CHEESE YIELD INVESTIGATIONS

2. THE SAMPLING OF WHEY

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SUMMARY.

A system for the sampling of whey for the determination of fat and casein losses in cheese manufacture has been evolved. The figure for percentage fat content as determined on a sample of whey taken from the surface of the vat must be reduced by 0.045 to obtain the correct result. Such a surface sample, however, gives a fairly reliable value for protein content.

The system may have to be modified according to the method of cheesemaking adopted.

I. INTRODUCTION.

Trials were carried out in an attempt to find a satisfactory method of sampling whey so that fat and casein losses in cheese manufacture could be accurately determined. Exploratory work was carried out at four different cheese factories, and the testing of the method decided upon was carried out at one factory where adequate facilities were available. As this is the factory where the main cheese yield investigations are being made, the results are applicable to this work.

The question of losses in the white whey was not examined in this investigation as it is considered that they can be determined separately.

II. METHODS.

The usual factory method is to take samples from a few different positions at the surface of the whey immediately the stirrers are removed before the whey is run off. As a first step it was decided to check this method against other possible methods.

The following samples were taken:—

(1) From the surface of the vat. A dipperful was taken at 12 places around the perimeter of the vat.

(2) From the whey discharged as soon as the tap was opened. A bucket was placed underneath and a sample taken.

(3) From the whey discharged when the vat was approximately half-empty.

(4) From the whey discharged when the level of the whey was half-way down the orifice.

Investigations were carried out on three vats at each of two factories (A and B). At a third factory (C) an effort was made to ascertain when the drop in fat content occurred, by measuring with a stopwatch the time from the commencement of wheying-off when each sample was taken.

Analyses for fat content were carried out in duplicate on each sample, using the N-butyl-alcohol modification of the Babcock test.

To obtain an accurate assessment of the fat percentage in the bulk whey, in each case the whole of the bulk whey up until the second turning of the curd was pumped into a tank, where it was thoroughly stirred with a curd rake and then sampled. The fat content of this sample is regarded as measuring accurately the fat content of the bulk whey with the exception of white whey. In this manner it was hoped to find out if the difference between the tank and the sample from the surface is constant. If the difference is constant, then an accurate determination of the fat content can be made by applying a correction factor to the result obtained from a sample from the surface of the vat.

As casein losses are also of importance, protein determinations were carried out on samples from six vats. The method used was similar to the A.O.A.C. Kjeldahl method for milk.

III. RESULTS.

(1) Fat Losses.

At factory A, the results shown in Table 1 were obtained.

Table 1.

FAT CONTENT OF WHEY TAKEN PROGRESSIVELY DURING RUNNING.

Sample.	Fat.
	%
Vat 1—1	0·44
2	0·43
3	0·44
4	0·24
Vat 2—1	0·30
2	0·30
3	0·28
4	0·22
Vat 3—1	0·38
2	0·37
3	0·35
4	0·21

Similar results were obtained at factory B but the difference between sample 4 and the other samples was not quite as marked. The results indicate, however, that there was a reduction in the fat content of the whey towards the end of the wheying-off.

At factory C, similar results were obtained for each vat, as shown in Table 2 and further illustrated graphically in Fig. 1.

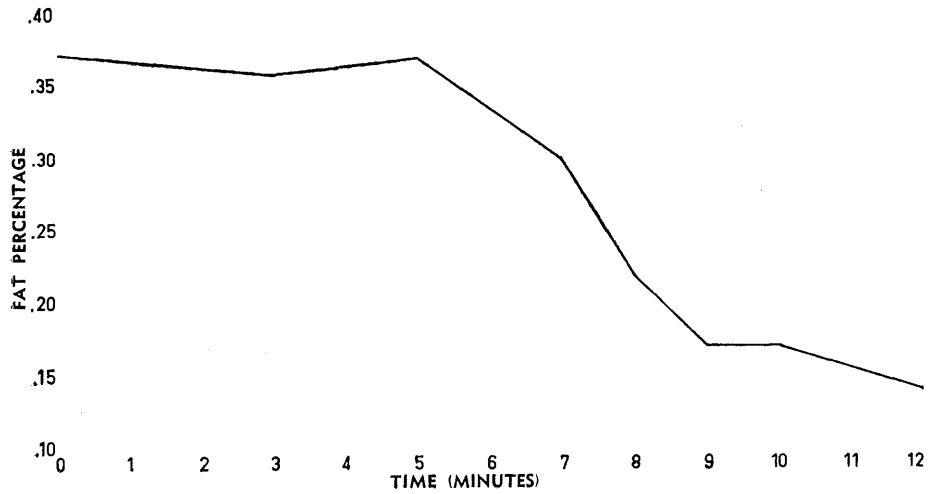

Fig. 1.

Fat Content of Whey Sampled Progressively During Running.

Table 2.

FAT CONTENT OF WHEY FROM COMMENCEMENT TO COMPLETION OF RUNNING.

——	Fat.
	%
Whey from the surface	0·36
As soon as cock opened	0·37
3 minutes after	0·36
5 minutes after	0·37
7 minutes after	0·30
8 minutes after	0·22
9 minutes after	0·17
10 minutes after	0·17
12 minutes after	0·14

Similar trends were obtained in a further seven trials at one factory.

The fat percentages of a series of samples during the course of running are shown in Table 3, together with the fat percentage of a sample from the tank. It will be seen that the difference between that from the tank and that from the surface of the vat was 0·04 per cent. Similar results, determined in quadruplicate, were obtained from eight different vats. The difference in fat content between tank and surface samples was always either 0·04 or 0·05 per cent., with a mean of 0·045 per cent.

Table 3.

FAT CONTENT OF WHEY AT VARIOUS STAGES OF RUNNING.

Sample No.	Fat.
	%
1	0·33
2	0·31
3	0·25
4	0·18
5	0·24
6	0·21
7	0·29

The following are particulars of the samples:—

Sample 1.—A dipperful of whey taken from the surface of the vat at 12 places around the perimeter.

Sample 2.—Taken from a bucket placed underneath the tap as soon as it was opened.

Sample 3.—Taken from the tap when the whey was level with the top of the orifice and the vat tipped.

Sample 4.—Taken from the tap when the whey was half-way down the orifice.

Sample 5.—Taken from the tap after the curd was parted.

Sample 6.—Taken from the tap after the curd was turned for the second time.

Sample 7.—Taken from the tank.

(2) Casein Losses.

Casein loss estimations are shown in Table 4.

Table 4.

PROTEIN CONTENT OF WHEY AT VARIOUS STAGES OF RUNNING.

Sample No.	Protein.
	%
1	1·02
2	1·01
3	1·01
4	1·02
5	1·18
6	1·07
7	1·01

It will be noted sample No. 5 was considerably higher than the others. Taking the value for the tank as a basis of comparison, sample No. 5 from the six vats examined was greater than this by the following values:—0·15, 0·14, 0·06, 0·13, 0·09, 0·17 per cent., with a mean value of 0·12 per cent. The differences between samples from the vat surface and the tank were as follows:—+0·02, —0·05, —0·03, +0·01, +0·03, +0·01, with a mean of 0·0 per cent.

Further evidence of the constant rate at which protein losses occur, in contrast to fat losses, is given in Table 5 for bulk whey and white whey from the same vat.

Table 5.

FAT AND PROTEIN PERCENTAGES OF BULK WHEY AND WHITE WHEY FROM FOUR DIFFERENT VATS.

—	Fat.	Protein.
	%	%
Bulk Whey	0·36	0·95
White Whey	4·6	1·33
Bulk Whey	0·40	0·96
White Whey	6·4	1·22
Bulk Whey	0·35	0·98
White Whey	6·3	1·40
Bulk Whey	0·33	1·06
White Whey	4·6	1·24

IV. DISCUSSION.

The results indicate that taking a sample from the surface of the whey is unsatisfactory unless some adjustment to the test result can be made. Wide variation occurs in the fat content of whey as wheying-off progresses, the reduction ranging from 0·44 per cent. to 0·21 per cent. It is probable that most, if not all, of the fat is in the whey before wheying-off is commenced. As wheying-off proceeds, the fresh whey continuously expelled from the curd has a very low fat content. This has a dilution effect on the amount of fat originally present and this effect increases as wheying-off progresses.

It appears therefore that a correction factor must be introduced if an accurate estimation of fat losses in cheese manufacture is to be obtained.

The difference between the fat content of the whey in the bulk whey tank and that of a surface sample from the cheese vat was practically constant and in every case was either 0·04 or 0·05 per cent., with a mean of 0·045 per cent. It is therefore proposed to use this figure as a correction factor in fat loss calculations in the main cheese yield experiment at the factory at which the tests were conducted.

There is no case as yet for applying this figure to other factories. In some cases, a difficulty is presented by the practice of running off some whey

and allowing the bulk to stand, thus hoping to speed up acidity development. However, it is considered probable that this will cause no perceptible variation in the correction.

There does not appear to be any significant difference in the casein losses in the whey as wheying-off proceeds and consequently the surface sample gives a reliable measure of the protein content.

The significance of the correction factor for fat content is illustrated by the difference in the estimated fat loss caused by an error in fat estimation of 0·045 per cent.

Consider 100 lb. milk giving 10 lb. cheese and 90 lb. whey. With an average fat content of milk of 4·0 per cent., the weight of the fat in the milk is 4 lb. The error in weight of fat due to an error of 0·045 per cent. in estimating the fat in the whey is equivalent to 0·04 lb.—that is, 1 per cent. As the average fat loss in the whey is about 7 per cent. an error of the magnitude of 1 per cent. is considered of importance.

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