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Sachin M Mule
Department of Animal Husbandry and Dairy Science, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Maharashtra, India

Suraj R Jadhav
Department of Animal Husbandry and Dairy Science, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Maharashtra, India

Snehal S Kadam
Department of Animal Husbandry and Dairy Science, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Maharashtra, India

Vishnu S Dandekar
Department of Animal Husbandry and Dairy Science, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Maharashtra, India

Sandip S Ramod
Department of Animal Husbandry and Dairy Science, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Maharashtra, India

Correspondence
Sachin M Mule
Department of Animal Husbandry and Dairy Science, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Maharashtra, India

Manufacturing technology and production cost of low fat lassi preapared by incorporation of lemon grass (*Cymbopogon citratus* L.) extract

Sachin M Mule, Suraj R Jadhav, Snehal S Kadam, Vishnu S Dandekar and Sandip S Ramod

Abstract
Lassi is an ancient refreshing beverage for quenching thirst. It is highly refreshing and palatable. Low fat i.e. buffalo skim milk lassi helps in restricting calorie intake. Low fat lassi affects rich taste and pleasant flavor of milk fat but addition of natural herbal flavor suppresses this drawback.
Presently herbal products in the form of cosmetics or food have become more popular in the world market. Herbal sweet preparation is new concept in dairy industry. Herbal such as lemon grass is being used in limited extent as flavoring agent in tea by household, besides it has medicinal properties against cough, cold etc. and is used extensively in Ayurvedic medicine. Lemon grass flavored skim milk lassi can be considered as herbal lassi. It was therefore, thought to evaluate the suitability of lemon grass extract as flavoring agent in developing lemon grass lassi.
In the present study the lassi was prepared from buffalo skim milk by using lemon grass extract at different levels viz. 2.5 per cent (T_1), 5.0 per cent (T_2), 7.5 per cent (T_3) and 10 per cent (T_4) of the content. This prepared lassi was compared with control (T_0) i.e. without addition of lemon grass extract.
From the result of present investigation it may be concluded that lemon grass extract could be successfully utilized for preparation of herbal lassi. The most acceptable quality lassi can be prepared by using 5.0 per cent lemon grass extract and having production cost of 63.60 per Kg. Such flavoring did not appreciably affect the composition of lassi.

Keywords: Low fat lassi, lemon grass, production cost.

Introduction
Milk is regarded as the complete food in the human diet. Milk provides all the nutrient elements, for the nourishment of the human body. In India, consumption of milk and milk products can be dated back to the times of Lord Krishna whom rendezvous with Gopikas and stealthy eating of butter and dahi has been gloriously described. It proves the point that milk and milk products have been 'assimilated' into Indian culture and ethos. No wonder then that today India has the largest population of livestock and stands to produce more milk than any other country in the world.
Milk is also considered to be divine, holy and a symbol of purity. In ancient times, a country was said to be prosperous based on its cattle population and milk production. "Land of milk and honey" was always symbol of richness and prosperity so much, so that availability of milk and milk products in a house was an indicator of its flourishing prosperity. Indigenous milk products have been woven into the fabric of our culture and therefore, they must be listed in the priorities.
Among the traditional milk products fermented milk products occupy most important place in our diet. It has been evidently proved that the fermented milk has unique importance in the diet of human being. Fermented milk products have been known for their "cure all" and life extending properties since ancient times (Gandhi and Nambudripal, 1977) [2].
Dahi is one of the oldest and well known fermented products consumed by the larger section of population throughout the country as a part of daily diet.
Lassi is an ancient refreshing beverage for quenching thirst. There is a large variation in the quality. In rural India lassi is also known as buttermilk. Lassi is creamy viscous fluid with rich aroma and mildly acidic in taste. Lassi contains 79 per cent water, 3 per cent fat, 2.8 per cent protein, 4.5 per cent lactose and 12 per cent sugar (Sharma, 2006) [4].
In the northern region of the country, whole milk curd beaten up and served as a beverage. In Maharashtra also generally lassi is prepared from buffalo milk curd which gives creamy appearance with pleasant mildly acidic sweet taste and rich aroma.

Milk fat is composed of higher concentration of saturated fat and cholesterol to add the problems of calorie conscious people. Hence preparing low fat lassi i.e. from buffalo skim milk will help in greatly restricting the calorie intake. Milk fat is the main contributor to the rich flavour and mouthful. Low fat lassi may affect the rich taste and pleasant flavour of milk fat, but addition of natural herbal flavour may suppress this drawback.

Lemon grass (*Cymbopogon citratus* L.) is a perennial grass in the family Poaceae grown for its fragrant leaves and stalks which are used as a flavoring agent. Lemon grass is also known as *Gavatichaha* in marathi and is used as an addition to tea and in preparations such as *kadha* which is traditional herbal soup used against cough, colds, etc. It has medicinal properties and is used extensively in Ayurvedic medicine. It is supposed to help with relieving cough and normal congestion.

Hence, considering the medicinal properties of lemon grass and use of skim milk in restricting the caloric intake, the present research project entitled Low fat lassi by incorporation of lemon grass (*Cymbopogon citratus* L.) extract was conducted.

Materials and methods

For preparation of lassi, buffalo milk was collected from dairy farm of College of Agriculture, Dapoli and skim milk was obtained by centrifugal cream separation method.

Cane sugar, salt and lemon grass were purchased from local market. Local starter culture i.e. previous days good quality curd was used as culture. The starter culture selected for use was not having any defects in the curd produced from it.

Manufacturing Technology

- **Preparation of lemon grass extract/Juice**

Green, fresh lemon grass leaves were selected. The leaves of lemon grass were washed with running tap water to remove dirt and dust. For extraction, leaves were cut into small pieces and then taken into electrically operated grinder cum mixer to make homogenous mixture of leaves. Small quantity of fresh clean water was added for proper grinding and mixing. Extract was obtained by squeezing the lemon grass and then filtering through four fold muslin cloth. Extract obtained was used to mix at different levels during lassi preparation.

Flow Diagram

Lemon grass leaves
⇩
Washing
⇩
Cutting into pieces
⇩
Grinding cum mixing
⇩
Squeezing
⇩
Filtration (muslin cloth)
⇩
Lemon grass extract/juice

- **Lassi preparation**

Lassi was prepared as per the procedure described by Kadlag (1982) with partial modifications while mixing lemon grass extract.

Flow Diagram

Buffalo whole milk
⇩
Pre-heating (35-40°C)
⇩
Filtration
⇩
Separation
⇩ → Cream
Skim milk
⇩
Pasteurization (80±2°C/10 min)
⇩
Cooling (37°C)
⇩
Inoculation (@1%)
⇩
Incubation (overnight at ambient temp)
⇩
Cooling of curd in refrigerator (2-3 hours)
⇩
Breaking of coagulum and sampling
⇩
Addition of cane sugar (16%)
⇩
Hand mixing
⇩
Addition of lemon grass extract as per treatment
⇩
Addition of salts (1-2%)
⇩
Mixing cum churning in mixer
⇩
Lemon grass lassi

Treatment details

T_0 - No lemon grass extract (Control)
T_1 - Addition of lemon grass extract @ 2.5 per cent of plain lassi (W/w)
T_2 - Addition of lemon grass extract @ 5.0 per cent of plain lassi (W/w)
T_3 - Addition of lemon grass extract @ 7.5 per cent of plain lassi (W/w)
T_4 - Addition of lemon grass extract @ 10.0 per cent of plain lassi (W/w)

The trial was conducted with six replications.

Results and discussion

- **Standardization method of addition of lemon grass extract for lassi preparation**

The extract from the lemon grass was extracted as discussed earlier. This extract was added to the lassi after churning of curd and addition of sugar. The sensory score revealed that this method of extract addition after churning curd is appropriate and provided desirable flavour, body and texture (consistency) and appearance to the product.

- **Cost of lassi production**

The cost of lassi production was worked out by considering the prevailing retail costs of ingredients only. The cost data are presented in Table: 1.

It is pointed out here that the data indicated the cost of ingredients only, as other cost factors remained constant for all treatments, so those were not accounted for cost estimation. The higher cost (□ 66.90 per Kg) was recorded in case of lassi prepared with 10.0 per cent lemon grass extract. (T_4), while lowest cost (□ 60.30 per Kg) recorded in case of lassi prepared without lemon grass extract (T_0). It was observed that the cost of lassi was increased with the increase in the level of lemon grass extract. The production cost of most acceptable level (T_2) was □ 63.60 per Kg.

Table 1: Cost of lassi production (based on cost of ingredients only)

Ingredients	Rate Per liter/kg (□)	Treatments									
		T_O		T_1		T_2		T_3		T_4	
		Qty (gm)	Cost (□)	Qty (gm)	Cost (□)	Qty (gm)	Cost (□)	Qty (gm)	Cost (□)	Qty (gm)	Cost (□)
Whole buffalo milk (ml)	50/-	1000	50/-	1000	50/-	1000	50/-	1000	50/-	1000	50/-
Buffalo skim milk (ml)	--	850	--	850	--	850	--	850	--	850	--
Culture (gm)	110/-	12	1.32	12	1.32	12	1.32	12	1.32	12	1.32
Curd (churned) with sugar (gm)	--	800	--	775	--	750	--	725	--	700	--
Sugar (gm)	35	120	4.20	120	4.20	120	4.20	120	4.20	120	4.20
Lemon grass extract (gm)	60/-	--	--	25	1.50	50	3.00	75	4.52	100	6.00
Cost of lassi (□)	--	920	55.52	920	57.02	920	58.52	920	60.02	920	61.52
Total cost per 100 gm (□)	--	--	6.03	--	6.20	--	6.36	--	6.52	--	6.69
Total cost of lassi per Kg. (□)	--	--	60.30	--	62.20	--	63.60	--	65.20	--	66.90

Conclusion

From the results of the present investigation, it may be concluded that lemon grass extract could be successfully utilized for preparation of lassi. Addition of lemon grass extract in lassi improved the sensory as well as chemical quality and acceptability of the product. Besides typical flavour, it also adds medicinal properties to the product. Such flavouring did not appreciably affect the composition of lassi. The most acceptable quality lassi can be prepared by using 5.0 per cent lemon grass extract and having production cost □ 63.60 per Kg. Being a low fat, such type of lassi will be beneficial to the health conscious people.

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