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UTAH AGRICULTURAL COLLEGE
UTAH AGRICULTURAL EXPERIMENT STATION

Physical Curd Character of Milk And Its
Probable Relation to Infant
Nutrition

R. L. HILL

A problem which must be met by many mothers is that of obtaining for their infants an adequate substitute for breast milk. The weaning period is a very critical time in the life of every infant. Its ability to properly digest and assimilate the food supplied will largely determine its state of health, provided it is kept free from infection.

Milk formulas for the feeding of infants are often made up to conform to certain fat requirements. Some infants apparently have difficulty in properly assimilating a milk with a high fat content. This may be due to a low fat tolerance on the part of the infant or it may be caused by the physical curd character of the milk which has coagulated in the child's stomach. The curd obtained by the coagulation of the milk from some cows is soft and feathery, resembling breast milk in this regard. From the milk of other cows, however, a tough, rubbery curd is obtained which has an entirely different texture from that of breast milk.

The physical curd character of the milk can be approximated by the test which is described in this publication¹. The milk is coagulated by means of a solution of dry-scale pepsin and calcium chloride. The ease with which the curd formed can be wrung thru a fine-meshed cheesecloth is an index to its physical character.

PREPARATION OF COAGULANT

1. One pound of crystalline calcium chloride dissolved in one ^{quart} ~~part~~ of water².
2. One level half teaspoon of *dry* 1-3000-scale pepsin³ dissolved in one-half pint (one measuring cup) of water at a temperature of 95° F.
3. After the pepsin is completely dissolved, it is thoroly mixed with one-third cup of the calcium-chloride solution, as described above.

DETAILS FOR MAKING THE TEST

Only fresh milk from which none of the cream has been removed and which has been well mixed should be used for this test. Half-pint samples in pint fruit jars should be placed in a pan containing warm water until the temperature of the milk reaches 95° F., at which time 25 cubic centi-

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¹A more accurate method for making this determination is given in the following publications by the same author:

Journal of Dairy Science, Vol. 6 (November, 1923), pp. 509-526
Utah Experiment Station Bulletin No. 203 (in press)

²When placed in a stoppered bottle, this solution will keep indefinitely; it can be used as a stock solution.

³Only *dry* 1-3000-scale pepsin should be used; this *dry* 1-3000-scale pepsin can be purchased at most drugstores. For measuring the pepsin, a special half teaspoon measuring spoon *only* should be used.

meters of the coagulant should be added. To measure this, a small graduated 25 cubic-centimeter cylinder⁴ or a pipette should be used. If the pipette is used, the tip should be broken off so as to allow a more rapid flow of the milk. The jar containing the milk should be rotated with the right hand before adding the coagulant, causing the milk to be thoroly and evenly mixed with the coagulant as it is added. After the coagulant is added the agitation should be immediately stopped. The sample of coagulated milk should be returned, without jarring, to the warm water for a period of ten minutes. If the agitation continues after the coagulant is added, the curd will be broken into small pieces and the test will be ruined.

THE COAGULANT SHOULD BE USED IMMEDIATELY AFTER BEING PREPARED. ONLY DRY 1-3000-SCALE PEPSIN SHOULD BE USED IN ITS PREPARATION.

The milk sets very quickly into a solid curd. The difference between the soft- and hard-curd milk is readily observed. The curd from the soft-curd milk appears "feathery" and evenly distributed throughout the jar, while that from the hard-curd milk appears as a more solid mass.

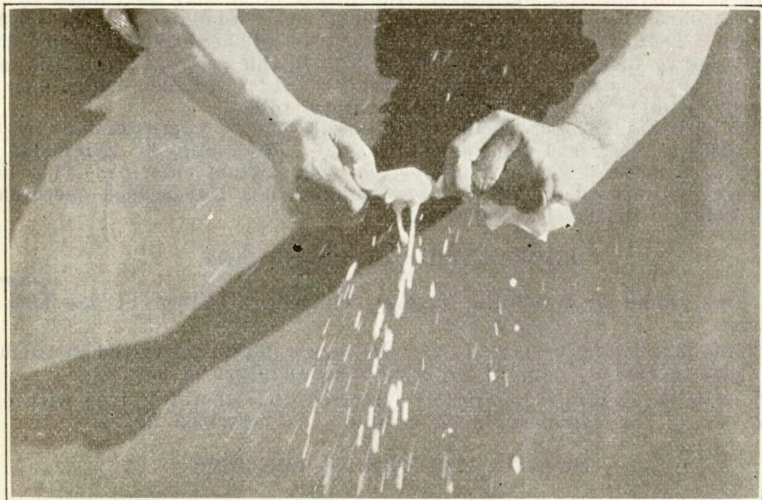


FIG. 1.—Curd from soft-curd milk being wrung thru fine-meshed cheesecloth.

The curd from the jars should be transferred to an oblong piece of finely-woven, close-textured cheesecloth and gently wrung, as illustrated in Figures 1 and 2. The curd from very soft-curd milk will be readily wrung thru the cheesecloth, leaving no lumps of curd. That from hard-curd milk will form a curd that does not pass thru the cheesecloth under ordinary twisting pressure. Milk which on coagulation forms a curd which is easily wrung thru the cheesecloth is usually adapted to the use of infants

⁴A 25 cubic-centimeter cylinder can be procured from most drugstores. In an emergency, a graduated medicine bottle can be substituted. It is *very important* that the entire 25 cubic centimeters of the coagulant be added at one time.

as far as the influence of the curd itself is concerned. However, it is very essential that the test be both carefully and accurately performed. The milk which cannot be wrung thru the cheesecloth after coagulation might require considerable modification; even when modified, this milk might not be adapted to the use of infants.

Figure 3 illustrates the difference in results obtained from the coagulation of the milk from a hard-curd cow and from a very soft-curd cow.

The difference in physical curd character between the hard- and soft-curd milks is clearly shown in Figure 4. The curd shown on the left was very tough and was readily molded into a solid mass; the curd on the right was so soft it could not be molded.

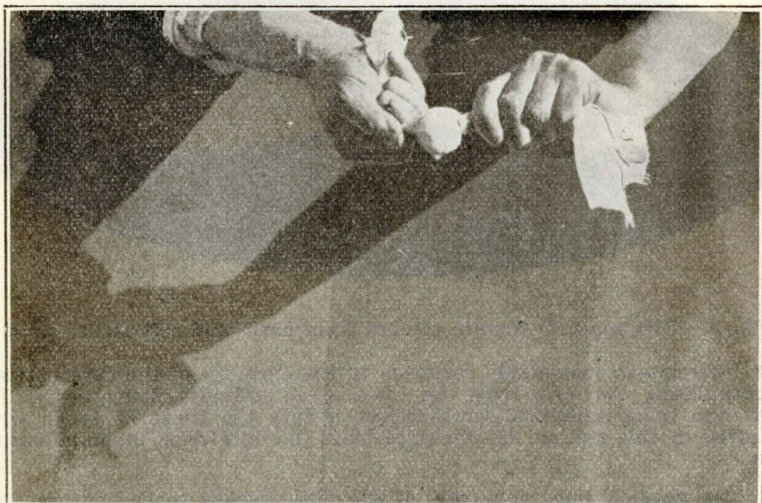


FIG. 2.—Curd from hard-curd milk being wrung thru fine-meshed cheesecloth.

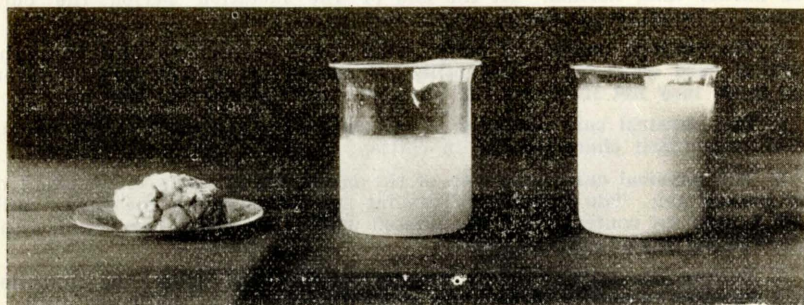


FIG. 3.—*Left*: curd from hard-curd milk which did not pass thru fine-meshed cheesecloth; *middle*: whey from this hard-curd milk; *right*: curd and whey from soft-curd milk, all of which passed thru fine-meshed cheesecloth. The curd from this milk resembled buttermilk in texture.

CONCLUSIONS⁵

The method of determining the physical character of the curd, as described in Station Bulletin No. 203 (in press), is much more accurate than the above described method. A specially designed spring balance and curd knife were used, and the hardness of the curd was measured by the pull required to draw the curd knife thru the coagulated milk. By the use of this test the following conclusions seem justifiable:

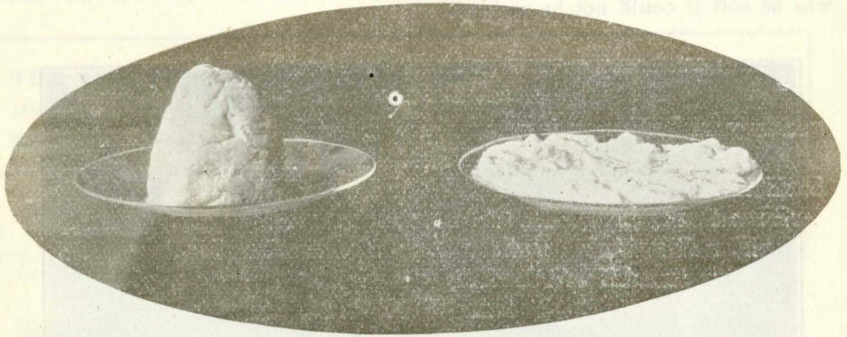


FIG. 4.—Difference in texture of curd from hard- and soft-curd milk.

1. There was considerable variation in the hardness of the curd obtained by coagulating the milk from the cows in an ordinary dairy herd. The milk from some individual cows formed a curd ten times as tough when measured by this test as was the curd from the milk from other individual cows.

2. The physical curd character of the milk seemed to be an individual characteristic of the cow, fairly uniform, and apparently permanent.

3. Results secured seemed to indicate that the period of lactation under normal conditions has little effect on the physical curd character of the milk except at the beginning and at the end of the lactation period. Ordinarily, for the first three or four weeks of the lactation period the curd was harder than normal. At the end of the lactation period the curd seemed to be either harder or softer and more variable.

4. The limited number of feeds given did not seem to influence the physical curd character of the milk. It should not be inferred, however, that feeds may not influence the physical curd character of the milk.

5. The physical curd character of the milk in a few cases was found to be a transmitted characteristic in cattle.

6. The physical curd character of the milk seemed to be independent of the fat content. The presence of the fat seemed to soften the curd. Milk with a high fat content when coagulated usually formed a hard curd, altho this was not invariably the case.

7. Boiling the milk softened the curd. The curd from the unboiled milk was approximately three times as hard as that from the boiled milk.

⁵These conclusions are based upon results obtained from the test as described in Station Bulletin No. 203 (in press) which contains the complete record of all data and results pertaining to the test.