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Preparation of Kulfi incorporated with apple (*Malus pumila*) powder

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DOI: <https://doi.org/10.22271/chemi.2021.v9.i2h.11876>**Abstract**

The present study entitled "Preparation of Kulfi incorporated with apple (*Malus Pumila*) powder" was carried out using different levels of apple powder with a view to optimize the process for its manufacture and to study its chemical, sensory and microbiological qualities. Initially the preliminary trials were conducted by blending of different levels of apple powder @ 0%, 2.5%, 5% and 7.5% in the apple Kulfi with 15% sugar to finalize the experimental treatments. Experimental apple Kulfi samples were analyzed for sensory, chemical and microbiological qualities. It was observed that apple Kulfi samples under different treatments showed significant differences for total solid, fat, protein, ash, acidity and moisture content. The values were ranged from 36.75 to 31.34, 12.40 to 11.34, 4.11 to 4.00, 1.21 to 1.13, 0.13 to 0.10 and 68.66 to 63.25, respectively. Total solids, Fat, Protein, Ash, Acidity and Moisture contents differed significantly among the different types of Kulfi with apple flavour. Significant difference was observed within the smell and taste score and the body and texture score of different types of Kulfi. In case of sensory evaluation, colour and appearance and overall acceptability found to be significant over the other treatments. The microbial results indicate the SPC, yeast and mould and coliform were within the all permissible limits. The Production cost of apple Kulfi under different treatments showed significant differences.

Keywords: Kulfi, apple powder, body and texture, colour and appearance, sensory evaluation, microbial evaluation

Introduction

Kulfi is a frozen dairy product made by suitable blending and processing of SMP and other milk products together with sugar and flavour, with or without stabilizer or colour. Kulfi is also known as malai Kulfi is an indigenous frozen dairy product, which closely resembles ice cream in composition. Traditionally, Kulfi is prepared by evaporating sweetened and flavored milk by slow heating with almost continuous stirring to keep milk from sticking to the bottom of vessels until its volume is reduced by a half thus concentrating the milk. Kulfi manufacturing helps to develop small scale industry and generate sizeable employment and income

Kulfi – is like most by the consumers as it is quiet cheap, palatable and nutritious frozen dairy dessert. It is widely accepted and its demand is increasing day by day next to ice cream. Ice cream is whipped with air or over run, Kulfi contains no air. It comes in various flavours, including strawberry, rose, mango, saffron (Keshar) and pistachio, the more traditional flavours, as well as supplemented with fruit powder like apple, orange, strawberry and peanut (Ubale *et al.*, (2014)^[14].

In recent years, growing health consciousness has led to development of novel dairy products, having therapeutic and nutritive value. In view of this, Indian Kulfi, the most commonly consumed Indian frozen dairy product, if enriched with apple powder, could result in increased acceptability, value addition and therapeutic value of the product.

Kulfi is made from concentrated sweetened milk with or without added nuts and flavour and is known for its refreshingly cool and delightfully sweet characteristics. There is no significant improvement in the traditional method of Kulfi making which is produced mainly by the unorganized sector (Ramachandran *et al.*, (2005)^[10].

In recent year, the consumption of ice cream in India has increased considerably in big cities and towns. After long time it was realized that there is need to develop the Indigenous product, as they have ready market in India Aneja *et al.*, (1992)^[1].

Kulfi has nutritional significance but possess no therapeutic properties (Siddhu *et al.*, (2017) [11]).

Apples fruit is rich in vitamins B₁, B₂, C and A. It contains dietary fibre, energy, potassium, phosphorus, sodium, iron, zinc and copper. It is good source of vitamin C. Apples fruit have many association health benefits that are low risk of diabetes, weight loss, prevent cancer, protect asthma, etc. Apples helps to improve digestion, prevents stomach disorders, liver disorders.

Kulfi is often prepared by addition of flavours to enhance its colour, appearance and flavour. Thus, present study was envisaged to study the preparation and the quality characteristics of kulfi as a novelty product by blending with the apple powder.

Materials and methods

The research was conducted in Department of Animal Biotechnology, College of Agricultural Biotechnology, Loni. Commercial grade clean, white crystalline cane-sugar and apple powder were procured from local market of Loni, Tal. Rahata, Dist- Ahmednagar.

In this trial, the following different levels of apple in kulfi were studied.

T₀ - Control (without addition of apple powder)

T₁- Addition of 2.5% apple powder in kulfi mix

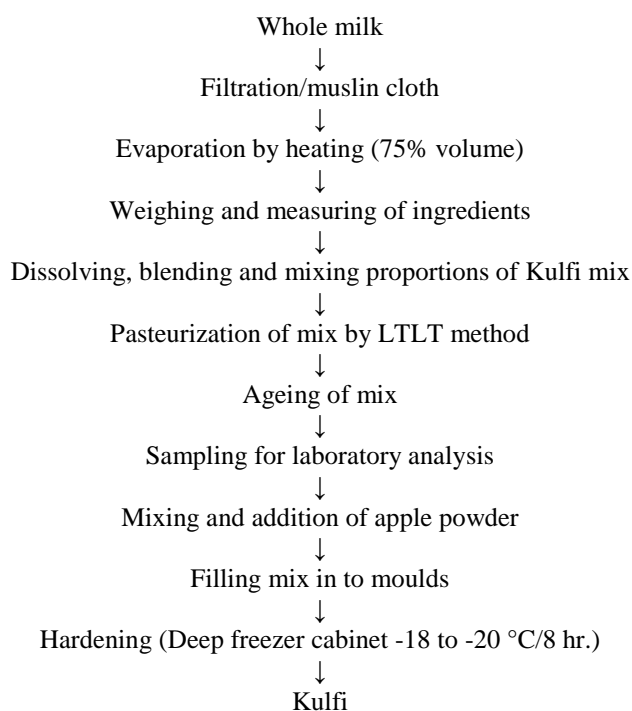
T₂ - Addition of 5% apple powder in kulfi mix

T₃ – Addition of 7.5% apple powder in kulfi mix.

Composition of apple Kulfi mix

Sr. No	Ingredient	T ₀	T ₁	T ₂	T ₃
1	Milk with 6.04% fat & 9.0% SNF (ml)	39.7538	5037.2536		
2	Cream with 25% fat & 5.5% SNF (ml)	39.7538	5037.2536		
3	Milk powder with 0.5% fat & 99% SNF(ml)	5	5	5	5
4	Sugar (g)	15	15	15	15
5	Stabilizer (g)	0.5	0.5	0.5	0.5
6	Apple powder (g)	-	2.5	5	7.5

Flow chart for preparation of Apple Kulfi



Physico-chemical analysis

The total solid content of milk, cream, milk powder and apple were determined by gravimetric method as per IS: 1479 (part II), 1961 [8]. The fat content was determined by using standard Gerber method as described in IS: 1224 (part II), 1977. The protein content was determined by estimating the per cent nitrogen by Micro-kjeldhal method as recommended in IS: 1479 (part II), 1961 [8]. The per cent nitrogen was multiplied by 6.38 to find out protein percentage in Kulfi. Per cent ash content was determined by the method described in A.O.A.C., 1975. Per cent moisture content was determined by gravimetric method as per IS: 1479 (part II) 1961 [8]. The acidity of kulfi expressed as per cent lactic acid was determined by the method described in IS: 1479 (part I), 1960 [7].

Sensory Evaluation

The fresh sample of kulfi were evaluated organoleptically by nine point hedonic scale for various quality attributes such as general appearance, body, texture and flavour by panel of 8-10 judges. The experimental samples were served to the judges at 7 °C. The panelists were instructed to rate each sample on 9 point hedonic scale. They were provided hedonic scale score cards for evaluating the quality of product as described in IS: 6273 (part-II) 1971 [5].

Microbiological Analysis

All the treatment samples of apple kulfi along with control sample were stored at 4°C and analysed for different microbial parameters such as standard plate count, coli form count, yeast and mould count by adopting standard procedure as given by (Dubey and Maheshwari, 2004) throughout the storage period.

Statistical Analysis

For present investigation RBD i.e. Randomised Block Design was employed using three replications. The data were tabulated and analysed according to Snedecor and Cochran (1994) [13].

Results and Discussion

Table 1: Chemical analysis of buffalo milk, curd and apple powder

Sr. No.	Constituents	Buffalo milk (%)	Cream	Apple powder
1	Total Solid	16.34	31.84	96.44
2	Fat	6.04	25.10	2.94
3	Protein	4.54	2.14	4.86
4	Acidity	0.14	0.08	0.58
5	Ash	0.82	1.10	1.92

These observations indicate that the buffalo milk used in the present investigation was of good quality. It is clear from the figures of total solid, fat, protein, acidity, ash that they lies within the limits of legal standards for buffalo milk in Maharashtra state as prescribed by PFA rules, 1976, cited by De (2008) [3].

Table 2: Effect of different levels of apple powder on total solids of Kulfi (Per cent)

Treatment	R ₁	R ₂	R ₃	R ₄	Average	S.D.
T ₀	31.32	31.30	31.36	31.38	31.34 ^d	0.031623
T ₁	33.18	33.10	33.12	33.20	33.15 ^c	0.041231
T ₂	34.90	34.88	35.00	35.02	34.95 ^b	0.060828
T ₃	36.79	36.64	36.71	36.86	36.75 ^a	0.082765

It was observed that the total solid content showed gradual increase with the increase in level of apple powder. This simultaneous increase from T₀ to T₃ may be due to high amount of total solid content of apple powder (96.44) than buffalo milk (16.34), cream (31.84) and skim milk powder (90.16). The lowest total solid content was noticed at T₀ i.e., kulfi blended without addition of apple powder, while the highest total solid content was observed at T₃ i.e. kulfi blended with 7.5% apple powder. Treatment T₃ found significantly different than other treatments.

Table 3: Effect of different levels of apple powder on fat content of apple Kulfi (Per cent)

Treatment	R ₁	R ₂	R ₃	R ₄	Average	S.D.
T ₀	12.42	12.49	12.38	12.31	12.40 ^a	0.065192
T ₁	12.02	12.01	12.15	12.14	12.08 ^b	0.065192
T ₂	11.72	11.66	11.80	11.86	11.76 ^c	0.076158
T ₃	11.39	11.51	11.36	11.47	11.43 ^d	0.060156

Blending with apple powder had significantly affected the fat content of Kulfi. It was observed that blending of apple powder decrease the fat content of Kulfi. The declining trend of fat content of Kulfi can be attributed to the fact that the fat content of apple powder is much lower (2.94 per cent) than that of milk, cream and skim milk powder. Besides, obvious reason is that as the level of apple powder increased, there was reduction in amount of milk, cream and skim milk powder on added percentage basis.

The average fat content of apple kulfi was 11.92 per cent. The highest fat content in kulfi (12.40) was observed in (T₀) i.e. kulfi without addition of apple powder and the lowest (11.43 per cent) at 7.5 per cent level of apple powder (T₃). Treatment T₃ was found to be significantly superior over the Treatments T₂, T₁ and T₀, respectively.

Table 4: Effect of different levels of apple powder on protein content of apple Kulfi (per cent)

Treatment	R ₁	R ₂	R ₃	R ₄	Average	S.D.
T ₀	4.02	4.00	3.98	4.00	4.00 ^b	0.014142
T ₁	4.00	4.02	4.06	4.08	4.04 ^{ab}	0.031623
T ₂	4.06	4.08	4.10	4.08	4.08 ^{ab}	0.014142
T ₃	4.10	4.12	4.11	4.11	4.11 ^a	0.007071

Variation in protein content was significant. The average protein content of kulfi was 4, 4.04, 4.08 and 4.11 per cent for T₀, T₁, T₂ and T₃, respectively. The highest level of protein content was noticed at Treatment T₃ i.e. 7.5% apple powder, lowest (4.00) at T₀ i.e. without addition of apple powder. It was observed that the protein content showed gradual increase in Kulfi with the increase in level of apple powder. The simultaneous increase from T₀ to T₃ may be due to high amount of protein content of apple powder (4.86%). Treatment T₃ found significantly different than the T₁ and T₀ it is found at par with treatment T₂.

Table 5: Effect of different levels of apple powder on ash content of apple Kulfi (per cent)

Treatment	R ₁	R ₂	R ₃	R ₄	Average	S.D.
T ₀	1.12	1.14	1.13	1.13	1.13 ^a	0.007071
T ₁	1.16	1.15	1.17	1.16	1.16 ^a	0.007071
T ₂	1.16	1.19	1.19	1.18	1.18 ^a	0.012247
T ₃	1.19	1.14	1.28	1.23	1.21 ^a	0.051478

Ash content showed gradual increase with increase in level of apple powder. The simultaneous increase from T₀ to T₃ may

be due to total amount of ash content of apple powder (1.92). The lowest ash content was observed at T₀ i.e. kulfi without addition of apple powder mix (1.13), while the highest ash content was observed at T₃ i.e. Kulfi with 7.5% apple powder (1.21). All the treatment found at par with each other.

Table 6: Effect of different levels of apple powder on acidity of apple Kulfi (per cent)

Treatment	R ₁	R ₂	R ₃	R ₄	Average	S.D.
T ₀	0.10	0.09	0.10	0.09	0.10 ^b	0.005
T ₁	0.10	0.10	0.09	0.09	0.10 ^b	0.005
T ₂	0.11	0.10	0.14	0.13	0.12 ^{ab}	0.015811
T ₃	0.13	0.13	0.11	0.15	0.13 ^a	0.014142

It was observed that the acidity showed gradual increase with the increase in level of apple powder. This simultaneous increase from T₀ to T₃ may be due to high amount of acidity of apple powder (0.58) than buffalo milk (0.14), cream (0.08) and skim milk powder (0.14). The lowest acidity was noticed at T₀ & T₁ i.e. Kulfi blended without addition of apple powder and 2.5% apple powder, while the highest acidity was observed at T₃ i.e. Kulfi blended with 7.5% apple powder.

Treatment T₁ was found at par with Treatment T₀, Treatment T₂ was also found at par with Treatment T₃. Treatment T₀ and T₁ were found significantly different over the Treatments T₂ & T₃.

Table 7: Effect of different levels of apple powder on moisture content of apple Kulfi (per cent)

Treatment	R ₁	R ₂	R ₃	R ₄	Average	S.D.
T ₀	68.68	68.70	68.64	68.62	68.66 ^a	0.031623
T ₁	66.82	66.90	66.88	66.80	66.85 ^b	0.041231
T ₂	65.10	65.12	65.00	64.98	65.05 ^c	0.060828
T ₃	63.21	63.36	63.29	63.14	63.25 ^d	0.082765

The highest level of moisture content was noticed at Treatment T₀ i.e. without addition of apple powder, lowest (63.25%) at T₃ i.e. 7.5% apple powder. It was observed that the moisture content showed gradual decrease in Kulfi with the decrease in level of apple powder. The simultaneous increase from T₀ to T₃ may be due to high amount of moisture content of apple powder (3.56 per cent). Treatment T₀ found significantly different than the Treatments T₁, T₂ and T₃.

Sensory evaluation of apple kulfi

Table 8: Score for Colour and appearance of apple kulfi (out of nine)

Treatment	R ₁	R ₂	R ₃	R ₄	Average	S.D.
T ₀	7.20	7.35	7.65	7.85	7.52 ^a	0.253414
T ₁	7.50	7.35	8.00	8.05	7.73 ^a	0.305164
T ₂	7.60	7.35	7.65	7.20	7.45 ^a	0.183712
T ₃	7.45	7.70	7.35	7.70	7.55 ^a	0.15411

Score for colour and appearance was increased and sometimes decreased due to addition of apple powder. The highest score (7.73) was observed for Treatment T₁ i.e. kulfi blended with 2.5% apple powder and this highest score may be due to its peculiar slight white appealing colour and appearance which was liked most by the judges. Lowest score (7.45) was observed for Treatment T₂ i.e. kulfi blended with 5% apple powder. The lowest score may be due to its white colour which was not accepted by judges. Score for treatment T₁ found superior then the other treatments, whereas all treatments found at par with each other.

Table 9: Score for body and texture of apple Kulfi (out of nine)

Treatment	R ₁	R ₂	R ₃	R ₄	Average	S.D.
T ₀	7.20	7.35	7.30	8.15	7.50 ^a	0.379144
T ₁	7.35	7.65	7.45	7.45	7.47 ^a	0.108972
T ₂	7.40	7.25	7.65	7.45	7.44 ^a	0.143069
T ₃	7.90	7.15	7.65	7.70	7.60 ^a	0.276134

Kulfi prepared from T₃ level recorded highest score for (7.60) followed by T₂ (7.44). The sensory score increased at T₃ i.e. 7.5 per cent level of apple powder. All treatments found at par with each other.

Table 10: Score for flavour of apple Kulfi (out of nine)

Treatment	R ₁	R ₂	R ₃	R ₄	Average	S.D.
T ₀	7.25	7.70	6.80	7.10	7.22 ^b	0.32476
T ₁	7.70	7.45	7.15	7.55	7.46 ^{ab}	0.201168
T ₂	8.00	7.50	7.35	8.10	7.74 ^a	0.318934
T ₃	7.85	7.30	7.45	7.85	7.62 ^{ab}	0.243349

Kulfi prepared from T₂ level recorded highest score for flavour (7.74) followed by T₀ (7.22). The sensory score increased at T₂ i.e. 5 per cent level of apple powder. Treatment T₂ found significantly different than treatment T₀ whereas, other treatments found at par with each other.

Table 11: Score for Consistency of apple kulfi

Treatment	R ₁	R ₂	R ₃	R ₄	Average	S.D.
T ₀	7.70	7.85	7.85	6.85	7.56 ^a	0.415895
T ₁	8.05	7.50	7.45	7.50	7.63 ^a	0.246221
T ₂	7.45	7.40	7.60	7.50	7.48 ^a	0.073951
T ₃	7.05	7.75	6.80	7.65	7.32 ^a	0.399022

Kulfi prepared from T₁ level recorded highest score for consistency (7.63) followed by T₃ (7.32). The sensory score increased at T₁ i.e. 2.5 per cent level of apple powder. All treatment found at par with each other.

Table 12: Score for overall acceptability of apple Kulfi (out of nine)

Treatment	R ₁	R ₂	R ₃	R ₄	Average	S.D.
T ₀	7.33	7.56	7.35	7.49	7.44 ^a	0.09615
T ₁	7.64	7.48	7.51	7.63	7.56 ^a	0.068853
T ₂	7.62	7.40	7.56	7.56	7.53 ^a	0.079687
T ₃	7.53	7.42	7.28	7.69	7.48 ^a	0.15048

The results of overall acceptability scores thus indicate that Kulfi prepared from 2.5 per cent apple powder scored highest point (7.56), followed by Kulfi prepared from (T₀) without addition of apple powder (7.44). On the basis of results obtained we can affirmatively state that amongst different levels of apple powder T₁ (2.5 per cent apple powder) Treatment was found more acceptable for blending. The results of overall acceptability scores thus indicate that Kulfi blended with 2.5 per cent apple powder is superior over rest of Treatments. Lowest score was noticed for Kulfi blended without addition of apple powder. All treatments found at par with each other.

Changes in microbial qualities of apple Kulfi during storage

Standard plate count

It was observed that standard plate counts of apple kulfi increased with increase in storage period for samples stored at refrigerated condition.

The SPC of T₀ was 4×10^1 , 5×10^1 and 1.3×10^2 cfu/g at 1st, 7th and 15th days of storage, respectively. The SPC of T₁ was 2×10^1 , 1.1×10^2 , 1.2×10^2 cfu/g at 1st, 7th, and 15th day's storage, respectively. The SPC of T₂ was 1.4×10^2 , 1.4×10^2 , 1.4×10^2 cfu/g at 1st, 7th, and 15th day's storage respectively. The SPC of T₃ was 4×10^1 , 1.2×10^2 , 1.5×10^2 cfu/g at 1st, 7th, and 15th day's storage, respectively. From the observed results it is concluded that the samples were acceptable up to 15 days as the SPC was within the acceptable limit.

Yeast and mould count

It was observed that yeast and mould counts of apple kulfi increased with increase in storage period at 4°C. The yeast and mould count was marginal upto 7th days of storage however it was very high at 15th days. The count of T₀ was 14 and 12 cfu/g at 7th and 15th days, respectively. The count of T₁ was 15 and 16 cfu/g at 7th and 15th days, respectively. The count of T₂ was 12 and 68 cfu/g at 7th and 15th days, respectively. The count of T₃ was 15 and 100 cfu/g at 7th and 15th days, respectively.

Coli form count

The *E. coli* count was not detected upto 15 days. The microbial load may be due to inadequate cleaning or aseptic condition. Hence, it is recommended that the aseptic condition should be maintained during product preparation.

Production of cost

The data indicated the cost of ingredients only and other cost factors remains constant for all Treatments and were not accounted for cost estimation. The cost of apple kulfi production blended with apple powder was worked out by considering the prevailing retail cost of ingredients only. The cost of ingredients decreased with the increase in the level of apple powder. The yield of apple kulfi shows inclining trend, with the increase in the level of apple powder, which resulted in increasing cost of production on weight basis.

The highest cost (T₃) was recorded in case of apple kulfi blended with 7.5 per cent apple powder, while lower cost (T₀) recorded in case of apple kulfi without addition of apple powder. It was observed that the cost of apple kulfi was increased with the increase in the level of apple powder. The production cost of most acceptable level (T₁) /was Rs-205.68/Kg.

Conclusion

From the results of the present investigation, it may be concluded that apple powder could be successfully utilized for the development of kulfi. The most acceptable level of kulfi can be prepared by using 2.5 per cent apple powder. The apple powder had a positive effect on flavor acceptability and its consumption. On the basis of microbial results, it may be concluded that the aseptic condition should be maintain during product preparation.

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