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**Vishal Kedaree**

Department of Animal  
Biotechnology, College of  
Agricultural Biotechnology,  
Loni, Tal. Rahata, Dist.  
Ahmednagar, Maharashtra,  
India

**SD Nalkar**

Department of Animal  
Biotechnology, College of  
Agricultural Biotechnology,  
Loni, Tal. Rahata, Dist.  
Ahmednagar, Maharashtra,  
India

**GR Chinchkar**

Department of Animal  
Biotechnology, College of  
Agricultural Biotechnology,  
Loni, Tal. Rahata, Dist.  
Ahmednagar, Maharashtra,  
India

**Corresponding Author:**

**Vishal Kedaree**  
Department of Animal  
Biotechnology, College of  
Agricultural Biotechnology,  
Loni, Tal. Rahata, Dist.  
Ahmednagar, Maharashtra,  
India

## Preparation of Sandesh enriched with mango (*Mangifera indica* L.) Pulp cv. Keshar

**Vishal Kedaree, SD Nalkar and GR Chinchkar**

### Abstract

The present study entitled “Preparation of Sandesh enriched with mango (*Mangifera indica* L.) pulp cv. Keshar” was carried out using different levels of mango 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 mango pulp @ 7.5, 15, 22.5 & 30 % in the Sandesh. Experimental (Sandesh) samples were analyzed for sensory, chemical and microbiological qualities. It was observed that samples under different treatments showed significant differences for total solid, fat, protein, acidity, moisture and ash. The values were ranged from 45.14 to 37.10, 23.16 to 22.88, 16.81 to 16.57, and 0.85 to 0.68%, 54.85 to 62.89 and 2.42 to 2.04%, respectively. Total solid, fat, protein, acidity, moisture & ash differed significantly among the different types of Sandesh. Significant difference was observed within the smell and taste score and the body and texture score of different types of Sandesh. In case of sensory evaluation, flavour found to be significant over the other treatments, whereas, colour and appearance, body and texture, flavour and overall acceptability did not differ significantly. The microbial results of SPC, yeast and mould count and coli form were within the acceptable limit up to 15 days. This may be due to adequate cleaning and aseptic condition. So, it was suggested that Sandesh could be prepared successfully using mango pulp adding different proportion of mango pulp. It was suggested to incorporate mango pulp @ 22.5% in treatment T<sub>3</sub> which showed better overall acceptability and results among the all treatments.

**Keywords:** Mango, Sandesh, Keshar, physicochemical, sensory, microbial quality

### Introduction

Sandesh has an excellent market potential compared with other milk industry has made rapid strides in the last few decades; there is no systematic packaging system, developed so far, for storage of Sandesh. Keeping pace with the growing consumer’s demand for fresh, convenient and microbiologically safe foods design of proper packaging system is the need of the hour. Aneja *et al.*, (2002) <sup>[1]</sup> has mentioned that about 80% of chhana produced in Kolkata (West Bengal, India) is converted into Sandesh. Spices (clove, small cardamom, large cardamom, saffron, etc.) have been used as flavoring and also as coloring agent in Sandesh preparation of countries. It has been estimated that the annual production of Sandesh in West Bengal alone is 30,000 tons (Bandyopadhyay and Khamrui, 2007) <sup>[3]</sup>.

Mango is most popular and choicest fruit of the tropics due to its high palatability, excellent taste, flavour and nutritive value. It is a good source of vitamin ‘A’ and vitamin ‘C’. In India, more than thousand mango varieties are grown on commercial scale. Keshar is one of the leading commercial cultivar of the mango. It is recognized as the best variety for table as well as for processing purpose.

Keshar mango pulp contains vitamin A and vitamin C (milk product rich in vitamin A, D, E and K but deficient in vitamin C). It has value because of exemplary flavour, taste and colour. Its addition to Sandesh will not only improve nutritional quality and acceptability but also cause value addition.

Incorporation of mango pulp particular of Keshar variety enhances the acceptability of milk product like Sandesh, ice cream, milk cake, khoa burfi, kalakand, basundi, milk pudding, rasogolla etc. that incorporation of different milk products with fruit juices/pulps improves the their acceptability to considerable extent. It also helps in enhancing nutritional quality and market value of product.

Thus, considering nutritive value and appealing flavour of Keshar mango, the research topic entitled “Preparation of Sandesh enriched with mango (*Mangifera indica* L.) Pulp cv. Keshar.” was selected.

## Material and methods

The study was carried out at the Department of Animal Biotechnology, College of Agricultural Biotechnology, Loni. The fresh milk was obtained from the Satral Dairy, Satral Tal-Rahuri Dist-Ahmednagar (MS). Ingredients like sugar, salt was purchased from the local market.

## Physico-Chemical Analysis

The total solid content of whey, lemon juice and ginger juice and carbonated lemon whey beverage were determined by gravimetric method as per IS: 1479 (part II), 1961<sup>[8]</sup>. The fat content was determined by using standard Gerber method as described in IS: 1224 (part II), 1977<sup>[6]</sup>. The protein content was determined by estimating the per cent nitrogen by Micro-kjeldhal method as recommended in IS: 1479 (part II), 1961<sup>[8]</sup>. The per cent nitrogen was multiplied by 6.38 to find out protein percentage in whey. Per cent ash content was determined by the method described in A.O.A.C., 1975<sup>[2]</sup>. Per cent moisture content was determined by gravimetric method as per IS: 1479 (part II) 1961<sup>[8]</sup>. The acidity of whey expressed as per cent lactic acid was determined by the method described in IS: 1479 (part I), 1960<sup>[60]</sup>.

## Sensory Evaluation

The fresh sample of whey beverage 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<sup>[5]</sup>.

## Microbiological Analysis

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

## Statistical Analysis

For the present investigation Randomized Block Design was employed using five treatments and four replications. The data were tabulated and analyzed according to the statistical methods prescribed by Snedecor and Cochran (1994)<sup>[14]</sup>.

## Treatments

Preliminary trials were conducted to find out the blending of chhana and mango pulp along with sugar to have proper aroma and consistency. After trying different levels of chhana and mango pulp the following proportion were finalized for study.

T<sub>0</sub>: Control (No mango pulp).

T<sub>1</sub>: Addition of mango pulp @ 7.5% of weight of chhana.

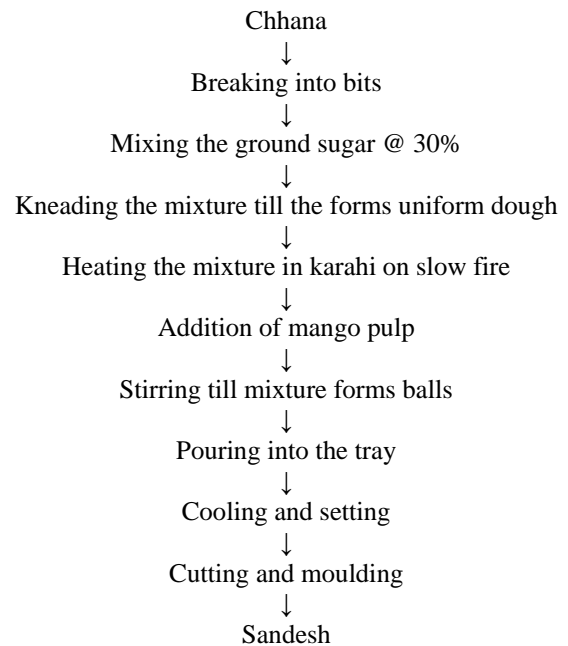
T<sub>2</sub>: Addition of mango pulp @ 15% of weight of chhana.

T<sub>3</sub>: Addition of mango pulp @ 22.5% of weight of chhana.

T<sub>4</sub>: Addition of mango pulp @ 30% of weight of chhana.

Cane sugar was used @ 30% of weight of chhana for all treatments.

## Flow diagram for preparation of mango Sandesh



## Results and discussion

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

Sr. No.	Constituents	Cow milk (%)	Chhana	Mango pulp
1.	Total Solid	13.06	46.38	30.98
2.	Fat	4.20	23.16	0.89
3.	Protein	3.46	16.84	0.94
4.	Acidity	0.13	0.84	0.52
5.	Ash	2.46	2.46	1.36

These observations indicate that the cow milk used in the present investigation was of good quality. Chhana used for Sandesh preparation had on an average fat content 23.16 per cent, acidity 0.84 per cent, protein 16.84 per cent and total solids 46.38 per cent.

**Table 2:** Effect of different levels of mango on total solids of Sandesh.

Treatments	Replications				Mean
	RI	RII	RIII	RIV	
T <sub>0</sub>	45.30	45.42	44.90	44.96	45.14 <sup>a</sup>
T <sub>1</sub>	44.08	44.06	44.02	44.08	44.06 <sup>b</sup>
T <sub>2</sub>	41.74	41.68	41.70	41.70	41.70 <sup>c</sup>
T <sub>3</sub>	39.41	39.40	39.38	39.34	39.38 <sup>d</sup>
T <sub>4</sub>	37.12	37.08	37.12	37.10	37.10 <sup>e</sup>
Mean	41.53	41.52	41.42	41.43	41.47

Total solids content of Sandesh decreased with the increase in the level of mango pulp. The maximum total solids content (45.14 per cent) was noticed in Sandesh without mango pulp i.e. T<sub>0</sub>, whereas the lowest (37.10 per cent) was recorded in Sandesh with 30% of mango pulp i.e. T<sub>4</sub>. Treatment T<sub>0</sub> was found to be significantly superior over the treatment T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub> & T<sub>4</sub>. Significant differences were observed in all treatment combinations.

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

Treatments	Replications				Mean
	RI	RII	RIII	RIV	
T <sub>0</sub>	23.18	23.16	23.14	23.16	23.16 <sup>a</sup>
T <sub>1</sub>	23.10	23.11	23.12	23.10	23.10 <sup>b</sup>
T <sub>2</sub>	23.02	23.06	23.03	23.05	23.04 <sup>c</sup>
T <sub>3</sub>	22.96	22.94	22.93	22.96	22.94 <sup>d</sup>
T <sub>4</sub>	22.89	22.87	22.89	22.89	22.88 <sup>e</sup>
Mean	23.03	23.02	23.02	23.03	23.02

The mean values of fat decreased significantly from T<sub>0</sub> to T<sub>4</sub>. The highest fat content (23.16 per cent) was observed in Sandesh prepared without mango pulp (T<sub>0</sub>), whereas the lowest fat content (22.88 per cent) in case of Sandesh blended with 30 per cent mango pulp (T<sub>4</sub>). Treatment T<sub>0</sub> was found to be significantly superior over the treatments T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub> & T<sub>4</sub>. Significant differences were observed in all treatment combinations.

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

Treatments	Replications				Mean
	RI	RII	RIII	RIV	
T <sub>0</sub>	16.82	16.80	16.82	16.82	16.81 <sup>a</sup>
T <sub>1</sub>	16.76	16.73	16.73	16.76	16.74 <sup>b</sup>
T <sub>2</sub>	16.69	16.71	16.68	16.69	16.69 <sup>c</sup>
T <sub>3</sub>	16.61	16.63	16.63	16.63	16.62 <sup>d</sup>
T <sub>4</sub>	16.56	16.59	16.59	16.56	16.57 <sup>e</sup>
Mean	16.68	16.69	16.79	16.69	16.68

There was significant decrease in protein content of Sandesh with the increase in the level of mango pulp. The highest protein content (16.81 per cent) was observed in Sandesh prepared without mango pulp (T<sub>0</sub>), whereas the lowest protein content (16.57 per cent) in case of Sandesh blended with mango pulp 30 per cent (T<sub>4</sub>). Treatment T<sub>0</sub> was found to be significantly superior over the treatments T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub> & T<sub>4</sub>. Significant differences were observed in all treatment combinations.

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

Treatments	Replications				Mean
	RI	RII	RIII	RIV	
T <sub>0</sub>	2.44	2.42	2.44	2.41	2.42 <sup>a</sup>
T <sub>1</sub>	2.36	2.35	2.33	2.36	2.35 <sup>b</sup>
T <sub>2</sub>	2.26	2.24	2.26	2.26	2.25 <sup>c</sup>
T <sub>3</sub>	2.13	2.15	2.15	2.13	2.14 <sup>d</sup>
T <sub>4</sub>	2.03	2.05	2.03	2.06	2.04 <sup>e</sup>
Mean	2.24	2.24	2.24	2.24	2.24

There was significant decrease in ash content of Sandesh with the increase in the level of mango pulp. The highest ash content (2.42 per cent) was observed in Sandesh prepared without mango pulp (T<sub>0</sub>), whereas the lowest ash content (2.04 per cent) in case of Sandesh blended with mango pulp 30 per cent (T<sub>4</sub>). Treatment T<sub>0</sub> was found to be significantly superior over the treatments T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub> & T<sub>4</sub>. Significant

differences were observed in all treatment combinations.

**Table 6:** Effect of different levels of mango pulp on acidity of mango Sandesh (per cent)

Treatments	Replications				Mean
	RI	RII	RIII	RIV	
T <sub>0</sub>	0.80	0.88	0.88	0.84	0.85 <sup>a</sup>
T <sub>1</sub>	0.80	0.80	0.81	0.79	0.80 <sup>b</sup>
T <sub>2</sub>	0.76	0.76	0.78	0.76	0.76 <sup>c</sup>
T <sub>3</sub>	0.72	0.72	0.74	0.72	0.72 <sup>d</sup>
T <sub>4</sub>	0.69	0.69	0.67	0.69	0.68 <sup>e</sup>
Mean	0.61	0.77	0.77	0.76	0.76

The increase in the level of mango pulp resulted in significant decrease in acidity content of Sandesh. The highest acidity content (0.85 per cent) was observed in Sandesh prepared without mango pulp (T<sub>0</sub>), whereas the lowest percentage (0.68 per cent) in case of Sandesh blended with mango pulp 30 per cent (T<sub>4</sub>). Treatment T<sub>0</sub> was found to be significantly superior over the treatments T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub> & T<sub>4</sub>. Significant differences were observed in all treatment combinations.

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

Treatments	Replications				Mean
	RI	RII	RIII	RIV	
T <sub>0</sub>	54.70	54.58	55.10	55.04	54.85 <sup>a</sup>
T <sub>1</sub>	55.92	55.94	55.98	55.92	55.94 <sup>b</sup>
T <sub>2</sub>	58.26	58.32	58.30	58.30	58.29 <sup>c</sup>
T <sub>3</sub>	60.59	60.60	60.62	60.66	60.61 <sup>d</sup>
T <sub>4</sub>	62.88	62.92	62.88	62.90	62.89 <sup>e</sup>
Mean	58.47	58.47	58.57	58.56	58.51

There was significant increase in moisture content of Sandesh with the increase in the level of mango pulp. The lowest moisture content (54.85 per cent) was observed in Sandesh prepared without mango pulp (T<sub>0</sub>), whereas the highest moisture content (62.89 per cent) in case of Sandesh blended with mango pulp 30 per cent (T<sub>4</sub>). Treatment T<sub>0</sub> was found to be significantly superior over the treatments T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub> & T<sub>4</sub>.

### Sensory evaluation of mango Sandesh

**Table 8:** Score for Colour and appearance of mango Sandesh (out of nine)

Treatment	Replication				Mean
	RI	RII	RIII	RIV	
T <sub>0</sub>	6.95	7.60	7.05	7.30	7.22 <sup>a</sup>
T <sub>1</sub>	7.15	7.55	7.55	7.75	7.50 <sup>a</sup>
T <sub>2</sub>	7.50	8.00	8.05	8.20	7.93 <sup>ab</sup>
T <sub>3</sub>	7.75	8.20	8.75	8.50	8.30 <sup>b</sup>
T <sub>4</sub>	8.10	7.25	8.60	8.80	8.18 <sup>b</sup>
Mean	7.49	7.72	8.00	8.11	7.82

The Sandesh prepared by using 22.5% mango pulp was superior amongst all the treatments in colour and appearance which recorded the highest score (8.30) i.e. T<sub>3</sub>. The lowest score (7.22) was obtained by the product without mango pulp i.e. T<sub>0</sub>.

**Table 9:** Score for body and texture of mango Sandesh (out of nine)

Treatment	Replication				Mean
	RI	RII	RIII	RIV	
T <sub>0</sub>	6.50	7.05	7.60	8.15	7.32 <sup>a</sup>
T <sub>1</sub>	6.85	7.50	7.95	7.85	7.53 <sup>a</sup>
T <sub>2</sub>	7.35	7.80	8.30	8.05	7.87 <sup>b</sup>
T <sub>3</sub>	7.80	8.60	8.95	8.45	8.45 <sup>bc</sup>
T <sub>4</sub>	7.90	8.30	8.65	8.60	8.36 <sup>c</sup>
Mean	7.28	7.85	8.29	8.22	7.90

The Sandesh prepared by using 22.5% mango pulp was superior amongst all the treatments in body and texture which recorded the highest score (8.45) i.e. T<sub>3</sub>. The lowest score (7.32) was obtained by the product without mango pulp i.e. T<sub>0</sub>.

**Table 10:** Score for flavour of mango Sandesh (out of nine)

Treatment	Replication				Mean
	RI	RII	RIII	RIV	
T <sub>0</sub>	6.45	7.40	6.95	7.75	7.13 <sup>a</sup>
T <sub>1</sub>	6.95	7.65	7.75	8.15	7.62 <sup>a</sup>
T <sub>2</sub>	7.75	7.95	8.35	8.50	8.13 <sup>a</sup>
T <sub>3</sub>	8.25	8.10	8.75	8.40	8.37 <sup>b</sup>
T <sub>4</sub>	8.25	8.30	8.45	8.70	8.42 <sup>c</sup>
Mean	7.53	7.88	8.05	8.30	7.93

The Sandesh prepared by using 30% mango pulp was superior amongst all the treatments in flavour which recorded the highest score (8.42) i.e. T<sub>4</sub>. The lowest score (7.13) was obtained by the product without mango pulp i.e. T<sub>0</sub>.

**Table 11:** Score for overall acceptability of mango Sandesh (out of nine)

Treatment	Replication				Mean
	RI	RII	RIII	RIV	
T <sub>0</sub>	6.61	7.31	7.18	7.67	7.19 <sup>a</sup>
T <sub>1</sub>	6.96	7.52	7.72	7.87	7.51 <sup>a</sup>
T <sub>2</sub>	7.50	7.87	8.20	8.19	7.94 <sup>b</sup>
T <sub>3</sub>	7.90	8.27	8.79	8.41	8.34 <sup>c</sup>
T <sub>4</sub>	8.06	7.95	8.54	8.68	8.30 <sup>d</sup>
Mean	7.40	7.78	8.08	8.16	7.85

The Sandesh prepared by using 22.5% mango pulp was superior amongst all the treatments in overall acceptability which recorded the highest score (8.34) i.e. T<sub>3</sub>. The lowest score (7.19) was obtained by the product without mango pulp i.e. T<sub>0</sub>.

### Changes in microbial qualities of Mango Sandesh during storage

#### Standard plate count

It was observed that standard plate counts of mango Sandesh increased with increase in storage period for samples stored at room temperature of 4°C. The microbial results indicate the SPC was varied among the different treatments. Overall, the Sandesh was acceptable upto 15<sup>th</sup> day because the count was within the acceptable limit.

#### Yeast and mould count

A yeast and mould count of fresh Sandesh was measured very less and negligible. It was observed that yeast and mould counts of mango Sandesh increased with increase in storage period for samples stored at room temperature of 4 °C.

### 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 production for the Sandesh preparation was worked out by considering the prevailing retail cost of ingredients only. In calculating the cost of production for Sandesh, the cost of labour, fuel, electricity and depreciation on equipment were considered as the cost on all these aspects was same for all treatments. Sandesh prepared by using various level of mango pulp was slightly costly as compared to that prepared without addition of mango pulp.

Cost of production for preparing one kg of Sandesh from cow milk was Rs 185.69, Rs 191.40, 196.52, 201.15 and 205.35 for 0, 7.5, 15, 22.5 and 30% levels of mango pulp, respectively. The production cost of most acceptable Sandesh (T<sub>3</sub>) was Rs 201.15/Kg.

### Conclusion

From the results of the present investigation, it may be concluded that mango pulp could be successfully utilized for the preparation of Sandesh. The most acceptable quality Sandesh can be prepared using 22.5% mango pulp. Addition of the mango pulp improves sensory quality and acceptability of Sandesh. For the incorporation into the Sandesh the optimum level of mango pulp should be 22.5%. The production cost of Sandesh of most acceptable treatments T<sub>3</sub> was.

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