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Utilization of guava (*Psidium guajava*) pulp for Lassi preparation

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Abstract
The present investigation entitled "Preparation of cow milk lassi blended with guava (*Psidium guajava*) pulp" was conducted at Section of Animal Husbandry and Dairy Science, Nagpur. An effort was made to find out the optimum level of guava pulp in the preparation of lassi, with main objectives to evaluate the product by sensory evaluation, determination of physico-chemical composition and to calculate cost of production. Some of the finding emerged from the present investigation are summarized as follows. In view of above objective present study was carried out with five treatments including control T_1 and lassi prepared from cow milk with different level of guava pulp i.e. 5 percent, 10 percent, 15 percent, 20 percent in treatment T_2, T_3, T_4 and T_5, respectively. In respect to chemical composition of guava pulp added in lassi, it was observed that, the fat, protein and titratable acidity content were slightly decreased with addition of different level of guava pulp. The moisture, ash, pH and total solids contents of lassi was significantly increased with increase in the level of guava pulp. From the investigation it was observed that, the mean score of flavour of lassi in treatment T_4 was highest (8.50) and lowest in T_5 (5.50). The average score for colour and appearance of lassi was highest in T_4 (8.50) and lowest in T_5 (5.75). The average score for body and texture of lassi was highest in T_4 (8.50) and lowest in T_5 (5.25). The sensory evaluation for (overall acceptability) carried out by the judges, showed that lassi prepared by blending with 15 part of guava pulp (T_4) as most acceptable treatment. This superiority was found due to addition of 15 percent of guava pulp.

Keywords: Cow milk, Lassi, guava pulp, physico-chemical properties, cost of production

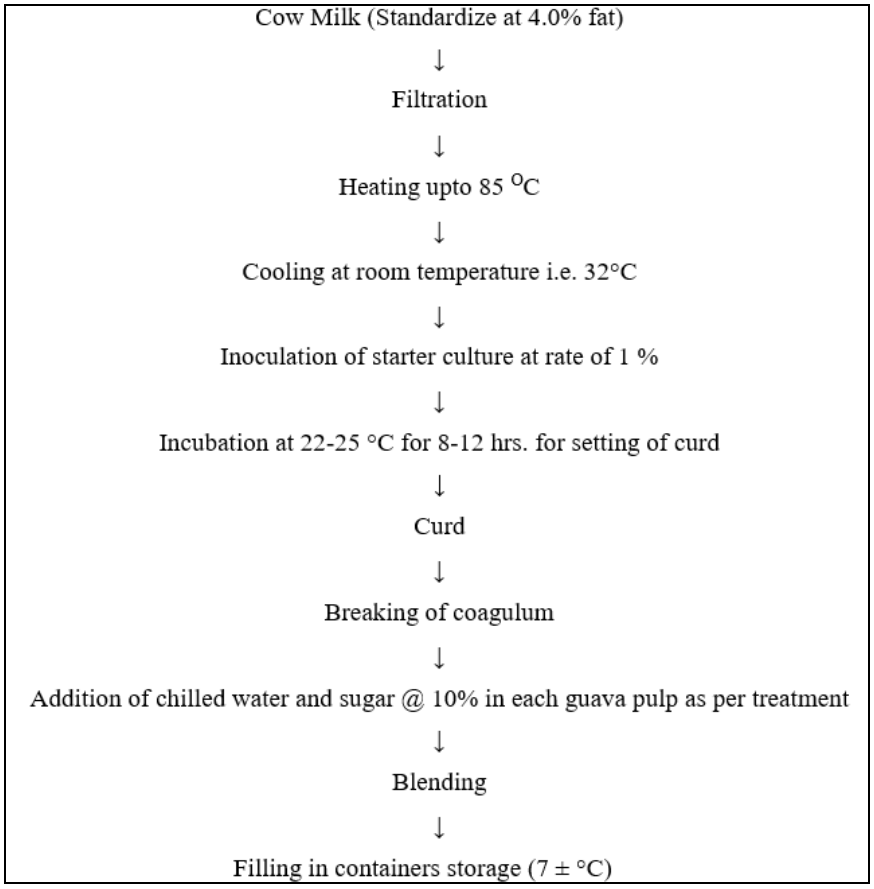
Introduction
Lassi is one of the fermented milk products is ideal for serving with hot dishes as after eating believed to be a folk remedy for gastroenteritis, lassi is not only perfect as a morning smoothie, but it is also relished as a hot weather refreshment to beat the scorching effect of heat and it acts as an energizing liquid meal or it provides relief after eating a delicious but hot spicy meal. Thus, lassi is a digestive aid for the afternoon meal; it settles the upset stomach and it is the perfect cooling agent. Fermented dairy products have long been an important component of nutritional diet. Historically, fermentation process involved unpredictable and slow souring of milk caused by the organisms inherently present in milk. However, modern microbiological processes have resulted in the production of different fermented milk products of higher nutritional value under controlled conditions (Panesar 2014) [7]. Guava (*Psidium guajava*) a native to tropical America is exceedingly well known fruit in India. And also known as *amrood* in Hindi, comes loaded with tiny hard seeds at the center. It is believed to have its genesis in Central America where it is alternatively known as "sand plum". Besides its unique flavour and fragrance, guava has been hailed as one of the super fruits due to the numerous health benefits it offers. It indeed is a powerhouse of nutrients. "This humble fruit is extraordinarily rich in vitamin C, lycopene and antioxidants that are beneficial for skin. Guavas are also rich in manganese which helps the body to absorb other key nutrients from the food that we eat. The potassium in guavas helps normalise blood pressure levels as well (Anonymous, 2023) [1].

Materials and Methods

Fresh, clean, whole cow milk was used for lassi preparation. Cow milk was procured for every trial from Livestock Instructional Farm of Section of Animal Husbandry and Dairy Science, College of Agriculture, Nagpur. Guava fruit, Dahi culture was procured from local market. Cow milk was standardized at 4 percent fat and then it was heated to 72 °C for 15 sec. After heating it was cooled to 32 °C and inoculated with 1 percent starter culture. Then it was allowed for incubation for 22-25 hours at room temperature. After which it was followed by break down the coagulum. After addition of chilled water and sugar @10 percent as per treatments. Start blending lassi was stored and filled in container storage (7±˚c).

Treatment Details

Treatment	Lassi (in part)	Guava pulp (in part)
T_1	100	0
T_2	95	5
T_3	90	10
T_4	85	15
T_5	80	20



Flow chart 1: Preparation of guava lassi by using guava pulp

Table 1: The composition of milk given below

Constituents (%)	Cow milk
Moisture	86.2
Fat	4.0
Protein	3.3
Total Solid	13.3
Acidity	0.14

Results and Discussion

The present study and investigation entitled as "preparation of cow milk lassi blended with guava (*Psidium guajava*) pulp", was carried out in the following order. The present study shifts in consumption pattern of the Indian consumers from milk to innovative milk products brings a large scope for dairy processing in the country. It is a great challenge to innovate methodologies and technologies at the same time encouraging the value addition as well as the by-product utilization of these commodities.

Table 2: Mean values of five replication in percent

Treatments (% guava pulp)	Fat	Protein	Ash	Total Solids	Moisture	Acidity	pH
T_1	4.55	4.49	0.72	15.12	86.35	0.80	4.32
T_2	4.43	4.29	0.82	17.25	87.47	0.72	4.39
T_3	4.32	4.14	0.91	18.27	88.58	0.91	4.42
T_4	4.23	3.94	1.14	19.32	89.67	1.14	4.46
T_5	4.12	3.71	1.21	19.55	90.78	1.21	4.53
'F' test	Sig	Sig	Sig	Sig	Sig	Sig	Sig
SE (m)±	0.007	0.010	0.007	0.005	0.11	0.004	0.006
CD at 5%	0.021	0.030	0.023	0.016	0.34	0.012	0.019

Fat

It is seen from table 2, that the fat content of lassi in treatments T_1, T_2, T_3, T_4 and T_5 are 4.55, 4.43, 4.32, 4.23 and 4.12 percent respectively. The average fat percent was significantly highest (4.55) in treatment T_1. While fat percentage was lowest (4.12) in treatment T_5 prepared with 20 percent level of guava pulp. It was determine that increase in the level of guava pulp decrease in the fat content of lassi.

The similar result were reported by Nichal *et al*. (2022) [6] observed that the fat percentage of the aloe vera juice lassi in different proportion of 100:00 (T_1), 69:4 (T_2), 92:8 (T_3), 88:12 (T_4) and 84:16 (T_5) lassi to aloe vera juice. Fat content were recorded as 3.80, 3.65, 3.50, 3.35 and 3.20, respectively.

Protein

It is seen from table 2, that the protein content of lassi blended with guava pulp in T_1, T_2, T_3, T_4 and T_5 treatments were 4.49, 4.29, 4.14, 3.94 and 3.71 percent respectively. The protein percentage is significantly highest in T_1 (4.49) plain lassi while protein content was lowest T_5 (3.71) in 20 percent guava pulp. It is observed from the present study that as increase in guava pulp there was decrease in protein content.

Similar results were reported by Kedaree *et al.* (2021) [3] observed that the protein percentage of the kiwi pulp lassi in different proportion of 100:00 (T_0), 97.5:2.5 (T_1), 95:5:5 (T_2) and 92.5:7.5 (T_3) lassi to kiwi pulp. Fat content were recorded as 3.68, 3.59, 3.56 and 3.47, respectively. The level of protein percent was decreased as per increase in level of kiwi pulp in lassi. The highest protein content in T_1 (3.68) and lowest protein content in lassi is T_4 (3.47).

Ash

It is seen from table 2, that the ash content in lassi sample was significantly affected due to addition of guava at different levels. Ash contents in the lassi (T_1), (T_2), (T_3), (T_4), (T_5) were 0.72, 0.82, 0.91, 1.14 and 1.21 percent respectively. The ash percentage was significantly highest (1.21%) in lassi prepared with guava pulp (T_5) while ash content was lowest (0.72%) in lassi prepared without addition of guava pulp (T_1). It was determine that with increased in the level of guava pulp increased the ash content in lassi.

Similar results were reported by Kogde (2020) [4] studies on preparation of Burfi by the utilization of guava (*Psidium guajava*) pulp reported that the ash content was significantly varies due to addition of guava pulp. The average value of ash content in Burfi blended with guava pulp under the treatment (T_1), (T_2), (T_3), (T_4) and (T_5) were 2.45, 2.48, 2.64, 2.69 and 2.75 percent, respectively. Significantly highest ash content was noticed in T_5 (2.75%) and lowest fat content shown in T_1 (2.45). It is shown that with increased in the level of guava pulp increased the ash content in lassi.

Acidity

It is seen from table 2, that the titratable acidity of lassi sample was affected due to the addition of guava at different levels. Titratable acidity contents in the lassi T_1, T_2, T_3, T_4 and T_5 is 0.80, 0.78 0.76, 0.75 and 0.73 percent, respectively. It was observed that addition of different level of guava pulp had decreases on acidity of lassi. The acidity percentage was highest (0.80%) in lassi prepared without addition of guava pulp (T_1) while acidity content was lowest (0.73%) in lassi prepared with addition of 20 percent guava pulp (T_5).

The similar result were reported that Kedaree *et al*. (2021) [3] observed that the titratable acidity percentage of the kiwi pulp lassi in different proportion of 100:00(T_0), 97.5:2.5 (T_1), 95:5:5 (T_2) and 92.5:7.5 (T_3) lassi to kiwi pulp. Titratable acidity content were recorded as 0.86, 0.66, 0.61 and 0.54, respectively. The level of titratable acidity percent was decreased as per increase in level of kiwi pulp in lassi. The highest titratable acidity content in T_1 (0.86) and lowest titratable acidity content in lassi is T_3 (0.54).

PH

It is seen from table 2, that the pH content of lassi prepared by using different levels of guava pulp was ranged from 4.32 to 4.53. The mean pH of lassi for treatments T_1, T_2, T_3, T_4 and T_5 were 4.32, 4.39, 4.42, 4.46 and 4.53, respectively. The maximum pH was observed with the treatment T_5 (4.53) in lassi and minimum pH was observed with the treatment T_1 (4.32). It was determined that increased in the level of guava pulp increase the pH content in lassi.

Similarly, Dhumal *et al*. (2018) [2] studied the effect of pudina extract on physico- chemical properties of lassi with optimized the level of pudina leaves. The pH score of pudina extract lassi with addition of different level of pudina leaves extract at 100:0 (T_1) controlled, 97.5:2.5 (T_2), 95:5:5 (T_3) and 92.5:7.5 (T_4) were recorded as 4.19, 4.24, 4.25 and 4.27, respectively. The maximum pH was observed with the treatment T_4 (4.27) in lassi and minimum pH was observed with the treatment T_1 (4.19). It was determined that increased in the level of pudina extract increase the pH content in lassi.

Moisture

It is seen from table 2, that the moisture content for control (T_1) and lassi blended with guava fruit pulp (5, 10, 15, 20 percent) T_2, T_3, T_4 and T_5 is presented in table 2. It was highest in T_5 (90.78) and lowest in T_1 (86.35). The average moisture content of finished product i.e. guava fruit pulp lassi for treatment T_1, T_2, T_3, T_4 and T_5 were 86.35, 87.47, 88.58, 89.67 and 90.78 percent, respectively.

The moisture contents were comparable with Dhumal *et al*. (2018) [2] studied the moisture score of Pudina extract lassi with addition of different level of Pudina leaves extract at 100:0 (T_1) controlled, 97.5:2.5 (T_2), 95:5:5 (T_3) and 92.5:7.5 (T_4) were recorded as 88.45, 88.68, 88.75 and 88.84, respectively. The maximum moisture was observed with the treatment T_4 (88.84) in lassi and minimum moisture was observed with the treatment T_1 (88.45). It was determined that increased in the level of Pudina extract increase the moisture content in lassi.

Total solids

It is seen from table 2, that the total solids of guava pulp lassi in treatment. T_1, T_2, T_3, T_4 and T_5 were 15.12, 17.25, 18.27, 19.32 and 19.55, respectively. It was seen that as the levels of guava pulp increases the total solids content also increases in lassi. The mean total solids content for control (T_1) and lassi blended with guava fruit pulp (5, 10, 15 percent) T_2, T_3 and T_4 is presented in table 2. It was highest in T_5 (19.55%) and lowest in T_1 (15.12%). The result obtained in present study are in agreement with the results reported by Kedaree *et al.* (2021) [3] observed that the total solids percentage of the kiwi pulp lassi in different proportion of 100:00 (T_0), 97.5:2.5 (T_1), 95:5:5 (T_2) and 92.5:7.5 (T_3) lassi to kiwi pulp. total solids content were recorded as 9.03, 9.60, 10.11 and 10.43, respectively. The level of total solids percent was increased as per increase in level of kiwi pulp in lassi. The highest total solids content in T_3 (10.43) and lowest total solids content in lassi is T_0 (9.03).

Cost of production of lassi

The cost of production of 1 kg guava lassi under various treatments was calculated by taking in to consideration the prevailing retail market prices for various items i.e. milk, sugar, culture, guava. While the other charges such as labour, fuel etc. The quantity of chilled water used @ 10 percent by weight of curd in all treatments. The data showed that, the cost of production of 1 kg of lassi found to be decreased as the level of guava pulp. Lowest cost of production Rs. 56.56 per kg was calculated in case of lassi prepared with addition of sugar at 10% (T_5) treatment. The highest cost of production Rs. 59.09 per liter in case of (T_1) treatment.

Kedaree *et al.* (2021) [3] studied preparation of lassi blended with kiwi (*Actinidia deliciosa*) pulp observed that the lowest cost of production i.e. Rs. 40.93/lit (T_5) while highest cost of production (Rs. 55.94/lit) (T_1) Increase the level of kiwi pulp showed decreased in cost of production of lassi.

Table 3: Show the Particulars

Sr. No.	Particulars	Treatments									
		T_1		T_2		T_3.		T_4		T_5	
		Qty.	Amt. (Rs)	Qty.	Amt. (Rs)	Qty.	Amt. (Rs)	Qty.	Amt. (Rs)	Qty.	Amt. (Rs)
1.	(A) Quantity of standardized milk required (g)@Rs. 50/lit	1000	50.00	950	47.50	900	45.00	850	42.50	800	40.00
2.	(B) Quantity of guava pulp used by weight in (g) @ Rs.40/kg	-	-	50	2 00	100	4.00	150	6.00	200	S.00
3.	(C) Sugar used in (g) @ Rs. 40/kg	100	4	105	4.2	110	4.4	115	4.6	120	4.8
4.	(D) Chilled water used (ml) @ 10%	100	2	105	2.1	110	2.2	115	2.3	120	2.4
5.	(E) Starter culture (g) @ Rs. 5 / 100 gm	10	0.50	10	0.50	10	0.50	10	0.50	10	0.50
6.	(F) Cost of lassi Total = (A+B+C+D+E)	1210	56.5	1220	56.30	1230	56.1	1240	55.9	1250	55.7
7.	(G) Miscellaneous cost (Gas used, Electricity, Labour etc.)	-	15	-	15	-	15	-	15	-	15
8.	Total cost of production	1210	71.5	1220	71.3	1230	71.1	1240	70.9	1250	70.7
9.	(F+G) Total cost of production Rs./lit	1000	59.09	1000	58.44	1000	57.80	1000	57.17	1000	56.56

Conclusion

It was concluded from the present investigation that.

1. The blending of (T_4) 15% guava pulp for preparation of acceptable quality lassi was found superior over the rest of treatments.
2. In respect to physico-chemical composition of lassi i.e. fat, protein, and titratable acidity were decreased with increases in the levels of guava pulp, while moisture, total solids, ash and pH were increased with increase in the level of guava pulp in lassi preparation.
3. The cost structure of lassi decreased with the increased in the levels of guava pulp.
4. The cost of most acceptable treatment prepared with15 percent guava pulp (T_4) was Rs. 57.17 per liter.

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