Preliminary Studies in Milk

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This work was carried on in the bacteriology laboratories of Illinois State Normal University. The experiments were performed as class work in a course of General Bacteriology under the instruction of Dr. Lamkey.

The experiments for the most part are concerned with the size of the fat globules and their relation to the digestibility of milk. The fat globules of viscolized and ordinary milk were measured by diluting the milk and placing a drop on a hanging drop slide and then measuring with the micrometer eye piece in a miscroscope. From our measurements we found that the viscolizing process reduced the size of the fat globules eight times. Milk that had been standardized at 4 per cent butter fat and then viscolized was tested for butter fat content and the viscolizing process was found to have no effect on the butter fat content.

Next, samples of viscolized and ordinary milk were plated out to get the bacterial count of the respective milks. To do this, 1 c.c. of the milk was placed in 1000 c.c. of sterile water. Then ½ c.c. of the water was plated out in litmus agar. One c.c. of water was also plated out in litmus agar. Viscolized milk has a higher bacterial count than unviscolized milk. This fact was to be expected because the more times the milk is handled after pasteurization the greater the chance for contamination. The viscolization process is carried on after pasteurization. It is also possible that the viscolization had broken the bacterial clumps into various parts and that these parts had resulted in a higher count. Other counts were made on other samples of milk and the above results were borne out.

Digestion tests were then performed on the milks. Steapsin was the enzyme used and 5 per cent solution of litmus was the indicator.

(I) 50 c.c. of viscolized milk + 750 m.g. of steapsin boiled.
50 c.c. of viscolized milk + 750 m.g. of steapsin.

(II) 50 c.c. of pasteurized milk + 750 m.g. of steapsin boiled.
50 c.c. of pasteurized milk + 750 m.g. of steapsin.

The milk was heated to body temperature and the steapsin that had been dissolved in 5 c.c. of water was added. Four c.c. of 5 per cent solution of litmus was also added to each sample.

To one sample of viscolized milk boiled steapsin was added. The boiling killed the action of the enzyme.

To one sample of viscolized milk unboiled steapsin was added.

To one sample of ordinary milk boiled steapsin was added.

To one sample of ordinary milk unboiled steapsin was added.

The boiled samples were checks on the action of the steapsin in the milks. The boiled samples also indicated that it was not formation

of lactic acid [souring process] that changed the litmus from blue to red. A known standard of red was used as the end-point in the digestion. When the litmus had changed to the standard red the experiment was ended. We had no way of testing for completeness of digestion but were only testing for rapidity of digestion. The viscolized milk turned the litmus to the red standard in ⅓ of the time it took for ordinary milk to change the color of litmus. The steapsin digested the fat, forming fatty acids and glycerine. The fatty acids changed the litmus from blue to red.

We have run many digestion experiments with viscolized and ordinary milk and have found that the steapsin digests the viscolized milk three times faster than ordinary pasteurized milk.

Our next experiment was the comparing of the size of fat globules of Holstein and Guernsey milk and testing the rate of digestion of Holstein and Guernsey milk.

Representative samples of Holstein and Guernsey milk were diluted with water, placed on a hanging drop slide, and examined under the microscope. The size of the fat globules was measured with the micrometer eye piece of a microscope. The average size of the fat globules of Holstein milk was 6.7 microns. The average size fat globule of Guernsey milk was 7.7 microns. The Holstein had the smallest fat globule by about one micron or the fat globules of the Guernsey were 12 per cent larger than the fat globules of the Holstein milk.

In the digestion tests of Holstein and Guernsey milk, each test contained the following: 50 c.c. samples of milk; 750 m.g. of steapsin; 4 c.c. of 5 per cent litmus or 20 drops brom cresol green.

The milk used was composite samples of raw whole Holstein and Guernsey milk. The pH of the two milks were determined and found to be the same: a pH of 6.3 or slightly acid. Half of the milk was pasteurized at 60° C. for 20 minutes and the other half was left raw.

	Milk	*Condition*	*Indicator*
(I)	Holstein	Raw	Litmus
	Guernsey	Raw	Litmus
(II)	Holstein	Pasteurized	Litmus
	Guernsey	Pasteurized	Litmus
(III)	Holstein	Raw	Brom cresol green
	Guernsey	Raw	Brom cresol green

As in the case of the other digestion tests, an end-point was set for the color changes of the indicators. Again we were testing not for complete digestion but for rapidity of digestion. The samples were kept in an incubator while the experiment was in process, the temperature being 37½° C. No appreciable difference was found in the time it took Holstein and Guernsey milk to digest. On a check experiment the same results were obtained. However, not enough tests have been made to draw definite conclusions as to the qualities of digestibility of the two milks.