Studies on Various Methods to Minimise Fat Losses During Ghee Making*

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ABSTRACT

To minimize fat losses during ghee making direct cream heating method and creamery — butter method were studied. In the direct cream heating method four treatments were given to cream, namely addition of citric acid (B), washing the cream with 0·05 per cent lactic acid acidulated water with 100 per cent dilution (C); ripening the cream by addition of mixed culture of *Streptococcus lactis* and *Leuconostoc Citrovorum* to acidity of 0·25 ± 0·02 per cent (D) and washing the cream with 0·05 per cent lactic acid acidulated water with 100 per cent dilution and then ripening the same to 0·15 per cent lactic acid by addition of starter culture (E).

Washing the cream with 0·05 per cent lactic acid and ripening the same to an acidity level of 0·15 per cent resulted in significant increase in the yield (92·11%) and decrease in fat losses during ghee manufacture.

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INTRODUCTION

IN INDIA, the production of ghee is still essentially a cottage industry—wherein ghee is prepared by indigenous method. Creamery-butter method of ghee making is followed by large dairy plants.

Considerable amount of research work on manufacturing ghee directly from cream has been done by Dave (1935), Patel *et al* (1949), Guriye *et al* (1949), Sokkary and Ghoneium (1949) Srinivasan *et al* (1953), Mani *et al* (1954), to study the recovery of fat from milk as ghee as well as quality of the ghee. It was observed by few of these workers that direct cream heating method gave higher yield of ghee as compared to indigenous method while cream-butter method gave higher yield and superior quality of ghee as compared to direct cream heating method, but the cost of manufacturing ghee by the former method was higher.

Direct cream heating method gives a product which is mild in flavour and pasty in texture, (Guriye *et al*, 1949) but gives better recovery of fat in the form of ghee (92·8 per cent from cow milk and 93·5 per cent from buffalo milk). The manufacturing cost was less and can be adopted on small scale. Hence it was thought worthwhile to study direct cream heating method in relation to net yield, quality of ghee and finally comparing the same with creamery-butter method of ghee making.

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MATERIALS AND METHODS

PART I

Direct cream heating method:

Fifty kilograms of Kankrej cow milk was obtained from Sheth Mungalal Goenka Gaushala, Institute of Agriculture, Anand and the milk was separated with electrically driven Alfa-lavel cream separator at 95° to 100°F and 40% fat cream was obtained. The cream was treated as under:

Treatments:

A = Fresh cream (Control).
B = Fresh cream+0·1 per cent citric acid.
C = Fresh cream washed with acidulated water (0·05 per cent lactic acid).
D = Fresh cream ripened to 0·25±0·02 per cent lactic acid.
E = Fresh cream washed with acidulated water (0·05 per cent lactic acid) and ripened to 0·15±0·02 per cent lactic acid.

PART II

Creamery-butter method compared to Direct-cream heating method:

Twenty kilograms of Kankrej cow milk was obtained from the same source and was separated to 40% fat cream. Fat test of milk, cream and skim milk was carried out by standard Gerber method.

Whole lot of cream was divided into two equal lots. First lot was washed with acidulated water as usual. Then it was boiled and cooled and inoculated with one per cent of the culture of *Str.* lactis and *Leuco-Citrovorum* and incubated at room temperature (28 to 32°C) for 12 to 16 hrs when 0·15±0·02 per cent acidity was developed the cream was clarified into ghee. Quantity of ghee and ghee residue was weighed.

Second lot of cream was also boiled and cooled and was inoculated with one per cent of the culture of *Str.* lactis and *Leuco-Citrovorum* and incubated for 12 to 16 hrs After the acidity of cream was developed to 0·25±0·02 per cent lactic acid, the cream was kept in refrigerator (5°C to 10°C) for 12 hours for ageing. After the ageing was over the cream was transferred to Dazey glass churn and churning was continued. During the churning process, the churn was kept in chilled water tub (5°C to 10°C) and the butter was prepared as per factory conditions.

The resultant butter was clarified as ghee at the standard (110° to 115°C) temperature of heating and stirring. Ghee was strained through mulsin cloth and ghee and ghee residue were weighed.

Samples of ghee thus prepared were examined by thirteen judges for flavor, texture and colour.

All the data were statistically analysed (t test).

RESULTS AND DISCUSSION

Various treatments like ripening, washing, addition of citric acid etc. have been suggested to improve the yield and quality of ghee by Guriye *et al* (1949), Sokkary and Ghoneim (1949), Rangappa and Banerjee (1950), and Srinivasan *et al*

TABLE 1

Effect of various treatments to cream on yield of ghee as per cent fat in milk.

Treatments Replications	*A*	*B*	*C*	*D*	*E*
I	81·90	87·38	91·91	84·05	92·86
II	81·40	89·90	90·80	88·40	92·60
III	83·90	86·34	90·00	88·56	91·22
IV	81·22	85·37	89·02	87·32	91·70
V	80·24	85·00	90·48	84·52	91·91
VI	81·58	85·26	91·05	86·84	92·37
Mean	81·71	86·49	90·54	86·62	91·11
S.E.	0·53		C.D.	1·56	

Analysis of variance of the yield of ghee.

Source of variation	*D.F.*	*M.S.*	*F*
Replications	5	2·872	1·71 N.S.
Treatments	4	98·815	58·75**
Error	20	1·682	

N.S. = Nonsignificant
** = Significant at 1% level.

(1953). The results in respect of per cent yield of ghee obtained by giving various treatments to cream are presented in Table 1; along with the analysis of variance.

Perusal of the data in Table 1 indicate that treatment 'E' (fresh cream washed with 0·05 per cent lactic acid acidulated water and then ripened with the addition of starter culture to the acidity level of 0·15 per cent$\pm$0·02 per cent) gave significantly higher yield of ghee (92·11 per cent) than all the treatments followed by treatment 'C' (90·54 percent). Treatment 'B' (addition of 0·1 per cent citric acid to cream) and 'D' (ripening of cream by addition of starter culture to an acidity level of 0·25$\pm$0·02 percent) gave significantly higher yield of ghee than the control (A), but significantly lower yield than the treatments 'C' and 'E'. However, treatments 'B' and 'D' did not vary significantly from each other.

Treatments 'B' gave on an average 86·49 per cent of ghee which is lower than the results of Rangappa and Banerjee (1950), where they obtained 92 per cent yield of ghee by adding 0·1 per cent citric acid to the cream.

Srinivasan *et al* (1953) obtained 89·5 per cent yield of ghee from the cream washed with 0·05 per cent lactic acid acidulated water with 100 per cent dilution. During the present study treatment 'C' gave 90·54 per cent yield of ghee. The results are in agreement with the findings of Srinivasan *et al* (1953).

Treatment 'D' gave 82·62 per cent yield of ghee. This is in agreement with the findings of Guriye *et al* (1949) who ripened the cream to 0·26 per cent acidity thereby getting yield of 87·5 per cent of ghee. However, Rangappa and Banerjee (1950) observed that the yield of ghee was 92·0 per cent when the cream was ripened.

TABLE 2

Scores given by judges for flavour of ghee.

Judges (*Replications*)	*Treatments*				
	A	*B*	*C*	*D*	*E*
1	38	35	40	30	25
2	38	25	28	30	32
3	35	38	30	30	25
4	40	45	30	40	30
5	38	35	30	32	39
6	27	30	29	25	30
7	25	20	22	25	40
8	25	23	25	27	30
9	30	29	35	37	30
10	46	45	44	17	48
11	33	30	25	26	35
12	25	25	25	25	35
13	20	10	35	4	25
Mean	32·31	30·00	30·62	26·77	32·62

Analysis of variance of scores for flavour of ghee.

Source of variation	*D.F.*	*M.S.*	*F*
Judges	12	148·61	3·45**
Treatments	4	71·23	65 N.S.
Error	48	43·12	

N.S. = Nonsignificant
** = Significant at 1% level.

Guriye *et al.* (1949) reported that the yield of ghee was 92·8 per cent when the cream was washed with water unlike in the present studies. However, the cream was ripened to 0·16 per cent acidity. During the present studies the yield of ghee with the treatment 'E' was 92·11 per cent which is in agreement with the observations of the above workers. Treatment 'E' which is a combination of treatments 'C' and 'D', resulted in significantly higher yield, thereby minimizing fat losses.

Along with the higher yield of ghee, the quality of ghee should be acceptable by consumers. Therefore, to judge the quality of ghee, the samples of various treatments were offered to a panel of thirteen judges. In order to get a standard opinion about the product and a representation view of the consumers' attitude, judges having technical and non-technical aptitude were included in the judging panel. Flavour the most important character which determines the acceptance of the product, was given the maximum marks 50; while for texture 30 marks and for colour 20 marks were assigned.

The scores given by judges for flavour of ghee are given in Table 2 alongwith the analysis of variance. From the analysis of variance of the data it can be observed that the judges differ significantly from each other. This indicated that liking of judges was different from each other. The treatments were nonsignificant indicating that they were not different from each other. Only flavour score has been presented in this paper.

Keeping quality of experimental ghee after 30 days storage:

Samples of ghee, obtained from various treatments were filled in amber coloured, screw-capped bottles. Bottles

were filled completely without leaving any air space and were stored for 30 days.

Scores obtained by ghee samples for flavour after thirty days are presented

TABLE 3

Scores given by judges for flavour of ghee after storing for thirty days.

Judges / *Replications*	*Treatments* A	B	C	D	E
1	30	25	10	25	25
2	35	40	20	25	30
3	45	48	40	47	48
4	40	35	35	42	35
5	30	32	25	40	32
6	28	25	25	35	30
7	35	20	15	15	18
8	35	35	28	30	35
9	30	30	20	22	20
10	40	45	30	37	40
11	38	30	25	25	20
12	35	30	20	25	30
13	30	26	19	33	39
Mean	34·39	32·38	24·00	30·85	30·92
S.E.	1·28		C.D.	3·65	

Analysis of variance of scores for flavour of ghee.

Source of variation	*D.F.*	*M.S.*	*F*
Judges	12	231·36	10·89**
Treatments	4	206·87	9·74**
Error	48	21·25	

** = Significant at 1% level.

in Table 3 along with the analysis of variance. From these results it was observed that judges and treatments vary significantly from each other. Treatments 'A' and 'B' do not vary significantly from each other, and B, E and D also do not vary from each other. Treatments 'A' scored significantly higher than treatments 'E', 'D' and 'C'. Treatment 'C' scored significantly lower than the rest. It was observed from these results that flavour was deteriorated during storage in case of treatment 'C'.

PART II

A comparative study of direct cream heating method with creamery-butter method in relation to yield, fat losses and quality of ghee:

It has been well established that creamery-butter method of ghee making offers a product which, has uniform granular appearance with bigger grains, peculiar pleasant aroma and higher yield as compared to the direct cream heating method. In order to compare creamery butter method of ghee making with that of direct cream heating method, the treatment 'E' from Part I, which was found to be superior in respect of ghee, was selected. Observations were made as regards, yield, fat losses at various stages of ghee making and the quality of ghee and are presented in Table 4.

TABLE 4

Effect of method of preparation on per cent yield of ghee.

Trial No.	*Creamery-Butter method*	*Direct cream heating method*
1	90·53	90·00
2	89·78	91·11
3	90·24	91·22
4	91·20	92·00
5	91·00	92·60
6	91·91	92·22
7	91·58	92·11
8	91·67	92·86
9	92·97	92·34
10	92·13	92·34
11	90·48	91·91
12	92·72	92·04
13	90·98	91·47
Mean	91·32	91·86
S.E.	0·217	
"t"	—1·428	Nonsignificant

Nonsignificant 't' value indicates that the two methods did not vary significantly which is in agreement with Patel *et al* (1949).

Further these two methods were compared for the quality of ghee with respect to flavour, texture and colour and the score of flavour is presented in Table 5.

TABLE 5

Scores given by the judges for flavour of ghee prepared by creamery-butter and direct cream heating method.

Judges	*Creamery-Butter method*	*Direct cream heating method*
1	35	35
2	37	28
3	38	28
4	35	35
5	35	37
6	40	40
7	18	20
8	33	25
9	18	10
10	42	15
11	21	23
12	20	22
13	34	35
Mean	31·23	27·15
S.E.	2·319	
"t"	1·759	Nonsignificant

Non-significant values of 't' for all the above characters indicated that the creamery-butter method and direct cream heating method are not only equally good in respect of flavour, texture and colour but are also equal in yield of ghee hence the direct cream heating method (with treatment 'E') can be advocated from the economic as well as from practical point of view.

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