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## Studies on development of Shrikhand with incorporation of kiwi (*Actinidia deliciosa*) pulp

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**Abstract**

A study on development of Shrikhand with enrichment of kiwi pulp (*Actinidia deliciosa*) was carried out using different levels of kiwi 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 kiwi pulp @ 0, 10, 15 and 20% in the kiwi Shrikhand with 35% sugar to finalize the experimental treatments. Experimental kiwi Shrikhand samples were analyzed for sensory, chemical and microbiological qualities. It was observed that kiwi Shrikhand samples under different treatments showed significant differences for total solid, fat, protein, ash, acidity and moisture content. The values were ranged from 55.46 to 44.15%, 14.65 to 13.34%, 12.64 to 10.84%, 0.47 to 0.59%, 1.39 to 0.94%, 44.54 to 55.85%, respectively. Significant difference was observed within the smell and taste score and the body and texture score of different types of Shrikhand. 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 and yeast and mould count was varying among the different treatments. The *E coli* count was not detected upto 15 days. So, it was suggested that Shrikhand could be prepared successfully by adding different proportion of kiwi pulp. It was suggested to incorporate kiwi pulp @ 15% which showed better overall acceptability and result among the all treatments.

**Keywords:** Shrikhand, kiwi pulp, body and texture, colour and appearance, sensory evaluation, microbial evaluation

**Introduction**

The increasing demand from consumers for dairy products with 'functional' properties is a key factor driving value sales growth in developed markets. This has led to the promotion of added-value products such as probiotic and functional yoghurts, reduced-fat and enriched milk products, fermented dairy drinks, and organic cheese (Narayanan and Lingam, 2013). Present day consumers prefer food that promote good health and prevent diseases. Furthermore, these foods must fit into current lifestyles providing convenience of use, good flavor and an acceptable price value ratio. Such food constitutes current and future waves in the evolution of the food development cycle. Shrikhand is an Indian sweet dish made of strained yoghurt. The Shrikhand is a curd prepared with added sugar, flavoring agent. Shrikhand is an indigenous fermented milk product prepared by the fermentation of milk by using known strain of lactic acid bacteria. Shrikhand is extensively used as a sweet dish after meals. It is also used as a festive sweet in India. Sugar is added as an additive to the Shrikhand to enhance taste and does not have any preventive effect. Other natural additives like dried fruits, fruit juices /pulp etc. are added to the Shrikhand to enhance the flavor. Shrikhand is traditionally made at home in western India. Shrikhand is served as special delicacy during festivals and ceremonial occasions. Consumption of Shrikhand is reported to be effective in treatment of many diseases like diarrhoea, acidity, gastro-intestinal. Kiwi fruit is a fruit with many associated health benefits, including better sleep and healthy looking skin. Kiwi fruit reduces the risk of heart disease, diabetes, cancer etc. Kiwifruit is rich in vitamins C, E and A. It contains dietary fibre, potassium, phosphorous, magnesium and copper. It has a remarkable ability to remove excess sodium from the body which is good for the average person who eats too much salt. The present investigation was undertaken to explore the possibility of utilizing kiwi pulp in the formulation of Shrikhand.

**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 Kiwi fruits were procured from local market of Loni, Tal. Rahata, Dist- Ahmednagar. In this phase, the following different levels of Kiwi in Shrikhand were studied. To - Control (without addition of kiwi pulp) and 35% sugar.

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T<sub>1</sub> - Shrikhand prepared from 90% Chakka, 10% kiwi pulp and 35% sugar.

T<sub>2</sub> -Shrikhand prepared from 85% Chakka, 15% kiwi pulp and 35% sugar.

T<sub>3</sub> -Shrikhand prepared from 80% Chakka, 20% kiwi pulp and 35% sugar.

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

### Physico-Chemical Analysis

The total solid content of milk, kiwi and chakka 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 Shrikhand. Per cent ash content was determined by the method described in A.O.A.C., 1975 [1]. Per cent moisture content was determined by gravimetric method as per IS: 1479 (part II) 1961 [7]. The acidity of

Shrikhand 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 Shrikhand 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].

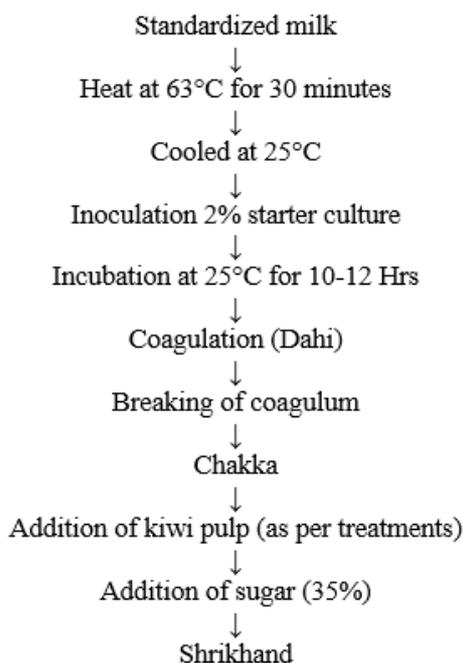
### Microbiological Analysis

All the treatment samples of kiwi Shrikhand 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) [12].

### Flow chart for preparation of Kiwi Shrikhand



### Results and discussion

**Table 1:** Chemical analysis of buffalo milk, curd and kiwi pulp

Sr. No.	Constituents	Buffalo milk (%)	Chakka	Kiwi pulp
1	Total Solid	15.78	30.98	27.14
2	Fat	6.18	14.78	0.68
3	Protein	3.94	12.96	1.01
4	Ash	0.79	0.51	0.80
5	Acidity	0.14	1.42	0.45

These observations indicate that the buffalo milk used in the present investigation was of good quality. Chakka used for

Shrikhand preparation had on an average fat content 14.78 per cent, acidity 1.42 per cent, protein 12.96 per cent and total solids 3.98 per cent.

**Table 2:** Effect of different levels of kiwi on total solids of Shrikhand.

Particulars	R <sub>1</sub>	R <sub>2</sub>	R <sub>3</sub>	R <sub>4</sub>	Average	S.D.
T <sub>0</sub>	54.74	54.98	55.18	56.94	55.46 <sup>a</sup>	0.87
T <sub>1</sub>	49.78	50.97	51.90	53.18	51.46 <sup>b</sup>	1.25
T <sub>2</sub>	48.62	48.76	47.91	47.66	48.24 <sup>c</sup>	0.46
T <sub>3</sub>	45.54	44.78	44.18	42.10	44.15 <sup>d</sup>	1.28

Total solid content of Shrikhand decreased with the increased in the level kiwi pulp. The maximum total solid content 55.46 per cent was noticed in Shrikhand without kiwi pulp i.e. T<sub>0</sub> whereas the lowest (44.15 per cent) was recorded in Shrikhand with 20% kiwi pulp (T<sub>3</sub>). Treatment T<sub>3</sub> was found to be significantly superior over the treatments T<sub>2</sub>, T<sub>1</sub> and T<sub>0</sub>, respectively.

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

Particulars	R <sub>1</sub>	R <sub>2</sub>	R <sub>3</sub>	R <sub>4</sub>	Average	S.D.
T <sub>0</sub>	14.58	14.64	14.64	14.74	14.65 <sup>a</sup>	0.06
T <sub>1</sub>	14.01	14.02	13.94	13.96	13.98 <sup>b</sup>	0.03
T <sub>2</sub>	13.78	13.68	13.54	13.50	13.63 <sup>c</sup>	0.11
T <sub>3</sub>	13.42	13.40	13.32	13.20	13.34 <sup>d</sup>	0.09

Fat content of Shrikhand decreased with the increased in the level of kiwi pulp. The maximum fat content 14.65 per cent was noticed in Shrikhand without kiwi pulp i.e. T<sub>0</sub> whereas the lowest (13.34 per cent) was recorded in Shrikhand with 20% kiwi pulp (T<sub>3</sub>). Treatment T<sub>0</sub> was found to be significantly superior over the treatments T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>, respectively.

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

Particulars	R <sub>1</sub>	R <sub>2</sub>	R <sub>3</sub>	R <sub>4</sub>	Average	S.D.
T <sub>0</sub>	12.90	12.54	12.80	12.32	12.64 <sup>a</sup>	0.23
T <sub>1</sub>	11.76	11.90	11.94	11.92	11.88 <sup>b</sup>	0.07
T <sub>2</sub>	11.06	11.02	10.90	10.98	10.99 <sup>c</sup>	0.06
T <sub>3</sub>	11.00	10.54	10.96	10.90	10.85 <sup>c</sup>	0.18

Protein content of Shrikhand decreased with the increased in the level kiwi pulp. The maximum protein content 12.64 per cent was noticed in Shrikhand without kiwi pulp i.e. T<sub>0</sub> whereas the lowest (10.85 per cent) was recorded in Shrikhand with 20% kiwi pulp (T<sub>3</sub>). The simultaneous decrease from T<sub>0</sub> to T<sub>3</sub> may be due to lower amount of protein content of kiwi pulp (1.01 per cent). Treatment T<sub>0</sub> found significantly different than the T<sub>1</sub> and T<sub>2</sub> and T<sub>3</sub> whereas treatment T<sub>3</sub> found at par the treatment T<sub>2</sub>.

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

Particulars	R <sub>1</sub>	R <sub>2</sub>	R <sub>3</sub>	R <sub>4</sub>	Average	S.D.
T <sub>0</sub>	0.50	0.48	0.46	0.42	0.47 <sup>a</sup>	0.03
T <sub>1</sub>	0.54	0.56	0.54	0.52	0.54 <sup>a</sup>	0.01
T <sub>2</sub>	0.56	0.58	0.58	0.58	0.58 <sup>a</sup>	0.01
T <sub>3</sub>	0.60	0.53	0.61	0.60	0.59 <sup>b</sup>	0.03

Ash content of Shrikhand increased with the increased in the level kiwi pulp. The maximum ash content 0.59 per cent was noticed in Shrikhand with 20% kiwi pulp i.e. T<sub>3</sub> whereas the lowest (0.47 per cent) was recorded in Shrikhand without kiwi pulp (T<sub>0</sub>). The simultaneous increase from T<sub>0</sub> to T<sub>3</sub> may be due to total amount of ash content of kiwi pulp (0.80). Treatment T<sub>0</sub> found significantly different than the T<sub>3</sub> whereas treatment T<sub>1</sub> and T<sub>2</sub> found at par the treatment T<sub>0</sub>.

**Table 6:** Effect of different levels of kiwi pulp on acidity of kiwi Shrikhand (per cent):

Particulars	R <sub>1</sub>	R <sub>2</sub>	R <sub>3</sub>	R <sub>4</sub>	Average	S.D.
T <sub>0</sub>	1.40	1.40	1.38	1.36	1.39 <sup>a</sup>	0.02
T <sub>1</sub>	1.04	1.21	1.26	1.22	1.18 <sup>b</sup>	0.08
T <sub>2</sub>	1.02	1.00	1.00	1.02	1.01 <sup>c</sup>	0.01
T <sub>3</sub>	0.94	0.98	0.91	0.91	0.94 <sup>c</sup>	0.03

Acidity content of Shrikhand decreased with the increased in the level kiwi pulp. The maximum acidity content 1.39 per cent was noticed in Shrikhand without i.e. T<sub>0</sub> whereas the lowest (0.94 per cent) was recorded in Shrikhand with 20% kiwi pulp (T<sub>3</sub>). Decrease in the acidity from T<sub>0</sub> to T<sub>3</sub> may be due to low amount of acidity of kiwi pulp (0.45). Treatment T<sub>0</sub> found significantly different than other treatments whereas treatment T<sub>3</sub> found at par the treatment T<sub>2</sub>.

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

Particulars	R <sub>1</sub>	R <sub>2</sub>	R <sub>3</sub>	R <sub>4</sub>	Average	S.D.
T <sub>0</sub>	45.26	45.02	44.82	43.06	44.54 <sup>a</sup>	0.87
T <sub>1</sub>	50.22	49.03	48.10	46.82	48.54 <sup>b</sup>	1.25
T <sub>2</sub>	51.38	51.24	52.09	52.34	51.76 <sup>c</sup>	0.46
T <sub>3</sub>	54.46	55.22	55.82	57.90	55.85 <sup>d</sup>	1.28

Moisture content of Shrikhand increased with the increased in the level kiwi pulp. The maximum moisture content 55.85 per cent was noticed in Shrikhand with 20% kiwi pulp i.e. T<sub>3</sub> whereas the lowest (44.54 per cent) was recorded in Shrikhand without kiwi pulp (T<sub>0</sub>). Treatment T<sub>3</sub> was found to be significantly superior over the treatments T<sub>2</sub>, T<sub>1</sub> and T<sub>0</sub>, respectively.

### Sensory evaluation of kiwi Shrikhand

**Table 8:** Score for Colour and appearance of kiwi Shrikhand (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>0</sub>	7.50	7.40	7.50	7.30	7.43 <sup>c</sup>	0.08
T <sub>1</sub>	7.80	7.60	7.70	7.50	7.65 <sup>b</sup>	0.11
T <sub>2</sub>	8.30	8.40	8.30	8.50	8.38 <sup>a</sup>	0.08
T <sub>3</sub>	7.20	7.10	7.30	7.00	7.15 <sup>d</sup>	0.11

The highest score (8.38) was observed for treatment T<sub>2</sub> i.e. Shrikhand blended with 15% kiwi pulp and this highest score may be due to its peculiar slightly greenish colour and appearance which was liked most by the judges. Lowest score (7.15) was observed for treatment T<sub>3</sub> i.e. Shrikhand blended with 20% kiwi pulp. Treatment T<sub>2</sub> was found to be significantly superior over the treatments T<sub>1</sub>, T<sub>0</sub> and T<sub>3</sub>, respectively.

**Table 9:** Score for body and texture of kiwi Shrikhand (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>0</sub>	7.40	7.30	7.10	7.20	7.25 <sup>b</sup>	0.11
T <sub>1</sub>	7.50	7.30	7.30	7.40	7.38 <sup>b</sup>	0.08
T <sub>2</sub>	8.10	8.00	8.10	7.90	8.03 <sup>a</sup>	0.08
T <sub>3</sub>	7.30	7.40	7.30	7.20	7.30 <sup>b</sup>	0.07

Shrikhand prepared from T<sub>2</sub> level recorded highest score for (8.03) followed by T<sub>1</sub> (7.38). The sensory score increased at T<sub>2</sub> i.e. 15 per cent level kiwi pulp. Treatment T<sub>2</sub> was found to be significantly superior over the treatments T<sub>1</sub>, T<sub>3</sub> and T<sub>0</sub>, respectively.

**Table 10:** Score for flavour of kiwi Shrikhand (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>0</sub>	7.50	7.40	7.30	7.50	7.43 <sup>c</sup>	0.08
T <sub>1</sub>	7.80	7.60	7.60	7.70	7.68 <sup>b</sup>	0.08
T <sub>2</sub>	8.20	8.30	8.10	8.20	8.20 <sup>a</sup>	0.07
T <sub>3</sub>	7.30	7.20	7.20	7.10	7.20 <sup>d</sup>	0.07

Shrikhand prepared from T<sub>2</sub> level recorded highest score for

flavour (8.20) followed by T<sub>1</sub> (7.68), T<sub>0</sub> (7.43) and T<sub>3</sub> (7.20). The sensory score increased at T<sub>2</sub> i.e. 15 per cent level kiwi pulp. Treatment T<sub>2</sub> was found to be significantly superior over the treatments T<sub>3</sub>, T<sub>1</sub> and T<sub>0</sub>, respectively.

**Table 11:** Score for overall acceptability of kiwi Shrikhand (out of nine):

Treat	R1	R2	R3	R4	Average	S.D.
T <sub>0</sub>	7.46	7.36	7.30	7.33	7.36 <sup>c</sup>	0.06
T <sub>1</sub>	7.70	7.50	7.53	7.53	7.57 <sup>b</sup>	0.08
T <sub>2</sub>	8.20	8.23	8.16	8.20	8.20 <sup>a</sup>	0.02
T <sub>3</sub>	7.26	7.23	7.36	7.10	7.24 <sup>d</sup>	0.09

The results of overall acceptability scores thus indicate that Shrikhand blended with 15 per cent kiwi pulp is superior over rest of treatments. Lowest score was noticed for Shrikhand blended with 20 per cent kiwi pulp. Treatment T<sub>2</sub> found significantly different than the treatments T<sub>0</sub>, T<sub>1</sub> and T<sub>3</sub> whereas treatment T<sub>3</sub> found at par the treatment T<sub>1</sub>.

### Changes in microbial qualities of Kiwi Shrikhand during storage

#### Standard plate count

It was observed that standard plate counts of kiwi Shrikhand 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 Shrikhand was acceptable at 1<sup>st</sup> day because the count was within the acceptable limit.

#### Yeast and mould count

A yeast and mould count of fresh Shrikhand was measured very less and negligible. It was observed that yeast and mould counts of kiwi Shrikhand 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 kiwi Shrikhand production blended with kiwi pulp was worked out by considering the prevailing retail cost of ingredients only.

It is pointed out here that 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 yield of kiwi Shrikhand shows declining trend, with the increase in the level of kiwi pulp, which resulted in increasing cost of production on weight basis.

The highest cost (T<sub>4</sub>) was recorded in case of kiwi Shrikhand blended with 20 per cent kiwi pulp, while lower cost (T<sub>0</sub>) recorded in case of Shrikhand without kiwi pulp. It was observed that the cost of kiwi Shrikhand was increased with the increase in the level of kiwi pulp flavour. The production cost of most acceptable level (T<sub>2</sub>) was Rs- 141.91/Kg.

### Conclusion

From the results of the present investigation, it may be concluded that kiwi could be successfully utilized for the preparation of Shrikhand. It may be concluded that kiwi pulp could be successfully utilized for preparation of Shrikhand. The most acceptable quality Shrikhand can be prepared by

using 15% kiwi pulp. Addition of the kiwi pulp improved the sensory quality and acceptability of Shrikhand. For the incorporation into the Shrikhand optimum level of kiwi pulp should be 15%.

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