

Curd in Cows' Milk.

The curd in cows' milk is dense, firm, and tough, owing to the amount of casein and calcium salts; the young calf with its four stomachs digests it with ease, but for the feeding of infants, it constitutes a great difficulty. By dilution, the density, and consistency of the curds formed in the stomach are diminished; if barley water, or gelatine water are used they act mechanically, and break up the curd in smaller masses, but there is always the drawback that by adding a diluent the percentage composition of fat, sugar, and salts is reduced at the same time as that of the proteids. It is claimed by those who advocate the giving of whole sterilised milk to infants, that certain changes, which modify the curd, take place in the process of sterilisation. Budin, the great French authority on infant feeding, prescribed it largely in his clinic, and never saw any bad results from its use. The milk was heated in a steriliser to 100 degs. Cent. for forty minutes; Chavane made careful and repeated experiments on the curd; in a paper on "Du lait stérilisé," he writes, "The casein is so modified as to effect the state of subdivision of the clot, and also the molecular structure of the particles. The clot offers no resistance or sense of elasticity to the finger on pressure; on microscopic examination the particles of casein are found to be smaller and more homogenous, differing from that of human milk, but comparable with that obtainable from asses' milk as regards the size of the casein particles."

There is yet another way of modifying the curd, which is simple and effective: The addition of sodium citrate. In order to understand its use it must be remembered that there are two methods of producing curdling, both of which operate in the stomach. There is first acid curdling; if 5 minims of hydrochloric acid be added to an ounce of milk, acid curds are formed; in like manner the acid gastric juice acts upon the casein of milk and forms curds, which are flocculent and soft; should there be an excess of acid, the curds are larger, and the next stage in the digestive process, the conversion of the clot into peptones, is delayed and incomplete; in such case the addition of sodium bicarbonate, or lime water, is useful; as a rule, however, it is not the acid curds which give rise to dyspepsia. Second, there is rennet curdling; this ferment present in the stomach produces firm curds; the milk must be neutral or acid, and the process depends on the presence of calcium salts; these combine with the acid caseinogen to produce the solid rennet curds. Arthus and Pages discovered that if all the calcium salts are precipitated with

oxalates and fluorides milk will no longer clot; if some only were removed, rennet coagulation was delayed; whereas, if calcium salts were added up to a certain point, coagulation was hastened, and the clot firmer. Here, then, is the great reason for the difference between human and cow's milk. Human milk contains .03 per cent. of calcium salts, while cows' milk contains .17 per cent., *i.e.*, about six times as much. The fact that the mineral salts differ in quantity and combination is quite as important, but far less well known than the difference which exists in the composition of the proteids.

If, then, some of the calcium salts in cows' milk are precipitated, the curd would be less dense and indigestible. Wright found that 1-200th per cent. of sodium citrate, a perfectly harmless salt, acts in the same way as oxalates and fluorides in preventing rennet coagulation; in smaller proportion it precipitates some of the calcium salts, and the curd formed is softer and lighter. Suppose, for example, two grains of sodium citrate are added to an ounce of cow's milk, the sodium combines with the caseinogen, forming a sodium compound which has a lower density than that of the calcium compounds; the calcium salts combine with the citric acid and produce calcium citrates; thus the calcium, though in different combination, is not lost to the economy.

This method of modifying cows' milk commends itself for its harmlessness, simplicity, and cheapness. In order to carry it out scientifically the curd of the milk used should first be tested by adding rennet and hydrochloric acid, and the proportion of sodium citrate made appropriately; as a rule, one or two grains to each ounce of whole milk is effective. The salt is very soluble, a convenient solution is 1 in 10, *i.e.*, one ounce of sodium citrate to 10 ounces of water; a drop of chloroform should be added to prevent the growth of mould. If the baby takes two ounces of milk at a feed it will be necessary to add 20 to 40 minims of the solution (*i.e.*, 2 to 4 grains of sodium citrate); as the quantity of milk is increased, the salt is increased proportionately. Messrs. Burroughs and Wellcome stock a tabloid, which is convenient; they should be well crushed before use.

Citrated milk has been well tried, and is highly commended by infant specialists for healthy infants. It is in no sense a remedy, but it is perhaps the best expedient known as yet for rendering the curd of cows' milk more easily digestible.

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