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Process Optimization for Preparation of *Lassi* Blended with Grape Juice (*Vitis vinifera*)

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Abstract

Lassi was prepared by using cow milk with optimized levels of grape juice and sugar. The sensory evaluation of lassi was done by semi trained judges. The investigation was undertaken to explore the possibilities of utilizing grape juice in lassi manufacture to improve the health benefits of product. The product obtained was subjected for chemical analysis. The lassi sample (T_4) prepared with 6 per cent grape juice and 15 per cent sugar level received the highest overall acceptability score i.e, 8.47. The sensorily most acceptable treatment combination (T_4) has an average chemical composition of 3.09 % fat, 3.26% protein, 78.08% moisture, 21.92% total solids, 0.75% ash, 0.85 % acidity, 4.15 pH ,4.34 % reducing sugars, 10.48 % non-reducing sugar and 14.82% total sugars.

Key words : Grape juice, cow milk, sugar, *Lassi*.

Fermented milk and its products are vital components of human nutrition, offering a range of health benefits. These products retain all the essential nutrients of milk while improving their bioavailability. During fermentation, milk proteins coagulate, making them easier to absorb and digest particularly beneficial for vulnerable groups such as children, the elderly, and individuals with gastric ulcers (Singh and Amin, 1983). *Lassi* is a traditional fermented dairy drink commonly enjoyed in many cultures. It is prepared by stirring whole curd into a delicious drink with addition of sugar or salt a small amount of cold water or ice to make the product flowable (Kedaree *et al*., 2021). This beverage has historically been an important part of diets in different regions, valued both for its refreshing qualities and nutritional benefits.

Grape juice contains high amounts of natural sugars, vitamins, and polyphenols so it can be used as a natural sweetener and functional ingredient. Grape is one of the largest fruit crops grown worldwide and rich in carbohydrates, organic acids, amino acids, vitamins, melatonin and phenolic compounds (Zare and Lashkari, 2021; Kersh *et al*.,2023). The grape berry and its derived products have potent antioxidant, anticarcinogenic, antibacterial, antidiabetic, and anti-inflammatory activities as well as cardioprotective, hepatoprotective and neuroprotective effects many people are becoming aware of the importance of their consumption in their daily life due to positive health benefits (Bendaali *et al*., 2022). Grapes are rich in bioactive compounds such as phenolic acids, flavonoids, anthocyanin, stilbenes, and lipids (Shiraishi *et al*., 2010).

Material and Methods

The following materials were used for the present investigation.

Collection of Cow Milk : Fresh clean, composite sample of crossbreed cow milk were obtained from Research Cum Development Project on Cattle, Department of Animal Husbandry and Dairy Science, Mahatma Phule Krishi Vidyapeeth, Rahuri.

Collection of Grape cultivar : Good quality fresh grapes fruits of cultivar Concerd, Arka Shyam and Banglore Blue were procured from AICRP on fruits MPKV, Rahuri and grape juice extraction was done.

Microbial Cultures : The standard dahi culture i.e., LF 40 containing Lactobacillus spp. were used in this study and was procured from NDRI, Karnal.

Chemicals : Analytical (AR) or guaranteed grade (GR) reagents were used in the chemical analysis.

Methods Phase –I

Preliminary Trials : Preliminary trials were conducted to optimize grape cultivar, juice levels and sugar levels.

Phase –II Experimental Trails

On the basis of results of sensory evaluation of preliminary trials 3, 6 and 9 % juice of concord cultivar and 12 and 15% sugar were used to prepare the *lassi* samples.

Preparation of *lassi* sample : *Lassi* was prepared as per the method suggested by De, (2004) with slight modifications.

Procedure : *Lassi* was prepared as per the procedure described by De, (2004).

Treatment combinations : For preparation of *lassi* by using grape juice (*Vitis vinifera*), the treatment combinations were finalized in preliminary trials as T_0 - Dahi + 12% sugar, $T_1(J_1S_1)$ - Dahi + 3% grape juice + 12% sugar, $T_2(J_1S_2)$ - Dahi + 3% grape juice + 15% sugar, $T_3(J_2S_1)$ - Dahi + 6% grape juice + 12% sugar, $T_4(J_2S_2)$ - Dahi + 6% grape juice + 15% sugar, $T_5(J_3S_1)$ - Dahi + 9% grape juice + 12% sugar and $T_6(J_3S_2)$ - Dahi + 9% grape juice + 15% sugar.

Flavour : The mean flavour score of *lassi* for treatments T_0, T_1, T_2, T_3, T_4, T_5, and T_6, were 7.83, 8.01, 8.20, 8.33, 8.46, 8.10 and 7.95 respectively. Flavour scores were significantly ($P < 0.05$) affected by both ingredients. Treatments T_1 and T_5 were at par with each other. Treatment T_4 achieved the highest flavour score of 8.46.

The flavour results from this study were

Receiving of cow milk
↓
Preheating (35-40°C)
↓
Filtration/Clarification
↓
Standardization (4 % fat)
↓
Heating (630C for 30 min)
↓
Cooling at 36°C
↓
Inoculation by 2% (LF-40) starter culture
↓
Incubation (32°C/12 hrs)
↓
Dahi
↓
Breaking firm Dahi by agitation
↓
Addition of 10% of water
↓
Addition of sugar (As per treatment)
↓
Addition of grape juice (As per treatment)
↓
Mixing (Agitation)
↓
Churning and formation of lassi
↓
Packaging
↓
Storage (5 ± 1°C)

Fig.1. Flow chart for preparation of lassi

similar to those reported by Gaikwad *et al*. (2018), they prepared a menthol juice *lassi* and found an average sensory score for flavour ranging from 7.31 to 8.80. Roy *et al*. (2019) studied that flavour of the four samples of grape juice yoghurt got near about same score ranging from sample S_1 7.17, S_2 7.33, S_3 7.17 and S_4 7.17.

Colour and appearance : For treatments T_0, T_1, T_2, T_3, T_4, T_5, and T_6, the *lassi* received colour and appearance scores of 7.80, 8.02, 8.17, 8.34, 8.56, 7.92 and 7.88 respectively. Colour and appearance scores were significantly ($P < 0.05$) affected by both ingredients. Out of all the treatments, treatment T_4 received the highest score (8.56), while T0 shows lowest score (7.80). Treatments T_1, T_2, T_3, T_4 and T_5 shown notable variations from one another.

The findings of this study align closely with those reported by Avtade (2010) and Ghule *et al*. (2015), they noted that the scores for the colour and appearance of *lassi* improve with increasing levels of pomegranate juice and strawberry pulp, up to a certain point, after which they gradually decline.

Consistency : The consistency score for treatments T_0, T_1, T_2, T_3, T_4, T_5, and T_6 were as 7.90, 8.10, 8.25, 8.30, 8.40, 7.85 and 7.76 respectively. The highest consistency score was observed for treatment T_4 (8.40), while the lowest score was noted for treatment T6 (7.76).

The results obtained in this study are in aggrement with the results obtained by Dhumal *et al*. (2018) who reported that *lassi* prepared from 15 per cent muskmelon and 2.5 per cent pudina extract was superior in consistency than other treatments.

Overall acceptability : The scores of the *lassi* samples in terms of overall acceptability for treatment T_0, T_1, T_2, T_3, T_4, T_5, and T_6 were 7.84, 8.04, 8.20, 8.32, 8.47, 7.90 and 7.79 respectively. The formulation including 6 per cent grape juice and 15 per cent sugar received the highest score, whereas the control sample, which contained no grape juice, received the lowest score. Compared to all other treatments, treatment T_4 demonstrated the best colour, flavor, consistency and was considerably ($P<0.05$) superior. Navale (2020) observed that increase in the level of orange juice resulted in better overall acceptability score of *lassi* up to a certain limit and there after it decreases proportionately.

Chemical composition of fresh lassi samples : The freshly prepared *lassi* samples were subjected to chemical analysis viz. fat, protein, moisture, ash, acidity, reducing sugars, non reducing sugars, total sugars, total solids and pH value. The observations and corresponding statistical analysis are presented in Table 2.

Fat : The fat content for treatments T_0, T_1, T_2, T_3, T_4, T_5, and T_6 were 3.30, 3.25, 3.20, 3.14, 3.09, 3.04 and 2.99 per cent respectively. The fat content shows significant difference. This was due to lower per cent of fat in grape juice. The result of fat content in the present investigation was comparable with the finding following research workers.

Table 1. Sensory score of fresh *lassi* samples (Sensory score out of 9)

Treatments	Flavour	Colour and appearance	Consistency	Overall acceptability
T_0	7.83^e	7.80^f	7.90^e	7.84^f
T_1	8.01^d	8.02^d	8.10^d	8.04^d
T_2	8.20^c	8.17^c	8.25^c	8.20^c
T_3	8.33^b	8.34^b	8.30^b	8.32^b
T_4	8.46^a	8.56^a	8.40^a	8.47^a
T_5	7.94^d	7.92^e	7.85^f	7.90^e
T_6	7.75^f	7.88^e	7.76^g	7.79^g
S.E.(m) ±	0.02	0.03	0.004	0.003
CD at (5%)	0.07	0.09	0.012	0.011

Jadhav *et al*. (2014) observed that the fat percentage of the *lassi* was decreased from 3.25 per cent to 2.92 per cent from treatment T0 to treatment T4. The level of fat per cent was decreased as per increase in level of citrus juice in *lassi*.

Protein : The protein content of *lassi* significantly (P<0.05) influenced due to addition of grape juice and sugar. The protein content is ranged from 3.34 to 3.22 per cent. The protein content was decreased due to the less amount of protein content in grape juice.

Nur Hossain *et al*. (2012), observed that there was a reduction in protein content with the addition of grape juices to yogurt. The above findings are in agreement with the result recorded by Upadhyay et. al. (2017), who reported protein content ranges from 3.53 to 2.82, the protein content in *lassi* decreased with the increasing level of carrot juice.

Total solids : The total solids content of freshly prepared *lassi* samples are presented in Table 2. The values for the total solids content of *lassi* were 21.09 to 22.48 per cent for the treatments T_0, to T_6 respectively. The total solids content in the *lassi* samples varied significantly (P<0.05) with the addition of grape juice.

Tambe *et al*. (2017) observed a significant enhancement in *lassi*'s total solids content attributed to the incremental addition of papaya pulp.

Moisture : The data shows that the moisture range of *lassi*. Treatment T_0, T_1, T_2, T_3, T_4, T_5, and T_6 had moisture content of 78.91, 78.53, 78.51 78.10, 78.08, 77.60 and 77.52 per cent respectively. Treatment T_0 was the highest moisture content of 78.91per cent, while T_6 had the lowest i.e., 77.52 per cent. The treatments T_1, T_2 as well as T_3 and T_4 were at par with each other. The moisture content was decreased as grape juice and sugar level increased from treatment T_0 to T_6, this might be due to grape juice had low moisture content as compare to cow milk.

Prabhakar (2018) undertook the moisture percentage for various sample of mango fortified *lassi* which are ranges from 79.87 to 76.05 for treatments T_1 to T_4 and it was observed that moisture percentage decreased from T_1 to T_4.

Ash : The ash content of freshly prepared *lassi* samples were 0.60, 0.63 0.70, 0.73, 0.75, 0.79 and 0.82 per cent T_0, T_1, T_2, T_3, T_4, T_5, and T_6 respectively. As the per cent of grape juice increased there is significant (P<0.05) increased in ash content could be due to grape juice contain various nutrients like iron, calcium, zinc, magnesium etc. The treatments T_3 and T_4 were at par with each other. Results

Table 2. Chemical composition of fresh *lassi* samples

Treatment Combination	Fat (%)	Protein (%)	Total solids (%)	Moisture (%)	Ash (%)	Acidity (%)	pH (%)	Reducing sugar (%)	Non-reducing sugar (%)	Total sugar (%)
T_0	3.30^a	3.34^a	21.09^g	78.91^a	0.60^f	0.72^f	4.31^a	3.65^d	10.20^g	13.85^g
T_1	3.25^b	3.32^b	21.47^f	78.53^b	0.63^e	0.76^e	4.27^b	4.01^c	10.26^f	14.27^f
T_2	3.20^c	3.30^c	21.49^e	78.51^b	0.70^d	0.79^d	4.22^c	3.99^c	10.30^e	14.49^e
T_3	3.14^d	3.28^d	21.90^d	78.10^c	0.73^c	0.83^c	4.18^d	4.36^b	10.39^d	14.75^d
T_4	3.09^e	3.26^e	21.92^c	78.08^c	0.75^c	0.85^c	4.15^d	4.34^b	10.48^c	14.82^c
T_5	3.04^f	3.24^f	22.40^b	77.60^d	0.79^b	0.89^b	4.12^e	4.73^a	10.60^b	15.33^b
T_6	2.99^g	3.22^g	22.48^a	77.52^e	0.82^a	0.92^a	4.07^f	4.72^a	10.73^a	15.45^a
S.E.(m) ±	0.007	0.003	0.003	0.004	0.004	0.005	0.007	0.005	0.006	0.008
CD @ (5%)	0.021	0.009	0.010	0.013	0.012	0.016	0.021	0.016	0.019	0.024

of present study are agreement to the results of Ghule (2015) that with increased in the strawberry pulp increased the ash content in *lassi*.

Acidity (% LA) : The acidity (% LA) of freshly prepared *lassi* samples were recorded as 0.72% for T_0, 0.76% for T_1, 0.79% for T_2, 0.83% for T_3, 0.85% for T_4, T_5 0.89% and 0.92% for T_6. The acidity of *lassi* significantly ($P<0.05$) influenced due to addition of grape juice. The acidity in the *lassi* sample was increased as the level of grape juice increased in the *lassi* samples because grape juice is acidic in nature. The treatments T_3 and T_4 were at par with each other.

The above results were comparable with the findings of following research workers. Matkar (2010) who reported acidity in the range of 0.77 per cent LA (control sample) and 1.04 per cent LA in the *lassi* blended with papaya pulp. Bagal *et al*. (2018) observed that as the amount of papaya pulp increased, there was a corresponding rise in the acidity level of the *lassi*.

pH : The pH for the treatment T_0, T_1, T_2, T_3, T_4, T_5, and T_6 were 4.31, 4.27, 4.22, 4.18, 4.15, 4.12 and 4.07 respectively. The pH values of *lassi* samples significantly ($P<0.05$) declined due to addition of grape juice to *lassi*. The treatments T_3 and T_4 were at par with each other. The maximum decline in pH value (4.07) was observed in *lassi* (T_6) prepared using 9 per cent grape juice. The above results were comparable with the findings of following research workers.

These results obtained in present study is in agreement with the results obtained by Ghule (2015) strawberry pulp decreases the pH in *lassi* with increased in strawberry pulp.

Reducing sugars : The reducing sugar content in *lassi* for treatments T_0, T_1, T_2, T_3, T_4, T_5, and T_6 were 3.65, 4.01, 3.99, 4.36, 4.34, 4.73 and 4.72 per cent, respectively. These variations were statistically significant ($P<0.05$), demonstrating that the quantity of grape juice significantly influenced the reducing sugar content in the *lassi*. The treatments T_1,T_2 and T_3, T_4 as well as T_5 and T_6 were at par with each other. Khore (2013) reported that The mean values of reducing sugar in the *lassi* samples were ranged from 3.82 (T_3) to 3.73 (T_0) percent. It was noticed that as the level of addition of strawberry pulp increased the reducing sugar content in the *lassi* samples increased significantly. Chakka whey beverage prepared using mango pulp as reported by Hapse (2004) had 4.19 percent reducing sugar.

Non reducing sugar : The Non-reducing sugar content of T_0, T_1, T_2, T_3, T_4, T_5, and T_6 were 10.20, 10.26, 10.30, 10.39, 10.48, 10.60 and 10.73 per cent, respectively. It was observed that the control sample had lowest non-reducing sugar content, T_0 (10.20%), whereas treatment T_6 samples had the highest non-reducing sugar content (10.73 %). The data indicated that the non-reducing sugar content in *lassi* increased with the addition of sugar. Treatments T_0, T_1, T_2, T_3, T_4, T_5, and T_6 were differ from one another considerably ($P<0.05$). Similar findings were reported by Hossain (2012) the carbohydrate content was highest in G3 (15% grape juice) type yoghurt and the lowest in plain (P) yoghurt. Statistical analysis showed that there were significant differences among the different types of fruit yoghurt in terms of carbohydrate content.

Total sugars : It is revealed that total sugars content in *lassi* saples of T_0, T_1, T_2, T_3, T_4, T_5, and T_6 were 13.85, 14.27, 14.29, 14.75, 14.82, 15.33 and 15.45 per cent, respectively. Treatment T_0 samples had the lowest total sugars level (13.85%), whereas treatment T_6 samples had the highest content (15.45 %). Treatments T_0, T_1, T_2, T_3, T_4, T_5, and T_6 were differ from one another considerably ($P<0.05$). Pardhi *et al*. (2014) reported that total sugars

content of T_0, T_1, T_2 and T_3 was 14.43, 14.83, 15.51, 16.26 per cent, respectively and it differed significantly ($P < 0.05$) from each other.

Conclusion

The better quality *lassi* can be prepared by incorporating 6 per cent grape juice and 15 per cent sugar (overall acceptability score 8.47). The sensorily superior fresh *lassi* sample had average chemical composition 3.09 per cent fat, 3.26 per cent protein, 78.08 per cent moisture, 21.92 per cent total solids, 0.75 per cent ash, 0.85 per cent acidity, 4.34 per cent reducing sugars, 10.48 per cent non-reducing sugar, 14.82 per cent total sugars and 4.15 pH.

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