, as we shall see, he was only partly right.

Then came one of the greatest of human benefactors, Louis Pasteur, who demonstrated to the world the nature and behavior of microscopic organisms. Now we know that foods spoil because of the presence of these organisms, (bacteria, yeasts and molds). We also know that if food is heated sufficiently to destroy them, then kept away from air that carries germ-laden particles, it will remain good indefinitely. The latter is accomplished, of course, by sealing the can air-tight just as the housewife seals her cans in preserving fruit and vegetables. All this is not to keep out the air itself, but to exclude particles of dust and moisture in the air which usually carry microscopic organisms active in causing food spoilage.

The Canning of Milk

The idea of preserving milk by concentrating it and heating it in sealed cans was brought to Highland, Illinois, from Switzerland, by John Meyenberg. It was in this little country town, near St. Louis, in 1885, that Evaporated Milk was first prepared commercially. Then it was only after several years of struggle and experiment that Evaporated Milk became a commercial success.

The Influence of Wars

How the military needs of France led to the beginning of the canning industry has already been pointed out. It is most interesting to note how the circumstance of war influenced the development of Evaporated Milk. Twelve years after it was first produced, the Spanish-American War came. Up to that time Evaporated Milk had been used only in out-of-the-way places where other milk could not be had. Our Government bought it for the army. Thousands of men learned about it, and when they returned to their homes they continued to use it and told their friends about it. It soon came into use in every city, town and village in America.

In 1914, Evaporated Milk had so grown in favor that ten million cases—nearly five hundred million cans—were produced in the United
States that year. When all of Europe again went to war, more than a hundred years after the time of Appert, the armies had milk in the camps and even in the trenches. Millions of cases of Evaporated Milk went from America to the allied armies. Millions more went to feed the civilian population of England, France, Italy and Belgium.

During this period most of the cattle in the warring nations of Europe were either killed or inadequately fed. Consequently, after the Armistice was signed, great quantities of milk continued to go to those countries as well as to Germany and Austria—to all the countries where war had left destruction and suffering. At that time the people depended almost entirely on evaporated and condensed milk imported chiefly from the United States. In 1919, we exported 728,740,509 pounds, most of it going to Europe. Herbert C. Hoover, then head of the American Relief Administration, recently made the following statement: "This organization and its allied organizations exported from the United States, for the use of these children upwards of 500 millions of pounds of condensed (evaporated and condensed) milk during the period of the war and reconstruction. It could be very well said that the saving of millions of children was accomplished only by virtue of the strength, the resilience, of the American dairy industry."

How the American soldiers of the Spanish-American War became acquainted with the good qualities of Evaporated Milk and continued to use it after returning to their homes has already been mentioned. A similar story can be told of the influence of the World War, except that it was on a much larger scale. The people of Europe at home as well as at the front learned that their health could be maintained by regularly using Evaporated Milk instead of the raw milk to which they had been accustomed. It seems now that in every corner of the world people are demanding Evaporated Milk and few, indeed, are the villages and towns where it cannot be purchased.

Some Significant Figures

In the United States alone, 1,600,000,000 pounds of Evaporated Milk are used each year, 4,400,000 pounds every day. If all these cans of milk were shipped at once from the same point, a train of 53,000 freight cars would be needed, and the train would be about 470 miles long. If these cans were placed end to end they would go five and a half times around the earth at the equator. (More interesting facts are given on pages 24 and 25.)
II—How Raw Milk Is Transformed
Into Evaporated Milk

"Where nature furnishes the materials, they are still rude and unfin-
ished, till industry, ever active and intelligent, refines them from their
brute state, and fits them for human use and convenience."—Hume.

If you should take two gallons of good, rich milk and boil it in an
open kettle until but one gallon remained, you would have a milk
of almost the same composition as the Evaporated Milk you buy from
the grocer. It would not, however, look much like the commercial variety.
It would probably be scorched, partly coagulated and there would be a
scum on the top of it. One of the requisites of making good Evaporated
Milk is to evaporate it quickly at a low temperature. This is accomplished
by using kettles so enclosed that all, or nearly all, the air can be pumped
out, thus producing a vacuum. If you ever have a chance to visit a milk
plant where Evaporated Milk is being prepared, you will see several
brightly polished closed vessels in which this process is carried out. These
are called "vacuum pans."

The Reason for the Vacuum

Many people have had the experience of attempting to boil eggs on
the top of a high mountain. They find that although the egg has been
in vigorously boiling water for five or six minutes, still it is not hard
boiled. If they had immersed a thermometer in this boiling water, they
would have observed that instead of boiling at 212° F. as water should
boil and does boil at sea level, the temperature was really less than 200° F.
The reason for this is simple enough: The pressure of air is less on the
mountain top than at sea level, and for this reason the water boils more
readily, that is, at a lower temperature.

Now the effect of the vacuum pan is the same as if the boiling took
place on the top of a mountain so high that the peak is entirely above the
atmosphere. With the air pressure removed from the surface of the milk, it
will boil vigorously and the water will evaporate off rapidly at about
130° F., which you see is only 32° above the temperature of the human body.

This not only prevents scorching and coagulation of the milk, but it
has another important advantage—scientific workers have discovered
that foods containing vitamins can be heated for a longer time and at
higher temperatures without destroying the vitamins provided the air
is kept away. At no stage of the process of preparing Evaporated Milk
is the milk heated to a high temperature in presence of such amounts of
air as to be a factor in this connection. This is one of the reasons why
Evaporated Milk is such a highly nutritious food. Other reasons will
be given in the third chapter.
Figure 1
Drawing of the vacuum pan and accessories. Here 60% of the natural water is removed from milk at a low temperature.
In Figure 1 will be found a very good representation of the vacuum pan together with its accessories. The student may obtain a good idea of the details of its operations by carefully studying the drawing. Vacuum pans as they appear in the factory are shown in Figure 2.

However, we are getting a little ahead of our story. Let us go back to where the milk comes into the plant and see what is going on there.

**Receiving the Milk**

Trucks filled with ten-gallon milk cans, covered with canvas to keep them cool in summer and prevent freezing in winter, bring the milk from the farm and deliver it at the receiving room of the plant.

Inspectors have already been sent out to each farm for the purpose of seeing that the milkers, the dairies and the cows are clean.

As the milk comes into the plant a sample is taken from each can and tested. See Figure 3. The milk must be of good quality, fresh and sweet, and must meet the standard requirements as to composition. Not a chance in the world for the farmer to have skimmed off a little cream for his morning coffee! The temperature of the milk is also taken, for the farmer must keep the milk cool until it reaches the plant.

When the milk has passed this inspection, it is weighed, and pumped into a large holding tank where it is kept cool until ready for the evaporation process.
Evaporation of the Water

The operation of the vacuum pan has already been described in detail. The pan operator takes great pride in keeping his pan spotlessly clean and shining. The pan is, of course, carefully washed every time it is used, but every morning before starting, live steam is turned into all corners and into all pipes leading into and out of it. This is for the purpose of killing every germ that might have remained behind.

Milk from the holding tank is then run into forewarmers where it is quickly heated and from here it goes to the pan where it is allowed to boil under vacuum until for every 2,000 pounds of fresh milk about 897 pounds remain. From the pan the milk is pumped to a very peculiar but important machine called the homogenizer.

Homogenizing the Milk

The common spray atomizer is about the nearest approach to a homogenizer as anything in every day life, but it is by no means the same. The process of homogenization consists in forcing the milk to pass
through an extremely small aperture. The opening is so small that it takes a pump working at 2,000 to 3,000 pounds pressure to make the milk go through. Due to the friction between the fat globules when passing through this aperture and to the sudden expansion on release of the pressure, the fat globules are broken up into numerous smaller ones. This has sometimes been referred to as “grinding” the milk, the effect on the

Freshly evaporated milk enters under a pressure of about 3500 lbs per square inch.

Large fat particles cause cream to separate.

These openings would be about 1/10,000 of an inch.

The minutely broken up fat particles leave the homogenizer blended with other milk elements.

Figure 4
Diagram illustrating the process of homogenization

fat particles is, indeed the same as if they had been ground in a mortar. Figure 4 illustrates the principle of homogenization. A view of the homogenizer is shown in Figure 5.

There are two important reasons why we homogenize Evaporated Milk. One is, that the fat particles are made so small that they remain evenly distributed throughout the milk—they will never rise to the top to form cream as they do in ordinary milk, for the reason that the gravitational force tending to make these small fat globules rise is less than

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the force necessary to push them through the viscous milk. When you opened the can of Evaporated Milk, you may have wondered why there was no cream line as would be the case with bottled milk. Evaporated Milk really contains more than twice as much butter fat or cream as average bottled milk, yet you might not judge this to be the case since the cream has not risen to the top.

The other important result of having the cream in a homogenized form is that it is more readily digested. It is a matter of common knowledge among nutrition workers that Evaporated Milk is more readily digested than raw milk. But more will be said about this later.

In the experiments at the back of this book it is suggested that you observe the fat globules of Evaporated Milk and of ordinary milk under the microscope. If you have had the opportunity of doing this, you found that there is no difficulty in seeing the fat particles of ordinary milk, while it is a real task to find them in the Evaporated Milk specimen. The reason for this is now, of course, clear.

A photograph made by focusing a camera into a microscope is shown in Figure 6. This picture shows how the fat globules of ordinary milk and of Evaporated Milk compare in size.
Canning the Milk

The milk is now ready for canning. The "vent-hole" type of can is used. This is shown in Figure 7. The cans are made of clean bright tin plate, and are completely closed except for a small hole in the center of one end.

The machine (See Figure 8) that fills the can is provided with small tubes not much larger than the "lead" of a lead pencil. This tube goes down into the small hole of the can and through it is forced a carefully measured quantity of the milk. The Government requires that there be in a can no less milk than is stated on the label. Upon this filling machine, then, rests the responsibility of making good the company's guarantee. Needless to say, it is carefully checked and tested at intervals all day long.

![Figure 6](fat_globules_in_evaporated_milk.png)

Fat globules in Evaporated Milk (Left) and in bottled milk (Right). Magnification 1,000 times. On account of the small size of the globules in Evaporated Milk, the cream does not rise.

After the correct amount of milk has been delivered into the can the small hole is immediately closed with a drop of solder. This effectually seals it air tight.

Sterilization

As commonly used, the word "sterilize" means to destroy all germs or bacteria present on or in the thing to be sterilized.

Bacteria are practically everywhere. In the center of a furnace, of course, none would be found. But air, water, soil and almost everything else upon the earth carry bacteria unless they have been sterilized by heat or by some other means. The moment cow's milk comes in contact with the air or milk pail, bacteria are sure to find their way in, and they imme-
diately and rapidly multiply so long as the milk is warm. That is why the farmer has to cool it and why it is kept cool in the factory. Most of these bacteria are harmless but they will cause the milk to sour nevertheless, and there may be harmful bacteria among them. The best milk that can be obtained, such as certified milk, contains from 1,000 to 10,000 bacteria per gram of milk; that would be 5,000 to 50,000 bacteria per teaspoonful.

Regardless, therefore, of the vigilance that is observed in the factory to keep everything spotlessly clean, common air bacteria are likely to be in the can of Evaporated Milk after the little hole is finally sealed with solder. In order, then, to destroy these remaining bacteria and thus make it possible for the housewife to obtain Evaporated Milk entirely free from harmful germs and in its original condition of freshness, the sealed cans of Evaporated Milk are sterilized.

One type of sterilizer is a large steel tank—a drawing of this appears in Figure 9. At one end is a door through which a small truck passes. This is loaded with thousands of cans, rolled into the sterilizer and the door clamped shut. Water and steam are introduced and the temperature raised to about 240° F., where it is held for 15 minutes.
Another kind of sterilizer is a continuous type, in which a stream of cans is caused to travel without interruption through heated compartments. The main advantage of the new sterilizer is the time saved in handling the cans in loading and unloading. See Figure 10.

The filling machine. As the can passes around the circle, a small stream of milk is forced into the opening by means of a small nipple. When the round trip is made, a drop of solder automatically and effectively seals the can.

The heat of sterilization not only destroys any bacteria that might later cause the milk to spoil, but at the same time, it renders the protein easier to digest. The heat of sterilization also has the effect of giving Evaporated Milk a definite flavor. People who have not had
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frequent occasion to use Evaporated Milk sometimes think the taste strange. It is a flavor, however, that one soon learns to like. Many people like it from the first, and children will almost always consider Evaporated Milk a real delicacy. Wherever you recognize this flavor you may know that you have milk which has been sterilized by heat and therefore absolutely safe. It is a stamp that marks the purity of Evaporated Milk as indelibly as if the following words appeared on the label: \textit{No Harmful Bacteria Can Be Present.}

![Figure 9](image)

Figure 9

Drawing of a sterilizer. The truck is filled with cans of milk and rolled through the door into the sterilizer. The door is clamped shut and steam applied. After the cans emerge, the milk is as safe as if there were not a germ in the universe.

Labelling and Packing

Figure 11 is a picture of a machine that labels the cans and arranges them for the purpose of placing them in cases. The cans are made to roll along a track at an astonishing speed. At one place in their journey, they are touched on one side so as to leave a few spots of glue. Rolling on, the sticky side of the can picks up one end of a label and then wraps itself up in the label as a little boy might roll himself up in a rug on the floor. The other end of the label then picks up another spot of paste which seals it to the first end. The cans are now ready to be packed in cases.

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There are two sizes of cans of Evaporated Milk sold by the grocer; one is the so-called "baby size" or small can which holds six ounces of milk, and the other, the "tall size" which holds just 14½ ounces. There are larger sizes for restaurants, hotels, bakers and ice cream makers; these cans hold about one gallon of Evaporated Milk.

The six-ounce cans of Evaporated Milk are packed in cases holding 96 cans or 48 cans, and the 14½ ounce size, 48 to the case. Now you perhaps know more about what a "case" of Evaporated Milk is than you did in the earlier part of the discussion when you read about the millions of cases of Evaporated Milk.

Figure 10
A row of continuous sterilizers in the plant. Note the cans of milk entering the machine.

The Chemist

Naturally, a good many of the details relating to the preparation of Evaporated Milk have been omitted in the preceding discussion. One of those details, and it is a detail of great importance, is the work of the chemist. Not only does he check up on the milk as it comes into the plant to see that the farmer has done his part in conforming to the requirements, but he must also make a very careful check on the composition of the milk before it can go out of the plant.
Figure 11
This machine labels the cans and arranges them for placing in cases. As the cans roll through, the labels are automatically picked up and attached.

Figure 12
After a final thorough testing, the perfect cans of Evaporated Milk are packed in cases and shipped rich and fresh to all parts of the world.
The Government requires that there must be not less than 7.8 per cent fat nor less than 25.5 per cent total milk solids in every package of Evaporated Milk on the market. Actually evaporated milk contains on the average 7.9 per cent fat and 26.3 per cent total solids. So the milk is generally of higher food value than the government specifies.

Our Government publishes a little circular called "Definitions and Standards for Food Products." It may be obtained free from the Superintendent of Documents at Washington, D. C. If you are interested in knowing the requirements that must be met in preparing Evaporated Milk as well as most other foods, you should send for a copy of this publication.

The diagram shown in Figure 13 has appeared in print a number of times and, no doubt, many students have seen it before, but it very well represents the relative chemical composition of Evaporated Milk and ordinary milk.

Figure 13
A diagram showing the relative composition of Evaporated Milk and the raw milk from which it is prepared.
III—The Nutritive Value and Consumption of Evaporated Milk

"Wouldst thou enjoy a long life, a healthy body, and a vigorous mind, and be acquainted also with the wonderful works of God, labor in the first place to bring thy appetite to reason."—Benjamin Franklin.

Wonderful, indeed, have been the discoveries in the past 25 years of the causes of disease! And it is astonishing to note how one disease after another has been attributed to improper diet. Scurvy, that has afflicted the human race for centuries, has within the last 15 years been shown to be due simply to a lack in the diet of one of the vitamins. Rickets, that dreaded malady of childhood, which marks a boy or girl for life, can be prevented by including in the baby's diet a food containing another of the vitamins. Goiter, certain forms of anemia, pellagra, some of the eye infections, diabetes, beri beri, asthma, hay fever, uric acid disturbances, hives, colds and what not, are either the result of dietary errors or greatly influenced by the choice of food.

Where disease is caused primarily by germs, careful diet is important; the outcome of such a disease often depends upon the patient's ability to build up a resistance within his body. We are frequently coming in contact with the germs of tuberculosis, pneumonia, possibly influenza and other diseases. If we are to win the continual battle against disease we must supply the defending army with proper food.

Milk, a Complete Food

There is no article of diet that can be said to be a perfect and complete food for all ages of people. Milk most nearly meets all the requirements and it can, without doubt, be said to be a complete food for the very young. It contains everything that is necessary for the building of bone, muscle, brain and nearly all tissues. A person will undoubtedly have better health when his diet includes a liberal supply of good, rich milk.

Evaporated Milk, a Particularly Rich Form of Milk

It is hard to understand why some people have had the idea that Evaporated Milk is something very different from what it really is. Some very well educated people even, have thought that it is skimmed milk, or that it has a preservative in it. Some have thought that it is the same as condensed milk, which contains added sugar, and others that the process of preparation has destroyed certain of the valuable properties of the natural cow's milk. The foregoing description of the
process of preparation shows that such ideas are not founded on facts. In order to make perfectly clear the facts about Evaporated Milk, we shall take up its various characteristics, point by point.

1. Evaporated Milk is Rich Milk—It was pointed out in the discussion on the preparation of Evaporated Milk that the chemist is continually analyzing the milk which the farmer brings to the plant to make sure of its quality. He also analyzes the milk as it leaves the plant to make sure that it contains at least the 7.8 per cent fat and 25.5 per cent total milk solids which the Government requires. Since these figures are twice as great as the percentages of fat and total milk solids in ordinary bottled milk, and since also the minerals, casein, milk sugar and all other constituents must also be twice as great, one is surely justified in saying that Evaporated Milk is a rich milk.

2. Evaporated Milk is More Readily Digested Than Raw or Pasteurized Milk—As early as 1905, scientists began to make a study of Evaporated Milk for the reason that it was then gaining considerable prominence as a form of milk for regular use. In the MEDICAL NEWS published in November of that year, Timothy Mojonnier described the results of his experiments in which he had compared Evaporated Milk with raw, pasteurized and boiled milk. In every test, which included a test with a small child, he observed that Evaporated Milk was more easily digested. Evaporated Milk is so readily digested that it has proved to be the best of foods for babies when mother’s milk can not be had. Doctor Kerley, a prominent New York physician, states in one of his well-known books, The Practice of Pediatrics,—‘‘Many infants of very weak digestion will thrive on evaporated milk when all other artificial methods fail.’’

3. Evaporated Milk Contains Vitamins—Almost every one these days knows something about vitamins. Newspaper and magazine articles are continuously telling us about these mysterious substances. Authorities disagree as to the exact number. It seems there are seven or more. At any rate certain ones have been definitely established and letters assigned to them. We know that if any one of these is not supplied in our food, a specific disease appears.

Vitamins

On vitamins A and D in Evaporated Milk, we may examine the unpublished findings of Farmer and Lemkau. Both vitamins, these workers found, are present in Evaporated Milk to the same extent as in the original milk, unaffected by evaporation, homogenization, sterilization, or stor-
age. Barnes, who observed a group of infants, reached the identical conclusion concerning vitamin D.

Koch and Samuels, and Todhunter, found vitamin G present to the same extent as in the original milk. Koch and Samuels reported a loss of about one-fifth to one-sixth of vitamin B in the evaporation process. As milk is not an important source of vitamin B, and since other foods containing it should be given, this loss is not significant. The same holds true with reference to vitamin C. While heating no doubt eliminates a large part of it, milk, even in its original state, has never been considered, quantitatively, a good source of this vitamin. In fact, no infant or child is well fed without the addition of an antiscorbutic.

Evaporated Milk is a completely dependable source of those vitamins which milk is depended upon to supply.

Probably everybody knows that the method used by scientists to determine whether or not a food contains vitamins is by trying it out on young animals and seeing whether or not the animals grow rapidly and

Figure 14

"Fuzzy," the bear mascot of the Battleship California, was captured while a very young cub and nourished with Evaporated Milk.
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do not develop any disease. With a very few exceptions, the requirements of all higher animals for vitamins are alike, so we can judge as to the value of a food to supply the needs of the human body by the way it influences the health of the animal. A great many people have had the experience of raising pets from birth on Evaporated Milk. Figure 14 is a picture of “Fuzzy,” the bear mascot of the Battleship California, who was captured when very young and nourished with it.

Figure 15
The splendid appearance of the men of the Navy is proof that vigorous health can be maintained with Evaporated Milk as the sole milk supply.

The U. S. Navy has always used Evaporated Milk extensively. The splendid appearance of the men of the Navy, for instance those shown in Figure 15, is proof that vigorous health can be maintained with this as the sole milk supply.

4. Evaporated Milk is Surely Safe—There are two kinds of bacteria that may do us harm—those which produce specific disease such as diphtheria, typhoid fever and scarlet fever; then there are those in the air and almost everywhere, which are harmful only when they are allowed
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to grow in food. The sealed can of Evaporated Milk as it is found on the
grocer’s shelves cannot possibly contain either of these kinds of bacteria—
cannot possibly undergo any change. The milk must remain in its original
condition of freshness.

Then there have been people who imagined that the tin of the can
might injure in some way the milk inside. And some people have thought
that while the metal might not hurt the milk before the can is opened,
after opening the food would be dangerously affected unless it were
immediately removed from the can. It has been proven beyond all doubt
that such fears have not the slightest basis of fact.

After the can of Evaporated Milk is opened, it makes no difference
whether it is left in the can or transferred to a clean pitcher. It is much
better to leave the milk in the can than to put it in a dirty pitcher.

One should bear in mind, however, the fact that after the tin is once
punctured with a can opener, germs are sure to get in from the outside.
Evaporated Milk is just as nutritious for bacteria as it is for human beings,
and once they get inside they will increase at a tremendous rate unless
the milk is kept on ice. After opening the can, Evaporated Milk can be
depended upon to remain good just as long as would bottled milk under
the same condition, in fact somewhat longer.

5. Evaporated Milk is Uniform—Whoever gets the first glass out of a
quart bottle of milk generally gets rich, creamy milk; less fortunate is he
who is served the last glass. It does not take long for most of the fat or
cream of ordinary milk to come to the top. It is not so with Evaporated
Milk. As has already been explained, Evaporated Milk contains more
than twice as much fat as average bottled milk, still it never rises. The
milk is of uniform richness from the top to the bottom.

Again, sometimes you may buy from a dairyman a bottle of milk that
is rather poor and thin. His cows may not have been of the kind that
could give good, rich milk. Do you know what is done in the Evaporated
Milk plant when this kind of milk is received? If it is a clean and pure
milk and meets the other requirements, the owner of the plant buys the
milk, but he also obtains from some other source rich cream to mix with
this low fat milk. This he is forced to do because, as has already been
stated, the Government requires him to have a high percentage of fat in
his finished Evaporated Milk. For this reason, again, Evaporated Milk
can be depended upon to be uniform. But there is still another reason.—

The milk of certain cows or herds of cows sometimes is found not to
“agree” with some people. Children, particularly, are known to be
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sensitive to milk from certain cows. No one has ever noted any such effects when Evaporated Milk is used. The milk of so many herds comes together in the plant that any peculiarities that may be in the milk of any individual cow is lost in the great mass that goes through the plant during the day.

6. Evaporated Milk is Economical to Use—It has been demonstrated over and over again that Evaporated Milk prepared in a rich dairy section a few hundred miles from a city can be shipped to the city, sold in a grocery store and delivered to your house for less money than the same milk could be brought to your doorstep in bottled form. In other words you can buy a pound of Evaporated Milk for less than an equivalent amount of bottled milk, which is a quart.

The process of transforming raw milk into Evaporated Milk has been perfected and rendered economical through years of scientific experiment. There is less water in Evaporated Milk to pay freight on, and refrigeration is not necessary. These and other factors are involved in making Evaporated Milk the most economical milk supply.

7. The Consumption of Evaporated Milk—The economies made possible through the use of this form of whole milk have been a large factor in its increased purchase during the last decade.

Between 1923 and 1933, consumption of Evaporated Milk in the United States increased 57 per cent. During 1933 the per capita consumption was 12.5 pounds—the highest on record—and 92 per cent greater than per capita consumption in 1920. The per capita consumption of all dairy products increased but 12 per cent during the same period. Butter per capita consumption increased 22 per cent, cheese 19 per cent.

These figures give a picture of the recognition by the public of the nutritive value and reasonable cost of Evaporated Milk. Its use now extends around the world to the Philippines, Japan, China, Africa, and Labrador. Famous explorers such as Byrd and Wilkins have carried it to the North and South Poles. It was one of the important items of supply on the expeditions of Roy Chapman Andrews into the Gobi Desert in his search for dinosaur eggs. In every corner of the globe, the virtues of Evaporated Milk are now understood.

On the next page is a table showing the increase in the annual consumption of Evaporated Milk in the United States between 1920 and 1933. The increase in annual per capita consumption is likewise shown.
### Annual Consumption of Evaporated Milk in the United States

(In pounds)

<table>
<thead>
<tr>
<th>Year</th>
<th>Total</th>
<th>Per Capita</th>
</tr>
</thead>
<tbody>
<tr>
<td>1920</td>
<td>694,229,000</td>
<td>6.5</td>
</tr>
<tr>
<td>1921</td>
<td>849,883,000</td>
<td>7.9</td>
</tr>
<tr>
<td>1922</td>
<td>920,493,000</td>
<td>8.4</td>
</tr>
<tr>
<td>1923</td>
<td>1,003,247,000</td>
<td>9.0</td>
</tr>
<tr>
<td>1924</td>
<td>1,106,794,000</td>
<td>9.8</td>
</tr>
<tr>
<td>1925</td>
<td>1,070,551,000</td>
<td>9.3</td>
</tr>
<tr>
<td>1926</td>
<td>1,138,161,000</td>
<td>9.8</td>
</tr>
<tr>
<td>1927</td>
<td>1,139,050,000</td>
<td>9.6</td>
</tr>
<tr>
<td>1928</td>
<td>1,248,493,000</td>
<td>10.4</td>
</tr>
<tr>
<td>1929</td>
<td>1,374,112,000</td>
<td>11.3</td>
</tr>
<tr>
<td>1930</td>
<td>1,398,433,000</td>
<td>11.4</td>
</tr>
<tr>
<td>1931</td>
<td>1,443,917,000</td>
<td>11.6</td>
</tr>
<tr>
<td>1932</td>
<td>1,563,715,000</td>
<td>12.5</td>
</tr>
<tr>
<td>1933</td>
<td>1,572,326,000</td>
<td>12.5</td>
</tr>
</tbody>
</table>

### Additional Important Facts

- Pounds of raw milk purchased from farmers in 1933 for use in Evaporated Milk—3,934,000,000.
- Percentage of all milk produced in the United States which is delivered to Evaporated Milk plants and used for the production of Evaporated Milk—3.4 per cent.
- Total payment to farmers in 1933 for all milk used in Evaporated Milk plants—$44,000,000.
- Number of plants at which Evaporated Milk is produced—164.
- Number of states in which plants are found—26.
- Number of manufacturers—43.
- Value of Evaporated Milk exported in 1933—$1,939,000—in value, 48.2 per cent of all dairy products exported.
Figure 16
Foods of the highest quality are prepared with creamy rich Evaporated Milk
IV—The Uses of Evaporated Milk

"Evaporated Milk is comparatively inexpensive and is conveniently packed for marketing and for use."—McLean and Fales.

Those who are experienced in the art of good cookery are realizing more and more what an extraordinary influence Evaporated Milk has on the texture and the flavor of food when used in the recipe. Ice cream manufacturers have long known of the velvety smoothness which Evaporated Milk gives to their product. For making candy that is smooth and not grainy, it is almost necessary that some Evaporated Milk be added. Soups, sauces, custards, puddings and gravies of first quality require the use of this rich milk. Often we find inferior cocoa being served even in the best of restaurants; but good cooks everywhere are now finding that by employing Evaporated Milk they can always turn out a fine product. Some splendid Evaporated Milk products are shown in Figure 16.

Delicious drinks are prepared by the use of fruit juices and Evaporated Milk. These are good for grown-ups as well as children. It is often found that children get "fed up" on drinking milk and it is difficult to get them to drink as much as they should have. In such cases Evaporated Milk either with or without egg appeals strongly to taste and appetite, and is a splendid way of building up an undernourished child.

On the other hand, the drinking of milk is not the only way to get it into the diet. The milk we eat is as good for us as the milk we drink. By the use of Evaporated Milk instead of ordinary milk or cream in food recipes it is possible to incorporate in the food more of the important nutrients of milk, even as much as double the amount. This is because Evaporated Milk contains twice the nutrients and less than half the water found in ordinary milk. A cup of Evaporated Milk can often be used in place of a cup of ordinary milk in the recipe. While food thus prepared is of particular importance to the children of the family, the adults are also benefited by giving such food a prominent place in their diet.

Then we come to the youngest member of the family, the newborn infant. All kinds of tests—physical, chemical and biological—have been applied to Evaporated Milk by way of comparison to normal mother’s milk, and it has been found that where mother’s milk cannot be had, Evaporated Milk suitably diluted with boiled water and with sugar added is the next best. One of the methods of comparing different forms of milk is the "curd test" which is illustrated in Figure 17.
THE STORY OF EVAPORATED MILK

One prominent doctor has been already quoted as to what he thinks about Evaporated Milk for feeding babies. Among many other quotations that might be presented are the following:

Dr. Fischer in his book called "The Health Care of the Baby" says: "Evaporated Milk is adapted for infants with weak digestion. It is especially useful during periods of fever. It is useful in summer for delicate infants as it is more easily digested than regular milk."

Babies thrive on Evaporated Milk because in digestibility it resembles mother's milk.

The prominent Chicago physician, Dr. Hess, says in his book: "Occasionally infants with a very weak digestion will thrive on evaporated milk where all other methods fail."

This is not the place to describe in detail how Evaporated Milk is used to such good advantage in cooking, making ice cream, candy, highly nutritious drinks and in infant feeding. But any one who is interested in getting booklets describing how it is so used, may write to The Evaporated Milk Association, Chicago, Illinois.

Conclusions

Milk the most important single article of food and one of the most perishable, is preserved in cans as Evaporated Milk in its original condition of freshness. Just as fruits and vegetables, jellies and jams, and other foods are to be obtained in sealed packages, clean and free from contamination, so also do we find milk.

The wholesomeness and freshness of the original milk, the spotless cleanliness of the milk plant, the vigilance of the superintendent
and chemist, the requirements of the Government, have united in making Evaporated Milk the safest, most nutritious, most convenient, and most economical form of milk.

Once it was used only when raw milk was not available. People said, "Oh! It's all right for camping or for the Army and Navy, but give me plain milk right from the cow." Now more than four million pounds of Evaporated Milk are used each day in the kitchens of the United States. To prepare fine food people are employing Evaporated Milk for every milk or cream use.

For the baby who must have a readily digested form of milk; for the growing, active child who needs food of the maximum richness; for the adult, who may possibly be subsisting on an improperly balanced diet; for the cook who enjoys the satisfaction of producing food of fine appearance, texture and flavor; for convenience, safety and economy; we find Evaporated Milk,—a result of patient, scientific experimentation and industrial achievement.

![Figure 17](image)

*The curds, illustrated above, were obtained by treating different kinds of milk with pepsin and acid.  
Left: Mother's milk.  
Middle: Evaporated Milk.  
Right: Ordinary milk.

Mother's milk and Evaporated Milk curds are soft and flocculent; ordinary cow's milk curds are compact and firm.*
For the Classroom

Any or all of the following experiments will be found helpful. This work should precede the study of the text.

A number of cans of (unsweetened) Evaporated Milk are to be obtained from the local grocer. If possible, samples representing more than one manufacturer's brand should be procured. Observations are to be made by the student as follows:

1. Read the labels carefully. Note what they say about the method of preparation of the milk, its composition and uses, and the amount of Evaporated Milk in the can.

2. Remove a label, noting how it is attached to the can. Give your opinion as to the nature of the machine that attached it. A description of this machine will be found in the text.

3. Notice the spot of solder at the center of the bottom of the can. Account for this after reading the following chapters.

4. Open a can and pour the contents into a tumbler or beaker. Note the "creamy" consistency of Evaporated Milk. Let stand until the next day. Does the cream come to the top? Explain after reading the text.

5. If a microscope is available, observe the fat particles in a drop of Evaporated Milk diluted with three drops of water and compare with a drop of ordinary bottled milk diluted with one drop of water. A much higher magnifying power will be necessary to see the fat particles in Evaporated Milk; if possible, use an oil immersion lens. Account for the difference in size of the fat particles after studying the text.

6. If a lactometer or hydrometer is at hand, make readings of the following:
   - a—Evaporated Milk.
   - b—Evaporated Milk diluted with an equal amount of water.
   - c—Ordinary milk.

   Compare particularly b and c, and account for the resemblance.

7. Dilute some Evaporated Milk with an equal quantity of water and place in a bottle or flask. In another bottle put an equal amount of ordinary milk. Warm the bottles slightly, then add a little pepsin or rennet solution. (A solution prepared from a Junket tablet will be satisfactory.) Shake, then let stand quietly. Note the difference in the curds produced. An explanation of this will be given later.

8. Place a can of Evaporated Milk in water and bring to a boil. Remove and cool under running water. Open can, transfer to a bowl surrounded with ice and whip.
REFERENCES RELATING TO EVAPORATED MILK

I.
No Important Loss in Vitamins, Minerals, or Any Other Substance When Raw Milk Is Transformed Into Evaporated Milk.

II.
Evaporated Milk Is Readily Digested and Assimilated.

III.
Evaporated Milk For Babies.

IV.
Evaporated Milk as a Source of Milk Supply From the Public Health Point of View.
Other Publications on Evaporated Milk
Sent Free Upon Request
(Send for a complete list)


5. A Safer World for Babies. Why Evaporated Milk is the best form of milk for baby’s formula. Hints on the care of the baby.


17. Planning Lunches for School Children. Menus for the lunch box and the home lunch.

21. Nutritive Value of Evaporated Milk (Scientific References). References and quotations from research workers in nutrition.

24. Eating for Efficiency (Revised). Useful for classes in nutrition and child care, and for dietitians as well as housewives. Thirty-two days of menus; food values of each diet. One hundred twenty-one recipes; food values per serving. Tables of values for all common foods.


38. Some Facts About Evaporated Milk and Other Dairy Products. Principally statistical data. Extensive information relating to Evaporated Milk, the dairy industry, and food consumption in the United States. Map showing where milk is and is not produced in this country.


43. Infant Feeding with Unsweetened Evaporated Milk (Scientific References). Quotations from authorities on infant feeding and related references.

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