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Standardization process for the manufacture of milk cake-part-I

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Abstract
Sensory quality of milk cake as a function of processing variables was evaluated to optimize the process for manufacturing long-life milk cake. In the present study two levels of each of the four variables were attempted viz. addition of citric acid level: 0.03 & 0.04 % after 1/3rd concentration, liquid glucose: 1 and 1.5 percent; ghee: 1 & 1.5 % at final stage and heat treatment, after packaging: 70 °C/ 60 min. & 70˚C for 90 minutes; The levels of other variables such as fat in milk (6 %), sugar (6 %) were decided in the preliminary trials and kept constant in all formulations. In all total 16 formulations, as per 2^4 factorial designs in SPSS software was analyzed using different proportions of ingredients. It was concluded that, low level of citric acid & ghee at all liquid glucose & heat treatment levels gave higher score of overall acceptability while high levels of citric acid and ghee scored less in overall acceptability, hence trial no 1, 2 and 3 are considered for further study.

Keywords: Milk cake, process standardization, sensory quality

Introduction
Production of traditional dairy products account for more than 50 percent of total milk produced and is hence of considerable significance to the Indian dairy sector. Milk cake is one of the popular traditional dairy products (sweets) of northern and central parts of India. Such milk-based Indian sweets have established domestic markets and are popular among Indian ethnic population in other countries as well. According to Rasone (2015) [15] the consumption of dairy products is growing at annual growth rate of more than 20 per cent as compared to the western dairy products, which have growth rate varying from 5- 10 per cent. The market for this largest and fast growing segment of Indian dairy industry is estimated at 75,000 crores (Parekh 2013) [10]. Traditional dairy products also have huge export potential due to strong presence of Indian Diaspora in many parts of world.

Milk cake is one of the most popular traditional dairy products (sweets) of northern and central parts of India and gaining popularity in other parts of the country. *Milk cake* is characterized by well-defined grains having more pronounced caramelized flavour comparatively more intense than *Kalakand*. The traditional procedure of *milk cake* involves the preparation of Danedar form of khoa similar to *Kalakand*, but a part of mass is caramelized more intensively and layered between the less caramelized portions (Mathur, 1991) [9].

Milk cake is rich source of energy, milk proteins, minerals and other growth promoting factors. In spite of its high economic and nutritional importance the *milk cake* has not received adequate attention of R & D workers. Since the process of manufacturing of *milk cake* is confined to unorganized sector. It has proven to be energy and labour intensive with inconsistent quality and poor hygienic condition thereby increasing the microbial load. It would be of great advantage, therefore, to delve deep into the various technological aspects. Organized handling of such products would help the researchers to identify various hazards and control critical points in the production lines, so that the product processes batch to batch consistency and also hurdles are removed to pave the way for export as well as for our own requirements.

However, technology for milk cake manufacture, like other traditional products (sweets), has remained confined mostly to the unorganized sector (halwais) where quality of the products depends on the skills of the manufacturer. For a consistent quality, a standardized method of manufacture of milk cake which can be scaled up for the organized industry is therefore very relevant.

The processing variables both in terms of the levels of ingredients added during the manufacture and the thermization treatment given to the product for Texturization and development of typical colour and luster play a key role in sensory acceptability of the product. The fat content of milk, level of sugar added the concentration of other additives and the time-temperature combinations employed during the thermization are the most critical factors. Several workers in the past have tried different methods for the manufacture of milk cake. Karwasra *et al*., (2001) [3] made milkcake using 6 % sugar and 0.02 % citric acid. Landge *et al*. (2004) [7] used 0.01 % alum for coagulation and 2 % ghee for improved sensory attributes. Rao *et al*., (2003) made milkcake of good quality using milk with 6% fat, and 15% sugar and Varma *et al*., (2005) [16] standardized the process for making milkcake from cow milk.

Sucrose being an important ingredient of milkcake not only imparts flavour but also helps in maintaining the physical characteristics of the product. To replace sugar, apart from texture and sensory attributes, the stability and packaging aspects of the products must be considered. Liquid glucose is a well-known humectant used in various food products. It lowers the water activity of food products in which it is added in addition to improvement in the body & texture, especially of dairy products. Thus, it not only acts as a sweetener but also helps in enhancing storage stability of the product. Dharam Pal (2000) [2] replaced 50% of cane sugar with liquid glucose (42 DE) in burfi and observed improvement in texture along with the reduction in water activity which exerted an inhibitory influence on the growth of the bacteria.

Milk sweets and syrup based sweets prepared from cereal or legume flours, individually or in combination are highly common all over India. However, information regarding standardization and storage behavior are lacking for a variety of traditional sweets with such new ingredients (Sen and Ramanna, 1979) [14]. Since there is no scientific literature available related to this product, it is therefore, realized that a stepwise identification of the problems is carried and a systematic research is conducted to standardize the processing technique for the manufacture of this product. Since the raw materials and ingredients play a pivotal role in deciding the final quality of the product, it is envisaged that each ingredient used in the manufacture be tried for its individual influence upon its quality. As the present study was intended to optimize the processing parameters with a long time objective to develop technology for the manufacture of long-life.

Materials and Methods

Buffalo milk obtained from local market was standardized to fat level 6 % and 9% SNF. The levels of fat and SNF were selected based on the results of the market survey (Kumar, 2005; Patel, 2010) [6, 11] and available literature. Liquid glucose was added as an ingredient to act as a humectant which could also improve the texture of the product. The liquid glucose and ghee was added at two levels (1.0 and 1.5 %) whereas two heat treatment temperatures (70 °C for 60 and 90 min) were studied during the experiments. The method of manufacture of milkcake recommended by Mathur, (1991) [9] (Figure1) served as broad guideline for standardization of the process for milkcake manufacture. For the manufacture of milkcake, standardized milk was heated in a kettle and filtered with muslin cloth. The milk was boiled and acidified by citric acid (0.03 & 0.04 %) to induce partial coagulation and grain formation in the product. Desiccation was continued till patting stage, sugar added and mixed by stirring properly. After working the mass for few minutes, liquid glucose and ghee was added and worked further till the mass started leaving surface of the kettle. The hot mass was then packed in laminated pouches, sealed, filled in tin container and heat treated at different time-temperature combinations in hot air oven. After thermization, the product was taken out, cooled to room temperature and served to the panel of judges for sensory evaluation. Samples were evaluated for sensory characteristics on a 9-point hedonic scale (Lawless and Hayman, 1998) [8] by a panel of five judges. The data obtained from sensory evaluation was analyzed statistically using SPSS software.

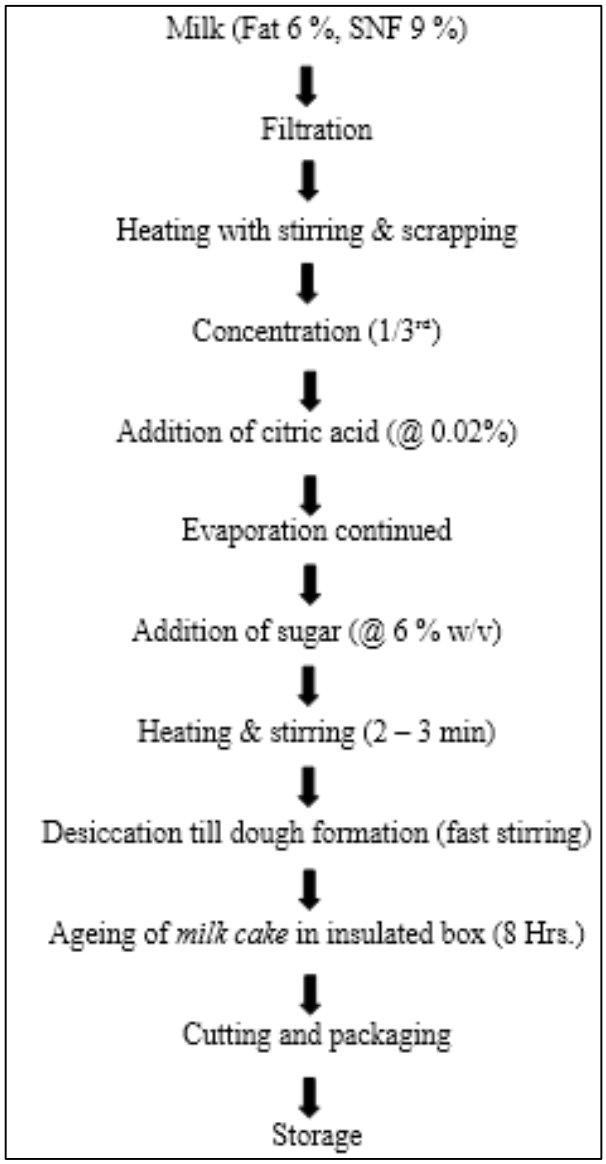

Fig 1: Preparation method of *milk cake* by traditional method

The proposed method for milk cake using various ingredients and process parameters as shown in Figure 2.

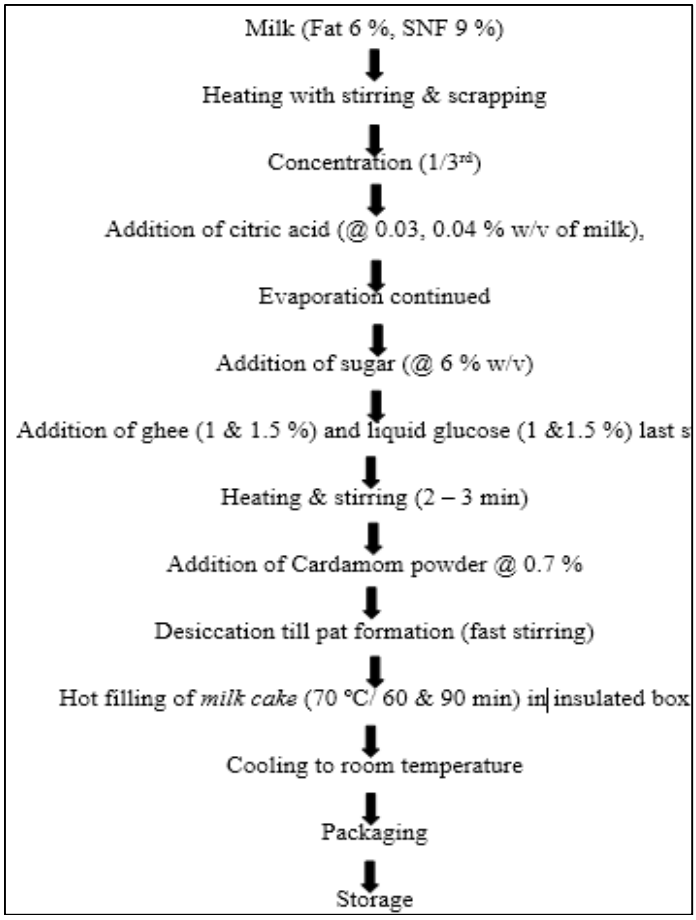

Fig 2: Proposed method of *milk cake*

Results and Discussion

Changes in sensory attributes

Acceptability of any product is assessed based on the evaluation properties by a panel of trained judges. For evaluating the sensory attributes Milk Cake, 9-point Hedonic scale was used. Flavour, body and texture, colour and appearance and overall acceptability were taken as the sensory characteristics evaluating the product. The average sensory scores of the attributes are given Table 1.

Different food products undergo deterioration in sensory profile as a consequence of various chemical and biochemical changes that progress during storage, subjective evaluation of sensory properties of any food decides acceptability of food product stored over a period of time, Sensory evaluation, in terms of flavour, body and texture, colour and appearance and overall acceptability of the developed milk cake with regard to its general acceptability was carried out for the Milk cake samples.

For the data obtained from the sensory evaluation of all combinations for fresh samples using 9.0 point hedonic scale, value of 6.0 was considered as a limit at which the product was considered to be unacceptable by the consumers for all the sensory attributes.

Table 1: Effect of process variables on sensory attributes of milk cake

Treatments	Color & Appearance	B & T	Flavour	Sweetness	Overall Acceptability
T1	8^{a}	8.14^{a}	7.87^{a}	8.01^{a}	8.21^{a}
T2	7.67^{b}	8.01^{a}	7.69^{abc}	7.63^{abc}	7.98^{ab}
T3	7.21^{cde}	7.66^{b}	7.73^{ab}	7.67^{abc}	7.98^{ab}
T4	6.81^{ef}	7.59^{bcd}	7.60^{abcd}	7.28^{bcde}	7.71^{bc}
T5	7.05^{def}	7.63^{bc}	7.33^{bcd}	7.49^{bcd}	7.4^{cdef}
T6	7.67^{b}	7.33^{bcde}	7.19^{cde}	7.13^{de}	7.23^{defg}
T7	7.59^{bc}	7.25^{defg}	7.35^{bcde}	7.44^{bcd}	7.46^{cde}
T8	7.07^{def}	6.99^{efghi}	6.89^{ef}	7.5^{bcd}	7.31^{defg}
T9	6.73^{f}	6.95^{fghi}	7.13^{cde}	7.67^{ab}	7.53^{cd}
T10	7.67^{b}	7.28^{cdef}	7.27^{cde}	7.17^{cde}	7.29^{defg}
T11	7.2^{cde}	6.99^{efghi}	7.13^{cde}	7.47^{bcd}	7.22^{defg}
T12	6.8^{ef}	6.79^{hi}	7.4^{abcd}	7.4^{bcd}	7.4^{cdef}
T13	7.07^{def}	6.86^{hi}	7.19^{cde}	7.33^{bcde}	7.4^{cdef}
T14	7.07^{def}	6.91^{ghi}	7.35^{bcde}	6.97^{e}	7.13^{efg}
T15	7.26^{bcd}	7.06^{efgh}	7.66^{abc}	7.33^{bcde}	7.06^{fg}
T16	6.73^{f}	6.69^{i}	7^{de}	7.09^{de}	6.98^{g}
F Value	6.532	3.146	1.224	0.68	0.005
SE	0.17	0.169	0.124	0.165	0.139
CD (5 %)	0.43	0.34	0.47	0.46	0.39

Effect of process variables on flavour of milk cake

The flavour score of milk cake ranged from 6.89 to 7.87. The maximum flavour score (7.87) for milk cake was obtained for trial No 01 was having the following combination of ingredients: Citric Acid (C.A.) 0.03 %, Ghee (GH) 1 %, Liquid Glucose (L.G.) 1 % and Heat Treatment (H. T.) 70 °C/ 60 min. whereas minimum flavour score was obtained for trial No.08 having combination of process variables (C.A.) 0.03 %, Ghee 1.5 %, L.G 1.5 % and H.T. 70 °C/ 90 min. The highest value is observed for trial no 1 which is at par with trial no 2 and 3 hence these trials are considered for further study.

It is concluded that heat treatment significantly ($p<0.05$) affected the flavour score of Milk cake (Table 2). With the increase in the level of heat treatment there was significant ($p<0.05$) decrease in the flavour score while in case of ghee and liquid glucose at 1 % level, the flavor score also increases.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
7.867	7.687	7.727	7.620	7.333	7.187	7.347	6.887	7.133	7.267	7.133	7.400	7.187	7.347	7.664	7.000

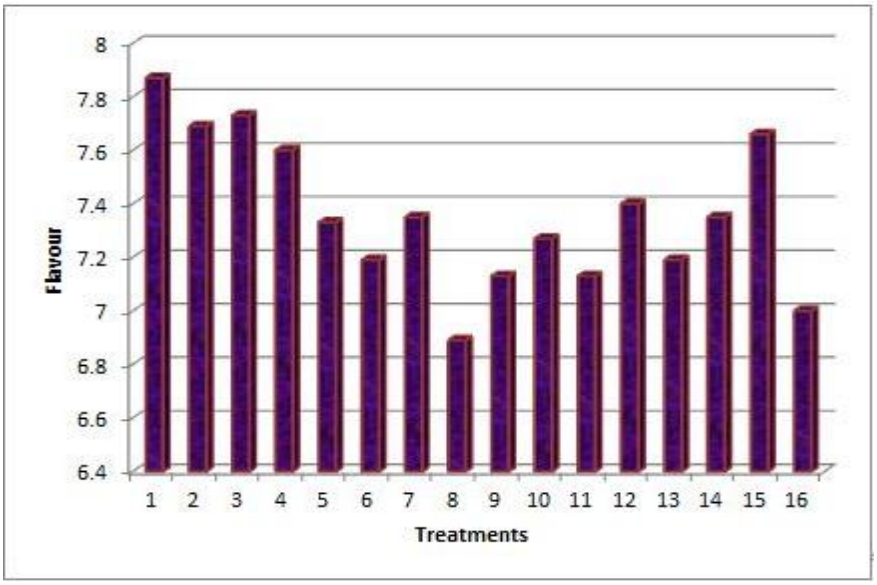

Fig 3: Effect of process variables on flavour of milk cake

The figure 3 indicates that, the flavour score increased with the increase in the level of heat treatment up to 70 °C/60 minutes but further increase in temperature resulted in lowering of flavour score. The minimum flavour score was recorded for trial No.8 (heat treatment) was 70°C for 90 minutes while the maximum score was observed for trial No.1 where the temperature was kept at 70 °C for 60 minutes. Similarly, ghee and liquid glucose had significant effect on the flavour of Milk cake.

Flavour		GH			
		0		1	
		HT			
CA	LG	0	1	0	1
0	0	7.867	7.687	7.333	7.187
0	1	7.727	7.620	7.347	6.887
1	0	7.133	7.267	7.187	7.347
1	1	7.133	7.400	7.664	7.000

Pivot Graph 1: Effect of process variables on flavour of milk cake

Pivot graph 1 shows the trend of flavour score from highest to lower values and the dominant parameters (CA & GH). Higher levels of LG at all CA levels combined with high levels of GH and HT adversely affected the flavor score of the milk cake. (Shown by reddish cells in the graph). Low levels of all parameters gave the highest flavour score (shown by green cell in the above graph). High level of HT with high level of LG & GH but low CA level gave higher score of flavour (shown by greenish cells in the above graph). Flavour also scored high at High CA, LG & GH but low HT.

Table 2: ANOVA table for flavour

Tests of Between-Subjects Effects					
Dependent Variable: FLAVOUR					
Source	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
Corrected Model	20.514[a]	15	1.368	3.301	.000
Intercept	12987.868	1	12987.868	31347.845	.000
CA	2.705	1	2.705	6.529	.011
GH	.490	1	.490	1.182	.278
LG	.604	1	.604	1.457	.229
HT	1.806	1	1.806	4.358	.038
CA * GH	.036	1	.036	.086	.769
CA * LG	.071	1	.071	.171	.679
CA * HT	1.305	1	1.305	3.149	.077
GH * LG	.009	1	.009	.021	.884
GH * HT	.136	1	.136	.329	.567
LG * HT	1.134	1	1.134	2.738	.099
CA * GH * LG	.010	1	.010	.024	.878
CA * GH * HT	4.480	1	4.480	10.814	.001
CA * LG * HT	5.760	1	5.760	13.903	.000
GH * LG * HT	.326	1	.326	.787	.376
CA * GH * LG * HT	1.637	1	1.637	3.951	.048
Error	92.392	223	.414		
Total	13100.100	239			
Corrected Total	112.907	238			

a. R Squared =.182 (Adjusted R Squared =.127)

Effect of process variables on body and texture of milk cake

Body and texture is an important parameter for acceptability of the milk cake. Definite size of grains, chewiness and gumminess are the ideal characteristics of the milk cake which finally decide the acceptability of the product.

Body and texture score of zero day milk cake varied from 6.69 to 8.14. Maximum score (8.14) was obtained for the trial No.1 which was having the following combination of ingredients: C.A. 0.03 %, Ghee 1 %, L.G 1 % and H. T. 70 ^{o}C/ 60 min. The minimum score was obtained by the samples of trial No.16 which was having a combination of the following ingredients: C.A. 0.04 %, Ghee 1.5 %, L.G 1.5 % and H. T. 70 °C/ 90 min.

The highest value is observed for trial no 1 which is at par with trial no 2 while trial no 2 is at par with trial any 3 hence these trials are considered for further study.

It is evident that heat treatment significantly ($p<0.05$) affected the body and texture score of Milk cake. With the increase in the level of heat treatment there was significant ($p<0.05$) decrease in the body & texture score while in case of ghee and liquid glucose at 1 % level, the body & texture score also increases.

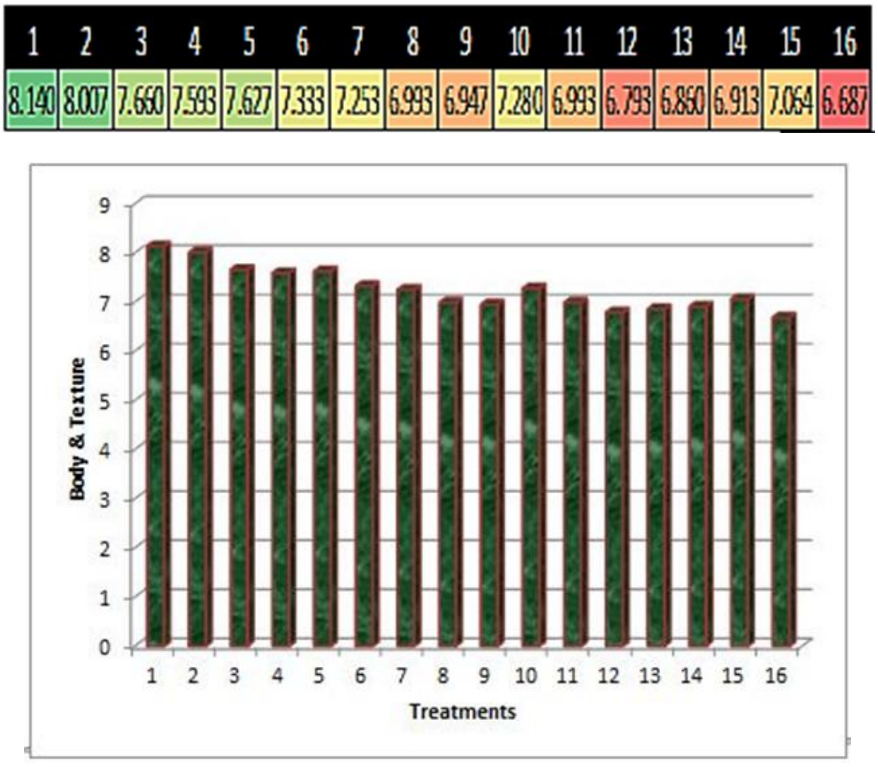

Fig 4: Effect of process variables on body & texture of milk cake

From Table 3, it was revealed that the level of heat treatment (H.T) ($p<0.05$), citric acid level and liquid glucose level had significant ($p<0.05$) effect on the body and texture of milk cake. Liquid glucose at 1 % and citric acid at 0.03 affected the body and texture score of milk cake significantly ($p<0.05$). The body and texture of milk cake is dependent upon the citric acid level used as the size and hardness of grains produced in the milk cake is largely governed by the acidity of milk used. Kumar, (1999) [5] also suggested that the well-defined grains could be attained in the milk cake prepared with citric acid level of 0.02%.

Fig. 4 shows the effect of process variables on score of body and texture of milk cake. It is evident from the graph that the body and texture score of milk cake increased as citric acid level was increased to 0.03 % and the score decreased as the citric acid level was further increased to 0.04 %. Same trend was observed in the case of heat treatment. As the heat treatment time was increased from 60 to 90 min., the body & texture score was decreased.

Body & Texture		CA			
		0		1	
		GH			
LG	HT	0	1	0	1
0	0	8.140	7.627	6.947	6.860
0	1	8.007	7.333	7.280	6.913
1	0	7.660	7.253	6.993	7.064
1	1	7.593	6.993	6.793	6.687

Pivot Graph 2: Effect of process variables on body & texture of milk cake

Pivot graph 2 shows the trend of B &T score from highest to lowest values and the dominant parameters (CA & LG). Higher levels of LG & HT combined at all levels of GH and high CA levels adversely affected the body & texture score of the milk cake. (Shown by reddish cells in the above graph). Low levels of all parameters gave the highest B&T score (shown by green cell in the above graph). High level of HT with low level of GH at all LG levels but low CA level gave higher score of B&T (shown by greenish cells in the above graph)

Table 3: ANOVA table for Body & texture

Tests of Between-Subjects Effects					
Dependent Variable: Body & Texture					
Source	**Type III Sum of Squares**	**Df**	**Mean Square**	**F**	**Sig.**
Corrected Model	35.956[a]	15	2.397	10.471	.000
Intercept	12557.067	1	12557.067	54854.314	.000
CA	20.417	1	20.417	89.188	.000
GHEE	4.873	1	4.873	21.289	.000
LG	2.604	1	2.604	11.376	.001
TEMP	1.700	1	1.700	7.427	.007
CA * GHEE	1.568	1	1.568	6.850	.009
CA * LG	.504	1	.504	2.202	.139
CA * TEMP	.888	1	.888	3.880	.050
GHEE * LG	.033	1	.033	.143	.706
GHEE * TEMP	.150	1	.150	.655	.419
LG * TEMP	.193	1	.193	.842	.360
CA * GHEE * LG	.384	1	.384	1.677	.197
CA * GHEE * TEMP	.241	1	.241	1.051	.306
CA * LG * TEMP	2.017	1	2.017	8.810	.003
GHEE * LG * TEMP	.104	1	.104	.455	.501
CA * GHEE * LG * TEMP	.280	1	.280	1.224	.270
Error	51.277	224	.229		
Total	12644.300	240			
Corrected Total	87.233	239			
a. R Squared =.412 (Adjusted R Squared =.373)					

Effect on colour and appearance of milk cake

Colour of any product is a typical and basic sensory perception that appeals to the consumer for its acceptability or rejection. Most of the dairy products range from creamy white to dark brown in colour depending on the thermal treatments given and additives used.

Colour and appearance score of zero day milk cake ranged from 6.73 to 8.00. The minimum score was obtained for the trial no 16 which consisted of the combination of ingredients: C.A. 0.04 %, Ghee 1.5 %, L.G 1.5 % and H. T. 70 °C/ 90 min. The maximum score was secured by the product (trial No.01) where the combinations of ingredients are: C.A. 0.03 %, Ghee 1 %, L.G 1 % and H. T. 70 °C/ 60 min. The highest value is observed for trial no 1 while trial No. 2 and 3 are at par with each other hence trial no 1, 2 & 3 are considered for further study.

From table 4 showed that the level of heat treatment 70 °C /60 min. and liquid glucose at 1 % had very significant ($p<0.05$) effect on the colour and appearance score of the milk cake. However, Kumar (1999) [5] reported that samples of milk cake having heat treatment 75 °C /60 min. gave significantly better colour and appearance than other treatments.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
8.007	7.667	7.213	6.813	7.047	7.667	7.587	7.073	6.733	7.667	7.200	6.800	7.067	7.067	7.264	6.733

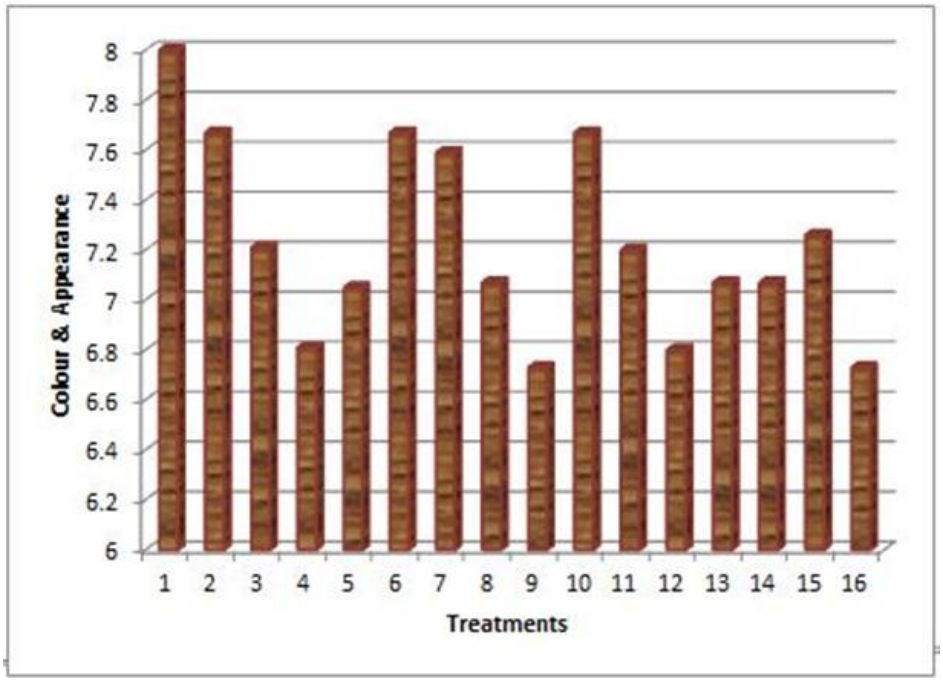

Fig 5: Effect of process variables on color & appearance of milk cake

Fig. 5 shows the effect of process variables on the colour and appearance of milk cake. It is evident from the figures that the highest score of colour and appearance was in the range of 70 °C for 60 min. heat treatment given to the product during processing and the maximum score of colour and appearance was observed for the product made from liquid glucose 1 % level. This shows that as the liquid glucose level increased from 1 to 1.5 % and heat treatment temperature from 70°C/60 to 70°C/90 minutes the colour and appearance score of milk cake decreases. Extent of browning not only varies with the thermal treatment but also with the type of humectants (sugar, liquid glucose etc.).

Colour & Appearance		CA			
		0		1	
		GH			
LG	HT	0	1	0	1
0	0	8.007	7.047	6.733	7.067
0	1	7.667	7.667	7.667	7.067
1	0	7.213	7.587	7.200	7.264
1	1	6.813	7.073	6.800	6.733

Pivot Graph 3: Effect of process variables on Color and appearance of milk cake

This graph shows the trend of C&A score from highest to lowest values and the dominant parameter combination. Higher levels of LG & HT combined at all levels of CA and GH adversely affected the colour and appearance score of the milk cake as also the high CA at low levels of other parameters. (Shown by reddish cells in the above graph). Low levels of all parameters gave the highest C&A score (shown by green cell in the above graph). High level of HT with high level of GH & LG at low CA level gave higher score of C&A (shown by greenish cells in the above graph).

Table 4: ANOVA table for Color & Appearance

Tests of Between-Subjects Effects					
Dependent Variable: CA					
Source	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
Corrected Model	34.016[a]	15	2.268	5.411	.000
Intercept	12473.394	1	12473.394	29764.189	.000
CA	6.033	1	6.033	14.396	.000
GH	.331	1	.331	.790	.375
LG	4.665	1	4.665	11.132	.001

HT	.372	1	.372	.887	.347
CA * GH	.003	1	.003	.007	.932
CA * LG	1.265	1	1.265	3.019	.084
CA * HT	.377	1	.377	.900	.344
GH * LG	3.221	1	3.221	7.685	.006
GH * HT	.044	1	.044	.105	.746
LG * HT	8.726	1	8.726	20.822	.000
CA * GH * LG	1.649	1	1.649	3.934	.049
CA * GH * HT	3.408	1	3.408	8.133	.005
CA * LG * HT	.420	1	.420	1.003	.318
GH * LG * HT	.069	1	.069	.164	.686
CA * GH * LG * HT	3.284	1	3.284	7.836	.006
Error	93.453	223	.419		
Total	12603.780	239			
Corrected Total	127.469	238			

a. R Squared =.267 (Adjusted R Squared =.218)

Effect on process variables on sweetness of fresh milk cake

Sweetness score of zero day milk cake ranged from 7.09 to 8.01. The minimum score was obtained for the trial no 16 which consisted of the combination of ingredients: C.A. 0.04 %, Ghee 1.5 %, L.G 1.5 % and H. T. 70 °C/ 90 min. The maximum score was secured by the product (trial no.01) where the combinations of ingredients are: C.A. 0.03 %, Ghee 1 %, L.G 1 % and H. T. 70 °C/ 60 min. The highest value is observed for trial no 1 which is at par with trial no 2 and 3 hence trial no 1, 2 & 3 are considered for further study.

The figure showed that the level of heat treatment 70 °C /60 min. and liquid glucose at 1 % had very significant ($p<0.01$) effect on the colour and appearance score of the milk cake. However, Kumar (1999) [5] reported that samples of milk cake having heat treatment 75 °C /60 min. gave significantly better colour and appearance than other treatments.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
8.007	7.633	7.667	7.280	7.490	7.133	7.440	7.500	7.667	7.167	7.467	7.400	7.333	6.967	7.357	7.093

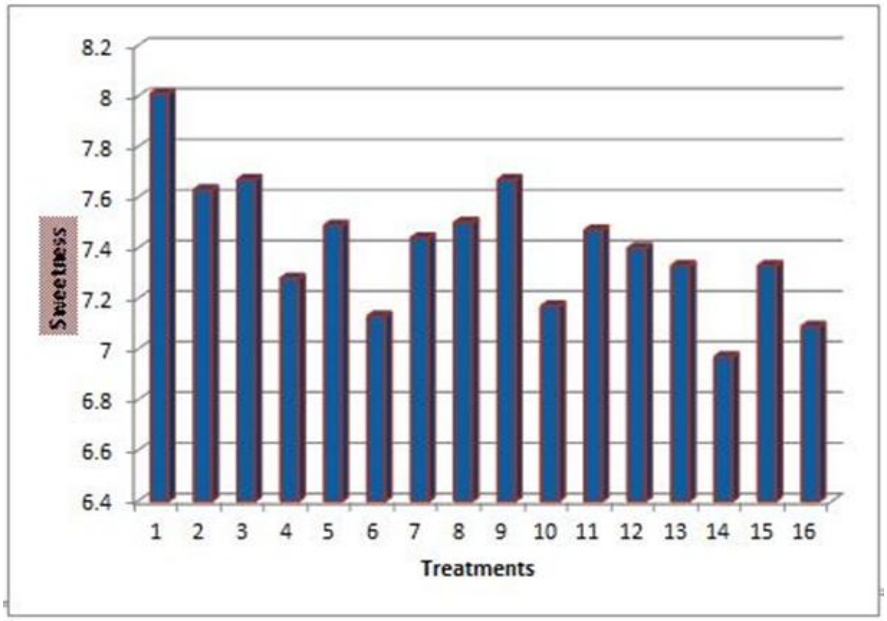

Fig 6: Effect of process variables on sweetness of milk cake

Sweetness		HT			
		0		1	
		CA			
GH	LG	0	1	0	1
0	0	8.007	7.667	7.633	7.167
0	1	7.667	7.467	7.280	7.400
1	0	7.490	7.333	7.133	6.967
1	1	7.440	7.357	7.500	7.093

Pivot Graph 4: Effect of process variables on Sweetness of Milk Cake

This graph shows the trend of sweetness score from highest to lower values and the dominant parameters (HT & GH). High level combination of HT combined at all levels of CA, LG and GH adversely affected the sweetness score of the milk cake. (Shown by reddish / red cells in the above graph). Low levels of all parameters gave the highest sweetness score (shown by green cell in the above graph). Low level of GH all L. G, CA & HT levels gave higher score of sweetness (shown by greenish cells in the above graph).

Table 5: ANOVA table for sweetness

Tests of Between-Subjects Effects					
Dependent Variable: SWEET					
Source	**Type III Sum of Squares**	**Df**	**Mean Square**	**F**	**Sig.**
Corrected Model	14.281[a]	15	.952	2.335	.004
Intercept	13130.563	1	13130.563	32202.484	.000
CA	2.091	1	2.091	5.127	.025
GHEE	2.904	1	2.904	7.122	.008
LG	.193	1	.193	.473	.493
TEMP	3.800	1	3.800	9.320	.003
CA * GHEE	.033	1	.033	.080	.777
CA * LG	.561	1	.561	1.375	.242
CA * TEMP	.104	1	.104	.255	.614
GHEE * LG	1.667	1	1.667	4.087	.044
GHEE * TEMP	.038	1	.038	.092	.762
LG * TEMP	1.320	1	1.320	3.238	.073
CA * GHEE * LG	1.233	1	1.233	3.023	.083
CA * GHEE * TEMP	.074	1	.074	.180	.672
CA * LG * TEMP	.004	1	.004	.010	.920
GHEE * LG * TEMP	.008	1	.008	.020	.888
CA * GHEE * LG * TEMP	.253	1	.253	.622	.431
Error	91.336	224	.408		
Total	13236.180	240			
Corrected Total	105.617	239			

a. R Squared =.135 (Adjusted R Squared =.077)

Effect of process variables on overall acceptability on milk cake

Overall acceptability of any product is an important parameter in addition to other sensory parameters like colour, body and texture, flavour, and/or Physico- chemical qualities and packaging of product which represent the total performance of the product in the mind of consumers.

Overall acceptability score of zero day milk cake ranged from 6.98 to 8.21. The minimum score (6.98) was obtained for the samples prepared as per trial no 16 which consisted of the following combination of ingredients: C.A. 0.04 %, Ghee 1.5 %, L.G 1.5 % and H. T. 70 °C/ 90 min. while maximum score (8.21) was observed for the product (trial No. 1) obtained from combination of ingredients are: C.A. 0.03 %, Ghee 1 %, L.G 1 % and H. T. 70 °C/ 60 min. The highest value is observed for trial no 1 which is at par with trial no 2 and 3 hence these trials are considered for further study.

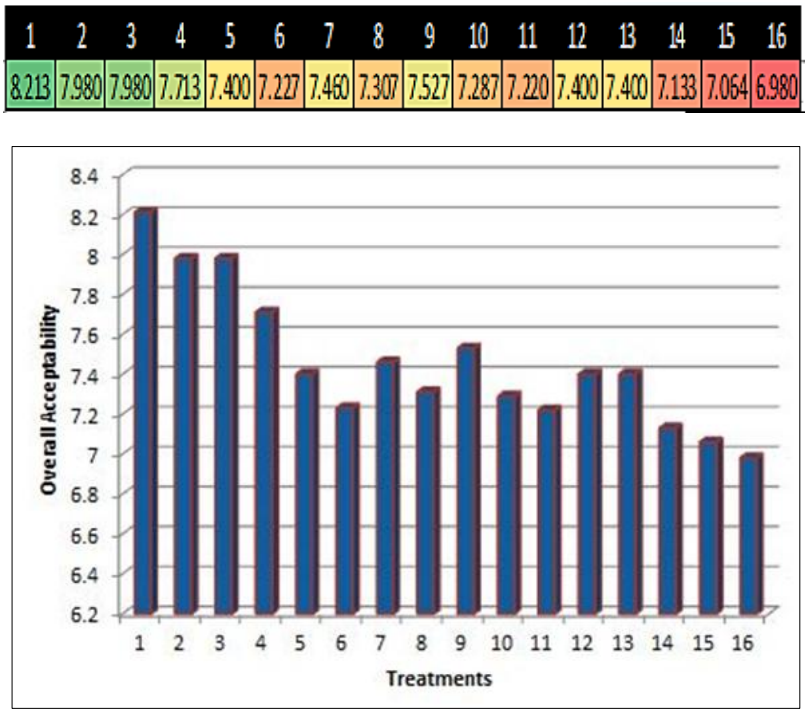

Fig 7: Effect of process variables on overall acceptability of milk cake

Overall Acceptability		GH			
		0		1	
		CA			
HT	LG	0	1	0	1
0	0	8.213	7.527	7.400	7.400
0	1	7.980	7.220	7.460	7.064
1	0	7.980	7.287	7.227	7.133
1	1	7.713	7.400	7.307	6.980

Pivot Graph 5: Effect of process variables on Overall acceptability of milk cake

Pivot graph 5 shows the trend of OA score from highest to lowest values and the dominant parameters (HT & GH). High level combination of HT, CA, LG and GH adversely affected the Overall Acceptability score of the milk cake. (Shown by red cell in the above graph). Low levels of all parameters gave the highest OA score (shown by green cell in the above graph). Low level of CA & GH at all LG& HT levels gave higher score of OA (shown by greenish cells in the above graph) while High levels of CA & GH scored less in OA (shown by reddish cells in the above graph).

Table 6: ANOVA Table for Overall acceptability

Dependent Variable: OA					
Source	**Type III Sum of Squares**	**Df**	**Mean Square**	**F**	**Sig.**
Corrected Model	23.925[a]	15	1.595	5.521	.000
Intercept	13284.864	1	13284.864	45986.384	.000
CA	6.468	1	6.468	22.390	.000
GHEE	9.048	1	9.048	31.321	.000
LG	.150	1	.150	.519	.472
TEMP	2.053	1	2.053	7.108	.008
CA * GHEE	.913	1	.913	3.159	.077
CA * LG	.308	1	.308	1.067	.303
CA * TEMP	1.067	1	1.067	3.692	.056
GHEE * LG	.088	1	.088	.305	.581
GHEE * TEMP	.017	1	.017	.058	.810
LG * TEMP	1.442	1	1.442	4.990	.026
CA * GHEE * LG	.451	1	.451	1.560	.213
CA * GHEE * TEMP	1.148	1	1.148	3.974	.047
CA * LG * TEMP	.131	1	.131	.452	.502
GHEE * LG * TEMP	.641	1	.641	2.218	.138
CA * GHEE * LG * TEMP	.001	1	.001	.005	.943
Error	64.711	224	.289		
Total	13373.500	240			
Corrected Total	88.636	239			

a. R Squared =.270 (Adjusted R Squared =.221)

The statistical analysis of data revealed that the overall acceptability score show that heat treatment (70°C / 60 min.), liquid glucose (1 %), ghee (1%) and citric acid (0.03%) (Trial no.01) had significant ($p<0.05$) positive effect on the overall score. This may due to the fact that ultimately heat treatment and liquid glucose affected the colour and caramelized flavour of the product. Also citric acid on the extreme side governed the size and the hardness of grains in the product consequently giving appropriate body and texture to the product which ultimately influenced the overall acceptability of the final product. Hence, heat treatment, liquid glucose, ghee and citric acid significantly affected the overall acceptability of the milk cake.

The figure 7 shows how the levels of different ingredients affect overall acceptability of milk cake. These plots revealed that the heat treatment of 70 °C/ 60 min. and liquid glucose at 1 % increased the overall acceptability score. However, heat treatment of 70 °C / 90 min. and liquid glucose and 1.5 % level decreased the overall acceptability score. Increase in citric level from 0.02 to 0.03 influenced the overall acceptability score positively. However, further increase in the citric acid level decreased the overall acceptability of the milk cake. Optimum colour of the milk cake with characteristic caramelized flavour and defined types of grains characterize milk cake and acidity of milk and heat treatment imparted to the product has effect on the types of grains and browning reactions in the product and reported in the literature (Kumar, 1999) [5].

Conclusion

The minimum score for overall acceptability (6.98) was obtained for the samples prepared as per trial no 16 while maximum score (8.21) was observed for trial No. 1. The highest value is observed for trial no 1 which is at par with trial no 2 and 3. Low level of Citric Acid & Ghee at all Liquid Glucose & Heat treatment levels gave higher score of overall acceptability while high levels of citric acid and ghee scored less in overall acceptability, hence trial no 1, 2 & 3 are considered for further study.

References

1. Chetana R, Srinivasa PC, Reddy SRY. Moisture sorption characteristics of milk burfi, a traditional Indian sweet, using sugar substitutes. Eur. Food Res. Technol. 2005; 220:136-141.
2. Dharam Pal. Technological advances in the manufacture of heat desiccated traditional Indian milk products- An overview. Indian Dairyman. 2000; 52(10):27-34.
3. Karwasra RK, Srivastava DN, Hooda S. Standardization of the process for the manufacture of milkcake. Indian Journal of Dairy Science. 2001; 54(5):280-282.
4. Kilcast D. Food Ingredients. Anal Int. 1999; 21:27-33.
5. Kumar RK. Technology and shelf life of milk cake. Ph. D thesis submitted to CCC Haryana Agri. University, Hisar, 1999.
6. Kumar A, GR Patil RRB Singh, AA Patel. Effect of processing variables on the sensory quality of milk cake. Indian J Dairy Sci. 2014; 67(5):375-379.

7. Landge SN, Kulkarni DN, Chavan BR, Shiva Aithal. Alum improves granular consistency in milkcake. Abstract in compendium of 16th Indian Convention of Food Scientists and Technologists. 2004, 56.
8. Lawless HT, Haymann H. Consumer field tests and questionnaire design. Sensory Evaluation of Food (Lawless, H.T. and Haymann, H. Eds.) Chapmann and Hall, New York, 1998, 480-518.
9. Mathur BN. Indigenous milk products of India: the related research and technological requirements. Indian Dairyman. 1991, 43:61–74.
10. Parekh JV. Innovations in traditional Indian dairy foods. Global dairy industry and food security. In: Souvenir, 41st Dairy Industry Conference & IIDE. IDA (west zone) Mumbai, 2013, 21-30.
11. Patel SY. Physico-Chemical, Sensory, Rheological Characteristics and Storage related changes in Market Samples of Milk Cake at Ambient Temperature. M. Sc thesis submitted to AAU, Anand, 2010.
12. Rao TM, Reddy CR, Ranganadahm M, Laxmnarayan M. Standardization of the method for milkcake preparation. Indian Journal of Dairy Science. 2003; 56(6):397-399.
13. Rasone R, Tanwar B, Dey A. Khoa: A study desiccated indigenous Indian dairy product. Research journal of pharmaceutical, biological and chemical science. 2015; 6(5):39-48.
14. Sen, DP, Ramanna BR. Proceedings of the symposium on the status and prospects of the confectionery industry in India, Mysore, India. 1979, 78-83.
15. Snedecor GW, Cochran WG. Statistical Methods. Oxford and IBH Publications, New Delhi, 1994.
16. Varma RV, Reddy KY, Sharma KS, Shiv Kumar, Kumar Ravi. Process optimization of milkcake using cow milk. Journal of Food Science and Technology. 2005; 42(2):167-169.