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## THE COMPOSITION OF CREAM.

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MANY years ago the question of the composition of cream was brought before us, owing to the fact of certain samples being apparently deficient in the non-fatty constituents, thus indicating the presence of added water. The point to be determined was whether there was any difference in the ratio between the non-fatty solids and the water contained in the cream and the ratio of these ingredients in the milk from which the cream had been obtained by hand-skimming. The result of these trials was to the effect that the difference, if any, was practically negligible, and therefore it followed that both milk and cream might be regarded as milk entirely devoid of fat, mixed with a greater or less percentage of milk-fat. Unfortunately, these results were not preserved separately; but one test made recently in a closed vessel gave the following results:

	Per Cent.			
	Milk.	Non-fatty Portion of the Milk.	Cream.	Non-fatty Portion of the Cream.
Milk-fat ... ..	4.07	None	36.00	None
Milk-solids other than milk-fat ...	9.00	9.38	5.51	9.42
Total solids ... ..	13.07	9.38	41.51	9.42

This corroborates our former results; but there are two other views of the matter which must be dealt with. It has been stated that the non-fatty portion of cream which has been obtained by the hand-skimming method, is *richer* in solids other than fat than the non-fatty portion of the milk from which it was prepared. This is easily disposed of by H. D. Richmond, who states that in the open vessels in which milk is allowed to separate, a little water may evaporate from the cream, and thus cause a distinct rise in the non-fatty solids. In the results just quoted there is certainly a slight rise in the latter, but it is within the limits of error, and we shall deal with it later. It has also been suggested that the solids in the non-fatty portion of cream may be *less* than those in the non-fatty portion of the milk from which it has been prepared, especially if a mechanical separator has been employed. To test this point, we made two trials with a separator, the object being to obtain cream comparatively low in fat and cream rich in fat respectively, as well as separated milk, from whole milk. In each case 8 gallons of milk were passed through the separator at a temperature of about 90° F., and in the first trial samples were taken when a quarter, half, three-quarters, and almost the whole, of the milk had passed through; whereas in the second trial samples were taken when half and almost the whole of the milk had passed through the separator. In the first

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trial the time occupied was five minutes, and in the second four and a half minutes, which is equal to the milk passing through the separator at the rate of 96 and 106 gallons respectively per hour. The accompanying table gives the analyses of the whole milk, the separated milk, and the six samples of cream. Only the average analysis of the separated milk is given, as the fat did not vary more than 0.02 per cent. in the six samples, and the non-fatty solids were practically identical in each. The samples of cream are given as "first cream," which in the first trial is the one taken after one-quarter of the milk had passed through the separator, and so on to the "fourth cream," which is that taken when nearly all the milk had passed through. In the second trial the "first cream" is that which was taken when half of the milk had passed through, and the "second cream" was the sample taken at the end of the trial.

COMPOSITION OF CREAM AND SEPARATED MILK OBTAINED FROM WHOLE MILK  
BY MEANS OF A SEPARATOR.

*Analyses of the Milks.*

	Per Cent.			
	Whole Milk.	Separated Milk.	Non-fatty Portion of Whole Milk.	Non-fatty Portion of Separated Milk.
Milk-fat ... ..	3.65	0.24	—	—
Non-fatty solids ... ..	9.04	9.37	9.38	9.39
Total solids ... ..	12.69	9.61	9.38	9.39
Mineral matter ... ..	0.74	0.76	—	—
Specific gravity ... ..	1032.4	1035.7	—	—

*Analyses of the Creams.*

	Per Cent.					
	First Trial.				Second Trial.	
	First Cream.	Second Cream.	Third Cream.	Fourth Cream.	First Cream.	Second Cream.
Milk-fat ... ..	12.75	17.73	27.01	32.28	39.86	56.44
Non-fatty solids ... ..	8.29	7.76	6.91	6.43	5.75	4.15
Total solids ... ..	21.04	25.49	33.92	38.71	45.61	60.59
Mineral matter ... ..	0.67	0.64	0.55	0.51	0.46	0.33
Specific gravity ... ..	1022.6	1017.6	1008.4	1003.6	995.0	972.8
Solids in non-fatty portion	9.49	9.44	9.46	9.48	9.56	9.52

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“Separator slime” was found in the above sample of whole milk to the extent of 3 grains per gallon in the wet condition, and 1 grain per gallon when dried at 100° C.

In the case of the creams, the solids in the non-fatty portion (that is, the separated milk entirely devoid of fat contained in the cream) are given, and are also stated in the cases of the whole and separated milk. It will be observed that the solids in the non-fatty portions of the creams are rather higher in every case than in the corresponding portion of the milk, and this was also observed in the hand-skimming test. H. D. Richmond's explanation does not apply here; but an observation made by Allen (Vol. IV., p. 97) may account for the difference. He stated that by careful microscopical examination minute particles of casein may be observed in milk; and if this is really the case, these particles could easily be caught up by the rising cream, and thus augment the non-fatty solids. In the trials we have made there is not the slightest indication of a reduction in the non-fatty solids of cream. In addition to the above, we tested the milk obtained from a cow after milking for two minutes, five minutes, and nine minutes respectively. The portions were collected separately, and analysed, with the following results:

				Per Cent.	
				In the Milk.	In the Non-fatty Portion.
<i>Two Minutes.</i>					
Fat ... ..	...	...	...	1·56	None
Non-fatty solids	...	...	...	8·82	8·96
<i>Five Minutes.</i>					
Fat ... ..	...	...	...	3·79	None
Non-fatty solids	...	...	...	8·61	8·95
<i>Nine Minutes.</i>					
Fat ... ..	...	...	...	8·85	None
Non-fatty solids	...	...	...	8·21	9·00

In the case of another cow, milked in the same way, similar results were obtained.

In addition we may give the results of fifteen samples of cream, all received from sanitary inspectors during the last two years, except two thick creams which we purchased ourselves. The fat in these varied between 8·40 and 58·97 per cent., and the solids in the non-fatty portion of the cream ranged from 8·70 to 10·07 per cent., so that we have here further proof of our contention. Only one of these samples gave a low result, which was as follows:

				Per Cent.	
				In the Sample.	In Non-fatty Portion of the Sample.
Fat ... ..	...	...	...	10·01	None
Non-fatty solids	...	...	...	7·12	7·91
Total solids				...	17·13
					7·91

It might be argued that this was an example of occasional variation from what would be expected; but there was certain circumstantial evidence to show that this

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was improbable. At the time the cream was taken, the inspector also took a sample of sweet and a sample of skim milk from the same vendor, and the analyses of these showed—

		Sweet.	Skim.
Fat ... ..	...	3·01	1·70
Non-fatty solids ... ..	...	7·40	7·46
Total solids ... ..	...	<u>10·41</u>	<u>9·16</u>

We think any public analyst would at once declare that these samples contained added water, or were deficient in non-fatty solids; but of course no prosecution could be taken on the skim milk, as it contained more than 9 per cent. of milk-solids. The vendor was convicted for adulteration of the sweet milk and the cream, but it is evident that he was diluting the skim milk down to the 9 per cent. standard, and had added water to the sweet milk and cream also. Of course, it might be argued that the sweet milk was exactly in the condition as obtained from the cow, and that consequently the cream and skim milk would appear also to be watered. Certainly such an argument would be extremely weak; but, supposing this were the case, we have the non-fatty portions of the cream, sweet milk, and skim milk, containing respectively 7·91, 7·63, and 7·59 per cent. of solids, and thus giving a higher result for the cream.

Our whole experience, therefore, goes to show that, whatever method of creaming be carried out, the solids of the non-fatty portion of cream are slightly higher than those in the corresponding portion of the milk from which it has been prepared, but that the difference has no practical significance, and may be disregarded.

