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## Preparation of Kulfi with incorporation of pineapple (*Anona scomosus*) pulp

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**Abstract**

The present study was carried out using different levels of pineapple pulp 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 pineapple pulp @ 5, 10, 15 and 20% in the pineapple Kulfi with 15% sugar to finalize the experimental treatments. Experimental pineapple Kulfi samples were analyzed for sensory, chemical and microbiological qualities. It was observed that pineapple Kulfi samples under different treatments showed significant differences for total solid, fat, protein, ash, acidity and moisture content. The values were ranged from 5.69 to 5.23, 2.81 to 2.23, 1.07 to 1.20, 0.19 to 0.24%, 0.05 to 0.11% L. A., and 94.31 to 94.77, respectively. Significant difference was observed within the smell and taste and the body and texture score of different types of Kulfi. The microbial results indicate the SPC and yeast and mould count was varying among the different treatments. Overall, the Kulfi was acceptable at 7<sup>th</sup> day because the count was within the acceptable limit. The *E coli* count was not detected upto 15 days. The microbial load may be due to inadequate cleaning or aseptic condition.

**Keywords:** Kulfi, pineapple pulp, body and texture, colour and appearance, sensory evaluation, microbial evaluation

**Introduction**

Kulfi is 500 year old a popular frozen dessert (Aneja, 1992) <sup>[1]</sup> of Indian origin and it occupies a privileged position amongst the traditional Indian dairy products. Kulfi is also known as qulfi, kulfa, kulphy...etc (Pandit, 2004) <sup>[9]</sup>. The word kulfi derives its origin from the Hindustani word kulaf meaning a 'lock' or a 'container' that has to be unlocked. The product is well known from all ages in our country and is very popular in the Northern parts of India. It is generally prepared and sold on small and scattered scale by halwai and street vendors by conventional practices, especially in summer season. It is widely accepted and its demand is increasing day by day next to ice-cream. Hence, we can call the Kulfi as poor man's ice cream. Kulfi is very popular in many parts of the country mainly due to its palatability and low price. Kulfi manufacturing helps to develop small scale industry and generate sizeable employment and income. According to Warner (1976) <sup>[14]</sup> Kulfi is defined as an indigenous product which resembles ice-cream ice became available. Kulfi is a nut ice-cream frozen in small containers of conical shape. Sweetened milk, containing 20-25 per cent added sugar is concentrated to about half of its volume and malai, crushed almonds, pistachio and flavouring materials such as vanilla and essence of rose are added after cooling Parikh (1977) <sup>[10]</sup>.

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 pineapple pulp, could result in increased acceptability, value addition and therapeutic value of the product.

Pineapple contains half of the daily-recommended value of vitamin C, according to the FDA. Vitamin C is a primary water-soluble antioxidant that fights cell damage, according to the Linus Pauling Institute at Oregon State University. This makes vitamin C a helpful fighter against problems such as heart disease and joint pain.

In addition to having lots of vitamin C, pineapple's bromelain may helps to reduce mucus in the throat and nose, according to the University of Maryland Medical Centre. Pineapple also effective in reducing the cold, coughing along with the allergies and reduction in long term sinus mucus. 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.

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## 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 Pineapple fruits were procured from local market of Loni, Tal. Rahata, Dist- Ahmednagar.

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

T<sub>1</sub> - Addition of 5% pineapple pulp in Kulfi mix

T<sub>2</sub> - Addition of 10% pineapple pulp in Kulfi mix

T<sub>3</sub> - Addition of 15% pineapple pulp in Kulfi mix

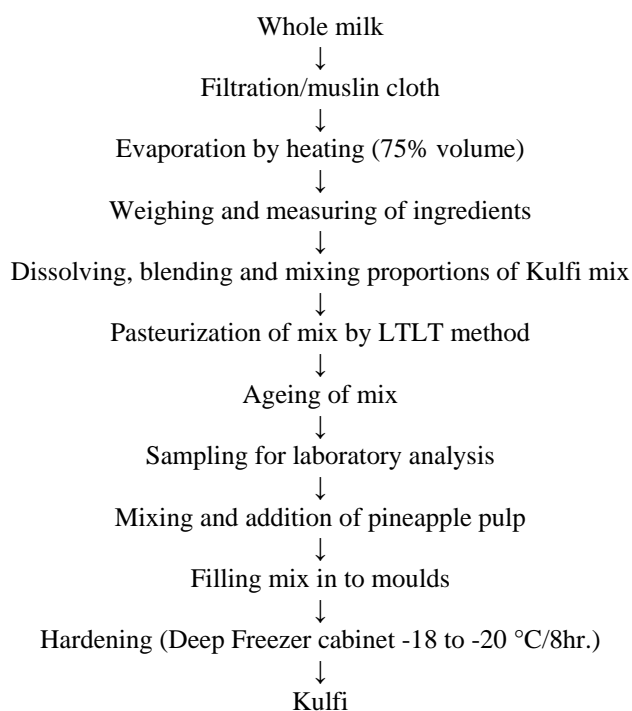
T<sub>4</sub> - Addition of 20% pineapple pulp in Kulfi mix

## Composition of pineapple Kulfi mix

Sr. No	Ingredient	T <sub>0</sub>	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>
1	Milk with 4.5% fat & 8.5% SNF (ml)	372.5	347.5	322.5	297.5
2	Cream with 25% fat & 5.5% SNF (ml)	372.5	347.5	322.2	297.5
3	Milk powder with 0.5% fat & 99% SNF(ml)	50	50	50	50
4	Sugar (gm)	150	150	150	150
5	Stabilizer (gm)	5	5	5	5
6	Pineapple pulp (ml)	50	100	150	200

For preparation of pineapple pulp (puree), first pineapple fruit was washed with clean water. The skin was peeled. Slices were made with the help of knife and finally it was converted into homogenous mass of pulp by putting into mixer.

## Flow chart for preparation of Pineapple kulfi:



## Physico-Chemical Analysis

The total solid content of milk, cream, milk powder and pineapple were determined by gravimetric method as per IS: 1479 (part II), 1961 [7].

The fat content was determined by using standard Gerber method as described in IS: 1224 (part II), 1977 [5]. The protein content was determined by estimating the per cent nitrogen by Micro-kjeldhal method as recommended in IS: 1479 (part II), 1961 [7].

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 [2]. Per cent moisture content was determined by gravimetric method as per IS: 1479 (part II) 1961 [7]. The acidity of kulfi expressed as per cent lactic acid was determined by the method described in IS: 1479 (part I), 1960 [6].

## 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 [4].

## Microbiological Analysis

All the treatment samples of pineapple 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) [15].

## Results and discussion

**Table 1:** Chemical analysis of cow milk, curd and pineapple pulp

Sr. No.	Constituents	Cow milk (%)	Cream	Pineapple pulp
1	Total Solid	13.34	31.80	12.82
2	Fat	4.5	25.00	2.03
3	Protein	3.2	2.00	7.2
4	Acidity	0.13	0.08	2.03
5	Ash	0.67	1.02	1.80

These observations indicate that the cow 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 lie within the limits of legal standards for cow milk in Maharashtra state as prescribed by PFA rules, 1976, cited by De (2008) [3].

**Table 2:** Effect of different levels of pineapple on total solids of kulfi (Per cent)

Particulars	R <sub>1</sub>	R <sub>2</sub>	R <sub>3</sub>	R <sub>4</sub>	Average	S.D.
T <sub>1</sub>	5.59	5.80	5.65	5.72	5.69 <sup>a</sup>	0.08
T <sub>2</sub>	5.44	5.49	5.37	5.41	5.43 <sup>b</sup>	0.04
T <sub>3</sub>	5.30	5.20	5.37	5.22	5.27 <sup>c</sup>	0.07
T <sub>4</sub>	5.21	5.24	5.18	5.30	5.23 <sup>c</sup>	0.04

Total solid content of kulfi decreased with the increased in the level pineapple pulp. The maximum total solid content (5.69 per cent) was noticed in kulfi with 5 per cent pineapple pulp i.e. T<sub>1</sub> whereas the lowest (5.23 per cent) was recorded in kulfi with 20% pineapple pulp (T<sub>4</sub>). Treatment T<sub>3</sub> found significantly different than the T<sub>1</sub> and T<sub>2</sub> whereas treatment T<sub>4</sub> found at par the treatment T<sub>3</sub>.

**Table 3:** Effect of different levels of pineapple pulp on fat content of pineapple kulfi (Per cent):

Particulars	R <sub>1</sub>	R <sub>2</sub>	R <sub>3</sub>	R <sub>4</sub>	Average	S.D.
T <sub>1</sub>	2.78	2.90	2.75	2.80	2.81 <sup>a</sup>	0.06
T <sub>2</sub>	2.63	2.67	2.72	2.61	2.66 <sup>b</sup>	0.04
T <sub>3</sub>	2.43	2.53	2.48	2.41	2.46 <sup>c</sup>	0.05
T <sub>4</sub>	2.29	2.28	2.31	2.35	2.31 <sup>d</sup>	0.03

The mean values of fat decreased significantly from T<sub>1</sub> to T<sub>4</sub>. The highest fat content (2.81 per cent) was observed in kulfi prepared with 5 per cent pineapple pulp (T<sub>1</sub>), whereas the lowest fat content (2.31 per cent) in case of pineapple kulfi blended with 20 per cent pineapple pulp (T<sub>4</sub>). Treatment T<sub>4</sub> was found to be significantly superior over the treatments T<sub>3</sub>, T<sub>2</sub> and T<sub>1</sub>, respectively.

**Table 4:** Effect of different levels of pineapple pulp on protein content of pineapple kulfi (per cent):

Particulars	R <sub>1</sub>	R <sub>2</sub>	R <sub>3</sub>	R <sub>4</sub>	Average	S.D.
T <sub>1</sub>	1.01	1.03	1.15	1.08	1.07 <sup>a</sup>	0.05
T <sub>2</sub>	1.08	1.18	1.18	1.09	1.13 <sup>ab</sup>	0.05
T <sub>3</sub>	1.12	1.22	1.19	1.13	1.17 <sup>bc</sup>	0.04
T <sub>4</sub>	1.17	1.21	1.19	1.23	1.20 <sup>c</sup>	0.02

There was significant increase in protein content of pineapple kulfi with the increase in the level of pineapple pulp. The highest protein content (1.20 per cent) was observed in pineapple kulfi prepared with 20 per cent pineapple pulp (T<sub>4</sub>), whereas the lowest protein content (1.07 per cent) in case of pineapple kulfi prepared with 5 per cent pineapple pulp (T<sub>1</sub>). Treatment T<sub>3</sub> found significantly different than the T<sub>1</sub> and T<sub>2</sub> whereas treatment T<sub>4</sub> found at par with the treatment T<sub>3</sub>.

**Table 5:** Effect of different levels of pineapple pulp on ash content of pineapple kulfi (per cent)

Particulars	R <sub>1</sub>	R <sub>2</sub>	R <sub>3</sub>	R <sub>4</sub>	Average	S.D.
T <sub>1</sub>	0.19	0.17	0.18	0.20	0.19 <sup>a</sup>	0.01
T <sub>2</sub>	0.20	0.19	0.21	0.18	0.20 <sup>b</sup>	0.01
T <sub>3</sub>	0.21	0.20	0.22	0.19	0.21 <sup>b</sup>	0.01
T <sub>4</sub>	0.22	0.24	0.26	0.23	0.24 <sup>b</sup>	0.01

The increase in the level of pineapple pulp resulted in significant increase in ash content of pineapple kulfi. The highest ash content (0.24 per cent) was observed in pineapple kulfi prepared with 20 per cent pineapple pulp (T<sub>4</sub>) whereas the lowest percentage (0.19 per cent) of kulfi blended with 5 cent pineapple pulp (T<sub>1</sub>). Treatment T<sub>1</sub> found significantly different than the T<sub>2</sub>, whereas treatment T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub> found at par with each other.

**Table 6:** Effect of different levels of pineapple pulp on acidity of pineapple kulfi (per cent)

Particulars	R <sub>1</sub>	R <sub>2</sub>	R <sub>3</sub>	R <sub>4</sub>	Average	S.D.
T <sub>1</sub>	0.05	0.06	0.04	0.05	0.05 <sup>a</sup>	0.01
T <sub>2</sub>	0.07	0.05	0.06	0.05	0.06 <sup>a</sup>	0.01
T <sub>3</sub>	0.10	0.09	0.08	0.10	0.09 <sup>b</sup>	0.01
T <sub>4</sub>	0.11	0.10	0.12	0.10	0.11 <sup>b</sup>	0.01

The increase in the level of pineapple pulp resulted in significant increase in acidity content of pineapple kulfi. The highest acidity content (0.11 per cent) was observed in pineapple kulfi prepared with 20 per cent pineapple pulp (T<sub>4</sub>) whereas the lowest percentage (0.05 per cent) was observed in kulfi blended with 5 cent pineapple pulp (T<sub>1</sub>). Treatment T<sub>2</sub> was found at par with treatment T<sub>1</sub>, treatment T<sub>3</sub> was also

found at par with treatment T<sub>4</sub>. Treatment T<sub>1</sub> and T<sub>2</sub> were found significantly different over the treatments T<sub>4</sub> and T<sub>3</sub>.

**Table 7:** Effect of different levels of pineapple pulp on moisture content of pineapple kulfi (per cent):

Particulars	R <sub>1</sub>	R <sub>2</sub>	R <sub>3</sub>	R <sub>4</sub>	Average	S.D.
T <sub>1</sub>	94.41	94.20	94.35	94.28	94.31 <sup>a</sup>	0.08
T <sub>2</sub>	94.56	94.51	94.63	94.59	94.57 <sup>a</sup>	0.04
T <sub>3</sub>	94.70	94.80	94.63	94.78	94.73 <sup>b</sup>	0.07
T <sub>4</sub>	94.79	94.76	94.82	94.70	94.77 <sup>c</sup>	0.04

The increase in the level of pineapple pulp resulted in significant increase in moisture content of pineapple kulfi. The highest moisture content (94.77 per cent) was observed in pineapple kulfi prepared with 20 per cent pineapple pulp (T<sub>4</sub>) whereas the lowest percentage (94.31 per cent) of kulfi blended with 5 cent pineapple pulp (T<sub>1</sub>). Treatment T<sub>1</sub> found significantly different than the treatments T<sub>3</sub> and T<sub>4</sub> whereas treatment T<sub>2</sub> found at par with the treatment T<sub>1</sub>.

### Sensory evaluation of pineapple kulfi

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

Particulars	R <sub>1</sub>	R <sub>2</sub>	R <sub>3</sub>	R <sub>4</sub>	Average	S.D.
T <sub>1</sub>	7.20	7.10	7.30	7.00	7.15 <sup>a</sup>	0.11
T <sub>2</sub>	7.50	7.40	7.50	7.30	7.43 <sup>b</sup>	0.08
T <sub>3</sub>	8.30	8.40	8.30	8.50	8.38 <sup>c</sup>	0.08
T <sub>4</sub>	7.80	7.60	7.70	7.50	7.65 <sup>d</sup>	0.11

Colour and appearance was increased and sometimes decreased due to addition of pineapple pulp. The highest score (8.37) was observed for treatment T<sub>3</sub> i.e. kulfi blended with 15% pineapple pulp and this highest score may be due to its peculiar slight yellowish appealing colour and appearance which was liked most by the judges. Lowest score (7.15) was observed for treatment T<sub>1</sub> i.e. kulfi blended with 5% pineapple pulp. The lowest score may be due to its white colour which was less accepted by judges. Treatment T<sub>4</sub> was found to be significantly superior over the treatments T<sub>3</sub>, T<sub>2</sub> and T<sub>1</sub>, respectively.

**Table 9:** Score for body and texture of pineapple kulfi (out of nine)

Particulars	R <sub>1</sub>	R <sub>2</sub>	R <sub>3</sub>	R <sub>4</sub>	Average	S.D.
T <sub>1</sub>	7.30	7.40	7.30	7.20	7.30 <sup>a</sup>	0.07
T <sub>2</sub>	7.40	7.30	7.10	7.20	7.25 <sup>b</sup>	0.11
T <sub>3</sub>	8.10	8.00	8.10	7.90	8.03 <sup>b</sup>	0.08
T <sub>4</sub>	7.50	7.30	7.30	7.40	7.38 <sup>b</sup>	0.08

Kulfi prepared from T<sub>3</sub> level recorded highest score for (8.03) followed by T<sub>2</sub> (7.25). The sensory score increased at T<sub>3</sub> i.e. 15 per cent level of pineapple pulp. Treatment T<sub>1</sub> found significantly different than the T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub>, whereas treatment T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub> found at par with each other.

**Table 10:** Score for flavour of pineapple kulfi (out of nine)

Particulars	R <sub>1</sub>	R <sub>2</sub>	R <sub>3</sub>	R <sub>4</sub>	Average	S.D.
T <sub>1</sub>	7.30	7.20	7.20	7.10	7.20 <sup>a</sup>	0.07
T <sub>2</sub>	7.50	7.40	7.30	7.50	7.43 <sup>b</sup>	0.08
T <sub>3</sub>	8.20	8.30	8.10	8.20	8.20 <sup>c</sup>	0.07
T <sub>4</sub>	7.80	7.60	7.60	7.70	7.68 <sup>d</sup>	0.08

The pineapple kulfi blended with 15 per cent pineapple pulp T<sub>3</sub> recorded highest score of 8.20 for flavor whereas the pineapple kulfi with 5 per cent pineapple pulp had

significantly lowest score 7.20. Significant differences were observed among all the treatments in the trial.

**Table 11:** Score for overall acceptability of pineapple kulfi (out of nine)

Treat	R1	R2	R3	R4	Average	S.D.
T <sub>1</sub>	7.26	7.23	7.36	7.1	7.23 <sup>d</sup>	0.09
T <sub>2</sub>	7.46	7.36	7.3	7.33	7.36 <sup>b</sup>	0.06
T <sub>3</sub>	8.2	8.23	8.16	8.2	8.19 <sup>c</sup>	0.02
T <sub>4</sub>	7.7	7.5	7.53	7.53	7.56 <sup>a</sup>	0.07

The results of overall acceptability scores thus indicate that kulfi blended with 15 per cent pineapple pulp is superior over rest of treatments. Lowest score was noticed for kulfi blended with 5 per cent pineapple pulp. Treatment T<sub>4</sub> was found to be significantly superior over the treatments T<sub>3</sub>, T<sub>2</sub> and T<sub>1</sub>, respectively.

### Changes in microbial qualities of Pineapple kulfi during storage.

#### Standard plate count

It was observed that standard plate counts of pineapple kulfi increased with increase in storage period for samples stored at room temperature of 4°C. Initial standard plate counts (SPC) on fresh kulfi were 4×10<sup>4</sup> cfu/gm, may be due to unavoidable conditions during processing operations. In kulfi samples, standard plate counts increased from 4×10<sup>4</sup> cfu/gm, 3×10<sup>4</sup> cfu/gm, 5×10<sup>4</sup> cfu/gm and 7×10<sup>4</sup> cfu/gm to uncountable in treatment T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub> respectively during 15 days of storage. From the observed results we can conclude that the samples were acceptable for 7 days.

#### Yeast and mould count

The yeast and mould count of fresh kulfi was measured very less and negligible. It was observed that yeast and mould counts for vacuum packed kulfi varied from 30×10<sup>1</sup> to 80×10<sup>1</sup> during storage of 15 hrs. It was observed that yeast and mould counts of pineapple kulfi increased with increase in storage period for samples stored at room temperature of 4°C. The yeast and mould count was found to be Nil at 1<sup>st</sup> day of inoculation. However the counts of all samples were increased from 7<sup>th</sup> to 15<sup>th</sup> day inoculation.

#### 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 cost of pineapple kulfi production blended with pineapple pulp was worked out by considering the prevailing retail cost of ingredients only.

Cost of ingredients decreased with the increase in the level of pineapple pulp. The yield of pineapple kulfi shows declining trend, with the increase in the level of pineapple pulp, which resulted in decreasing cost of production on weight basis.

The highest cost (T<sub>1</sub>) was recorded in case of pineapple kulfi blended with 5 per cent pineapple pulp, while lower cost (T<sub>4</sub>) recorded in case of pineapple kulfi with 20 per cent pineapple pulp. It was observed that the cost of pineapple kulfi was decreased with the increase in the level of pineapple pulp flavor. The production cost of most acceptable level (T<sub>3</sub>) /was Rs- 663.65/Kg.

### Conclusion

From the results of the present investigation, it may be concluded that pineapple could be successfully utilized for the preparation of kulfi. It may be concluded that pineapple pulp could be successfully utilized for preparation of kulfi. The most acceptable quality kulfi can be prepared by using 15% pineapple pulp. Addition of the pineapple pulp improved the sensory quality and acceptability of kulfi. For the incorporation into the kulfi optimum level of pineapple pulp should be 15%.

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