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## Preparation of lassi blended with kiwi (*Actinidia deliciosa*) Pulp

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**Abstract**

The present study 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 @ 2.5, 5 and 7.5% in the kiwi lassi with 15% sugar to finalize the experimental treatments. Experimental kiwi lassi samples under different treatments showed significant differences for total solid, fat, protein, ash, acidity and moisture content. The values were ranged from 9.03 to 10.43, 0.48 to 0.53, 3.68 to 3.47, 0.64 to 0.70%, 0.86 to 0.54% L. A., and 90.98 to 89.57, respectively. Total solids, Fat, Protein, Ash, Acidity and Moisture contents differed significantly among the different types of lassi with kiwi flavor. Significant differences were observed within the smell, taste and body and texture score of different types of lassi. 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. Overall, the lassi was acceptable at 1<sup>st</sup> day because the count was within the acceptable limit. The *E coli* count was not detected upto 15 days. So, it was suggested that kiwi lassi could be prepared successfully by adding different proportion of kiwi pulp. It was suggested to incorporate kiwi pulp @ 2.5% which showed better overall acceptability and result among the all treatments.

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

**Introduction**

Fermented milk products constitute a vital component of the human diet in many regions of the world. In the Indian sub-continent, such products are also classified as “indigenous milk products” like dahi (curd), lassi, shrikhand etc., which are prominent in people’s diet. Indigenous milk products refer exclusively to dairy products of a particular region or country. Lassi has amazing thirst quenching ability along with highly nutritive and therapeutic properties. It is ready to serve popular fermented milk lassi. Lassi can be made more delicious by adding different types of food materials. Lassi is popular indigenous fermented milk beverage, which is usually prepared by mixing curd and water in approximately equal proportions. It is serving on very large scale in cold drink shops and restaurants during summer in almost every state in India (Bhoir, *et al.*, 2012) [2]. Utilization of fruits and vegetable in milk products for value addition is a great challenge to dairy processing industry. Now a day’s consumers prefer value added milk products which are rich in vitamins and minerals. There is a large scope in dairy processing industry for conversion of milk into innovative fruits and vegetable based milk products. Looking to the great importance of value added milk products with fruits and vegetables research workers are trying to develop innovative methodology and technologies to develop value added milk products for satisfying consumer’s demands. Kiwi in the form of pulp can be used as an additive to lassi. As far as India is concerned, Lassi is a favorite drink to beat the sweltering heat of summer season. Lassi or fermented milk products are having universal acceptability all over the world. Kiwi can be considered as one of such additives and since it has very high nutritive and therapeutic properties. The present investigation was undertaken to explore the possibility of utilizing Kiwi pulp in the formulation of lassi. The results of this investigation related to the process optimization for incorporation of Kiwi pulp into lassi and their physical, chemical, sensory, microbiological evaluation and cost of production are presented with relevant tables.

**Materials and Methods**

The research was conducted in Department of Animal Biotechnology, College of Agricultural Biotechnology, Loni. Curd was prepared by using the procedure prescribed by De (2008) [4] with slight modifications. Commercial grade clean, white crystalline cane-sugar and Kiwi fruits were procured from local market of Loni, Tal. Rahata, Dist- Ahmednagar.

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In this trial, for the preparation of Kiwi lassi following different levels of Kiwi in Lassi were studied.

**T<sub>0</sub>** - Control (Lassi without addition of kiwi pulp)

**T<sub>1</sub>** - Lassi + 2.5% kiwi pulp

**T<sub>2</sub>** -Lassi + 5% kiwi pulp

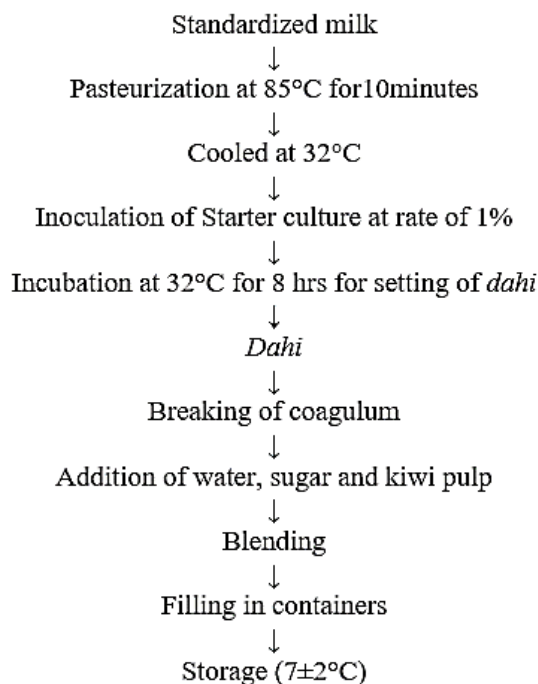
**T<sub>3</sub>** -Lassi + 7.5% kiwi pulp

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, curd and kiwi pulp were determined by gravimetric method as per IS: 1479 (part II), 1961<sup>[9]</sup>. The fat content was determined by using standard Gerber method as described in IS: 1224 (part II), 1977<sup>[7]</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>[9]</sup>. The per cent nitrogen was multiplied by 6.38 to find out protein percentage in lassi. Per cent ash content was determined by the method described in A.O.A.C., 1975<sup>[1]</sup>. Per cent moisture content was determined by gravimetric method as per IS: 1479 (part II) 1961<sup>[9]</sup>. The acidity of lassi expressed as per cent lactic acid was

### Flow chart for preparation of Kiwi Lassi



### Results and discussion

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

Sr. No.	Constituents	Cow milk (%)	Curd	Kiwi pulp
1	Total Solid	14.68	9.14	29.30
2	Fat	4.10	0.51	0.63
3	Protein	3.27	3.71	1.10
4	Ash	0.64	0.70	0.82
5	Acidity	0.13	0.91	0.43

These observations indicate that the cow milk used in the present investigation was of good quality. Curd used for lassi preparation had on an average fat content 0.51 per cent,

determined by the method described in IS: 1479 (part I), 1960<sup>[8]</sup>.

### Sensory Evaluation

The fresh sample of lassi 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>[6]</sup>.

### Microbiological Analysis

All the treatment samples of kiwi lassi 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)<sup>[13]</sup>.

acidity 0.91 per cent, protein 3.71 per cent and total solids 9.14 per cent.

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

Particulars	R <sub>1</sub>	R <sub>2</sub>	R <sub>3</sub>	R <sub>4</sub>	Average	S.D.
T <sub>0</sub>	9.10	9.00	8.98	9.02	9.03 <sup>d</sup>	0.05
T <sub>1</sub>	9.56	9.63	9.59	9.61	9.60 <sup>c</sup>	0.03
T <sub>2</sub>	10.15	10.10	10.08	10.12	10.11 <sup>b</sup>	0.03
T <sub>3</sub>	10.44	10.38	10.48	10.42	10.43 <sup>a</sup>	0.04

It was observed that the total solid content showed gradual increase with the increase in level of kiwi pulp. This simultaneous increase from T<sub>0</sub> to T<sub>3</sub> may be due to high

amount of total solid content of kiwi pulp (29.30) than cow milk (14.68) and curd (9.14). The lowest total solid content was noticed at T<sub>0</sub> i.e. lassi without kiwi pulp, while the highest total solid content was observed at T<sub>3</sub> i.e. lassi blended with 7.5% kiwi pulp.

**Table 3:** Effect of different levels of kiwi pulp on fat content of kiwi lassi (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	0.48	0.47	0.48 <sup>c</sup>	0.01
T <sub>1</sub>	0.51	0.51	0.51	0.50	0.51 <sup>b</sup>	0.00
T <sub>2</sub>	0.53	0.52	0.52	0.52	0.52 <sup>a</sup>	0.00
T <sub>3</sub>	0.53	0.53	0.53	0.54	0.53 <sup>a</sup>	0.00

The average fat content of kiwi lassi was 0.5 per cent. The highest fat content in lassi (0.53) was observed in (T<sub>3</sub>) i.e. lassi with 7.5% kiwi pulp and the lowest (0.48 per cent) at without kiwi pulp (T<sub>0</sub>). Treatment T<sub>3</sub> found significantly superior over the combination of treatments T<sub>0</sub>, T<sub>1</sub> and T<sub>2</sub> whereas treatment T<sub>2</sub> found at par with T<sub>1</sub>

**Table 4:** Effect of different levels of kiwi pulp on protein content of kiwi lassi (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>	3.68	3.66	3.68	3.69	3.68 <sup>a</sup>	0.01
T <sub>1</sub>	3.61	3.60	3.57	3.59	3.59 <sup>b</sup>	0.01
T <sub>2</sub>	3.57	3.57	3.57	3.54	3.56 <sup>b</sup>	0.01
T <sub>3</sub>	3.50	3.48	3.45	3.45	3.47 <sup>c</sup>	0.02

The highest level of protein content was noticed at treatment T<sub>0</sub> i.e. without kiwi pulp whereas, lowest (3.47 percent) at T<sub>3</sub> i.e. 7.5% kiwi pulp. It was observed that the protein content showed gradual decrease in lassi with the increase in level of kiwi pulp. The simultaneous decrease from T<sub>0</sub> to T<sub>3</sub> may be due to low amount of protein content of kiwi pulp (1.10 per cent).

**Table 5:** Effect of different levels of kiwi pulp on ash content of kiwi lassi (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>	0.66	0.64	0.64	0.62	0.64 <sup>d</sup>	0.01
T <sub>1</sub>	0.66	0.65	0.66	0.66	0.66 <sup>c</sup>	0.00
T <sub>2</sub>	0.68	0.67	0.68	0.68	0.68 <sup>b</sup>	0.00
T <sub>3</sub>	0.70	0.69	0.70	0.70	0.70 <sup>a</sup>	0.00

It was observed that the ash content showed gradual increase with increase in level of kiwi pulp. 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 (0.82). The lowest ash content was observed at T<sub>0</sub> i.e. lassi without kiwi pulp of mix (0.64), while the highest ash content was observed at T<sub>3</sub> i.e. lassi with 7.5% kiwi pulp (0.69). 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 6:** Effect of different levels of kiwi pulp on acidity of kiwi lassi (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>	0.84	0.90	0.87	0.84	0.86 <sup>a</sup>	0.02
T <sub>1</sub>	0.70	0.70	0.64	0.61	0.66 <sup>b</sup>	0.04
T <sub>2</sub>	0.61	0.60	0.61	0.60	0.61 <sup>c</sup>	0.01
T <sub>3</sub>	0.54	0.57	0.51	0.54	0.54 <sup>d</sup>	0.02

The average percent acidity of kiwi lassi were 0.86 (T<sub>0</sub>), 0.66 (T<sub>1</sub>), 0.60 (T<sub>2</sub>) and 0.54 (T<sub>3</sub>). It was observed that the acidity showed gradual decrease with the increase in level of kiwi

pulp. 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 7:** Effect of different levels of kiwi pulp on moisture content of kiwi lassi (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>	90.90	91.00	91.02	90.98	90.98 <sup>a</sup>	0.05
T <sub>1</sub>	90.44	90.37	90.41	90.39	90.40 <sup>b</sup>	0.03
T <sub>2</sub>	89.85	89.90	89.92	89.88	89.89 <sup>c</sup>	0.03
T <sub>3</sub>	89.56	89.62	89.52	89.58	89.57 <sup>d</sup>	0.04

The highest level of moisture content was noticed at treatment T<sub>0</sub> i.e. without kiwi pulp, lowest (89.57 percent) at T<sub>3</sub> i.e. 7.5% kiwi pulp. It was observed that the moisture content showed gradual decrease in lassi with the increase in level of kiwi pulp. The simultaneous decrease from T<sub>0</sub> to T<sub>3</sub> may be due to low amount of moisture content of kiwi pulp (70.70 per cent).

### Sensory evaluation of kiwi lassi

**Table 8:** Score for Colour and appearance of kiwi lassi (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	7.50	7.50	7.00	7.38 <sup>a</sup>	0.22
T <sub>1</sub>	8.00	8.00	8.00	8.00	8.00 <sup>a</sup>	0.00
T <sub>2</sub>	8.50	8.50	8.00	8.00	8.25 <sup>b</sup>	0.25
T <sub>3</sub>	8.00	7.50	8.00	7.50	7.75 <sup>c</sup>	0.25

The highest score (8.25) was observed for treatment T<sub>2</sub> i.e. lassi blended with 5% kiwi pulp and this highest score may be due to its peculiar slight greenish appealing colour and appearance which was liked most by the judges. Lowest score (7.38) was observed for treatment T<sub>0</sub> i.e. lassi without kiwi pulp. The lowest score may be due to its white colour which was not accepted by judges. Treatment T<sub>2</sub> found significantly different than the other treatments T<sub>2</sub> and T<sub>3</sub>, whereas treatment T<sub>1</sub> found at par with treatment T<sub>2</sub>.

**Table 9:** Score for consistency of kiwi lassi (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	7.00	7.00	7.50	7.25 <sup>cd</sup>	0.25
T <sub>1</sub>	8.20	8.50	8.00	8.50	8.30 <sup>a</sup>	0.21
T <sub>2</sub>	7.70	7.50	7.50	7.70	7.60 <sup>b</sup>	0.10
T <sub>3</sub>	7.20	7.50	7.00	7.00	7.18 <sup>d</sup>	0.20

Lassi prepared from T<sub>1</sub> level recorded highest score for (8.30) followed by T<sub>2</sub> (7.60). The sensory score increased at T<sub>1</sub> i.e. 2.5 per cent level kiwi pulp. Treatment T<sub>1</sub> significantly different than the other treatments where as the treatment T<sub>3</sub> found at par with treatment T<sub>0</sub>.

**Table 10:** Score for flavour of kiwi lassi (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>	8.00	7.50	7.50	7.00	7.50 <sup>bc</sup>	0.35
T <sub>1</sub>	8.50	8.00	8.50	8.50	8.38 <sup>a</sup>	0.22
T <sub>2</sub>	7.20	7.50	7.70	7.00	7.35 <sup>c</sup>	0.27
T <sub>3</sub>	7.70	7.70	7.00	7.00	7.35 <sup>c</sup>	0.35

Lassi prepared from T<sub>1</sub> level recorded highest score for flavour (8.38) followed by T<sub>0</sub> (7.50). The sensory score increased at T<sub>1</sub> i.e. 2.5 per cent level kiwi pulp. Treatment T<sub>1</sub> found significantly different than the other treatments T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub> whereas treatment T<sub>2</sub> and T<sub>3</sub> found at par with treatment T<sub>0</sub>.

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

Treat	R1	R2	R3	R4	Average	S.D.
T0	7.60	7.30	7.30	7.10	7.33 <sup>c</sup>	0.18
T1	8.20	8.10	8.10	8.30	8.18 <sup>a</sup>	0.08
T2	7.90	7.80	7.70	7.50	7.73 <sup>b</sup>	0.15
T3	7.60	7.50	7.30	7.10	7.38 <sup>c</sup>	0.19

The results of overall acceptability scores thus indicate that lassi blended with 2.5 per cent kiwi pulp is superior over rest of treatments. Lowest score was noticed for lassi blended without kiwi pulp. Treatment T<sub>1</sub> found significantly different than the other treatments whereas treatment T<sub>3</sub> found at par with treatment T<sub>0</sub>.

#### Changes in microbial qualities of Kiwi lassi during storage Standard plate count

The microbial results indicate the SPC was varied among the different treatments. Overall, the lassi was acceptable at 1<sup>st</sup> day because the count was within the acceptable limit.

#### Yeast and mould count

The microbial results indicate the yeast and mould was varying among the different treatments. Overall, the lassi was acceptable at 1<sup>st</sup> day because the count was within the acceptable limit.

#### Coli form count

The *E coli* count was not detected upto 15 days. The high 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 lassi 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. Cost of ingredients decreased with the increase in the level of kiwi pulp. The yield of kiwi lassi shows declining trend, with the increase in the level of kiwi pulp, which resulted in decreasing cost of production on weight basis.

The highest cost (T<sub>3</sub>) was recorded in case of kiwi lassi blended with 7.5 per cent kiwi pulp, while lower cost (T<sub>0</sub>) recorded in case of without kiwi pulp. It was observed that the cost of kiwi lassi was increase with the increase in the level of kiwi pulp flavour. The production cost of most acceptable level (T<sub>1</sub>)/was Rs-45.94/lit.

#### Conclusion

From the results of the present investigation, it may be concluded that kiwi could be successfully utilized for the preparation of lassi. The most acceptable level of lassi can be prepared by using 2.5 per cent kiwi pulp. The kiwi pulp had a positive effect on flavor acceptability and its consumption. On the basis of microbial analysis it may be concluded that the product is acceptable upto 7 days.

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