LESSONS IN DIETETICS.

By MARY C. WHEELER

Graduate of the Illinois Training School for Nurses and the Hospital Economics Course; Superintendent of Blessing Hospital, Quincy, Illinois

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COW'S MILK AND SOME FOODS DERIVED FROM MILK.

Chemical Composition.—Milk occupies almost a unique place among animal foods for it contains in itself the three principal nutrients of food: proteids, carbohydrates and fats, and a large percentage of water. The proteids of milk constitute only two or three per cent. of its total weight. The principal proteid is known as casein which is kept in a state of more or less perfect solution by its partnership with phosphate of lime.

The solution is not clear but opalescent, and is the chief cause of the opaque whiteness of milk. The other proteid of milk is an albumin called lactalbumin, which is entirely different from casein and which coagulates, very slowly, when milk is boiled. It makes up about $^1/_7$ of the total proteid of cow's milk.

The carbohydrate constituent of milk is milk-sugar or lactose. Milk contains from 4–5 per cent. of it. It differs very much from the cane-sugar and in nothing more than its comparative freedom from sweetness. Another peculiarity of lactose is that it is hardly capable of being fermented by yeasts. As a consequence it is better borne than other kinds of sugar in certain cases of disease. On the other hand, it is readily split up by certain micro-organisms, with the production of lactic acid, a process which occurs in the souring of milk, and sometimes, also, in the intestine, producing diarrhœa. Many cases of infantile summer diarrhœa are brought about in this way.

The fat of milk stands intermediate in amount between the proteid and sugar, constituting about 4 per cent. of the total weight. Fat exists in milk in the form of an emulsion of extraordinary perfection. When milk is allowed to stand, the fat globules run together, and float to the surface as cream. If this be removed skim milk is left; but when so prepared it still contains some fat, perhaps as much as 1 per cent. If the cream be removed by means of a centrifugal separator, its abstraction is much more complete, for separated milk usually contains less than

⅓ per cent. of fat. Milk so prepared should be described as separated milk.

Mineral matter is fairly abundant in milk, forming about 0.7 per cent., consisting mostly of phosphate of potash and phosphate of lime. Iron is scantily represented in milk. Citric acid is also present in milk in no small amount, for it has been calculated that a good cow yields as much citric acid in a day as would be contained in 2 to 3 lemons. It is chiefly combined with lime, and as calcium citrate it is a gritty substance, only imperfectly soluble and devoid of any sour taste. The solid particles met with in condensed milk consist chiefly of it.

Water forms a large proportion of milk, from 87–88 per cent., and holds the other ingredients in more or less complete solution. It is owing to the large amount of water which it contains, that milk, in its ordinary state, must be regarded as a dilute and bulky form of food.

COMPOSITION OF COW'S MILK.

Water	87–88 per cent.
Proteids	2–3 per cent.
Sugar	4–5 per cent.
Fat	8½–4½ per cent.
Mineral Matter	0.7 per cent.

In the mixed milk obtained from a large number of cows, variations in the milk must to considerable extent neutralize one another. Hence it is that the total milk from one dairy varies less in composition than that from any one cow in it, and the popular prejudice in favor of feeding an infant on milk "from one cow" is shown to rest on a false basis.

Whenever milk enters the stomach it undergoes a change by which it very soon becomes solid. It is then said to be coagulated. This coagulation is due to a change brought about in the casein by the ferment called "rennin." The exact nature of the change which the casein undergoes is still obscure. The coagulation of milk is what occurs in the making of junket. The curd consists primarily of the casein and in the process of setting the casein entangles the fat of the milk in its meshes. It usually also contains some of the sugar of milk, for the whey is never entirely squeezed out.

The curdling of milk is not the same as the process of coagulation. When milk "curdles," its casein is simply thrown down in the form of a precipitate without undergoing further changes. Curdling is due to the production of lactic acid in the milk, which turns the casein out of its partnership with lime salts, and the casein, being in itself not soluble, then falls down as a flocculent precipitate. The production of

lactic acid is due to a splitting up of milk-sugar by the agency of certain bacteria always present in milk, but the growth of which is greatly facilitated by heat, and by some authorities it is claimed that electrical conditions often influence the same.

The Effect on the Composition of Milk of Heating.—When milk is boiled in an open pan a tough "skin" forms on the top. This consists to some extent of coagulated lactalbumin, but partly also of casein and salts of lime. By boiling it, some of the CO_2 is driven off and this seems to cause some of the casein to be detached from the lime salts which hold it in solution, and then it becomes entangled with fat and floats to the surface, and is dried by evaporation into the "skin" with which we are familiar. If the "skin" be removed, another straightway appears, and by continuing the process the milk undoubtedly loses some of its nutritive value though not to a great extent. When heated for a long time, milk becomes brownish in color and changed in taste. The change in color seems to be due to the charring of the sugar. The change in taste sets in quite suddenly when a temperature of 70° C. is reached. The casein seems also to undergo some alteration on boiling, for boiled milk coagulates more slowly than raw milk.

By far the most important result of boiling milk is its sterilization. Milk as it comes from a perfectly healthy and perfectly clean cow, may be regarded as a sterile fluid; not only is it sterile, it seems even to be possessed of feeble germicidal properties. Commonly, the milk gets contaminated either by stagnation in the udders of the cow or from the introduction into it of foreign matter after it is withdrawn. These foreign matters are of all sorts, but are chiefly composed of manure. The hands of the dairyman and the water used in washing the cans are other possible sources of infection.

Once arrived in the milk, the germs are able to grow and multiply very rapidly, so that in a short space of time, especially if favored by warmth, it may be literally swarming with them. Roughly speaking, the micro-organisms met with in milk may be divided into two classes: (1) those which produce souring, (2) pathogenic bacteria. The former are probably harmless, unless so abundant as to produce decomposition of the milk in the intestine, when diarrhœa may set up. Their chief significance lies in the fact that, owing to their presence, milk cannot be kept for any length of time without turning sour. The pathogenic bacteria are bearers of disease. Amongst the diseases which have been proved to be conveyed by milk are diphtheria, typhoid fever, tuberculosis and possibly scarlatina and cholera. The disease germs are more easily destroyed than those which produce souring. A temperature of 75° C.

maintained for a few minutes is enough to kill most of them. If the milk is to be preserved for a long time, however, this is not sufficient and the temperature must be raised above the boiling point (110° C.) and kept there for some time. This is the process of sterilization. Sterilization alters the taste of the milk, destroys the fine emulsification of the fat, coagulates the lactalbumin and renders the casein less easy of digestion. Efforts have been made to overcome these disadvantages by pasteurization. This consists in keeping the milk at a temperature of 70° C. (158° F.) for twenty minutes or one half hour. Of this method, however, it may be said that, though it kills most of the disease germs, it has not been proved to destroy the tubercle bacillus, and certainly does not destroy some bacteria capable of causing diarrhœa. Milk so treated will not keep more than three or four days, for the acid-forming bacteria are still present; nor can one ever be certain of avoiding alterations in the taste, for that change sets in, as we have seen, just above 70° C. For ordinary purposes there is little doubt that simply boiling the milk for a few minutes is the simplest and most satisfactory method of procedure.

(*To be continued.*)

THE TOUR OF THE "IMMIGRANTS"

By K. DE W.

On April 26th, sixty nurses started together from Chicago for California, in two tourist cars; most of them had been royally entertained in groups by the various Chicago hospitals while attending the Visiting Nurse Conference there.

We were eight days in making the trip to the coast and we slept in our cars, even at our stopping-places, thereby avoiding hotel bills,—and we felt like true foreigners at times as we groped our way back at nearly midnight to the only refuge we knew, picking our way through the railway yards, dodging locomotives, and climbing the steps of cars D and E, so tired that the switching of engines and passing of trains could not disturb our slumbers.

No one who has not tried it has any idea how comfortable one may be on a long trip in a tourist car with congenial companions. We had many plans for whiling away the hours, most of which were never carried out. There never seemed to be time for much reading or writing or card playing, we were so occupied with housekeeping and visiting.

Each section was occupied by from one to three human beings and