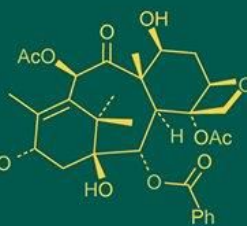
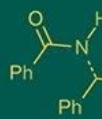


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Development of goat milk Lassi by using sapota pulp (*Manilkara zapota*) and betel leaf extract (*Piper beetle*)

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Abstract

Lassi is a popular indigenous fermented milk beverage of India Specially in summer. It is popular because of its characteristics flavor, taste, palatable nature and therapeutic value. The present study was made with an attempt to develop a Goat milk lassi blended with sapota pulp and betel leaf extract. Studied for its physico-chemical, microbial and sensory properties such as fat, protein, acidity, total solid, ash, moisture, carbohydrate, antioxidant, yeast and mould count, coliform count, color and appearance, flavor and taste, consistency and over all acceptability by trained panelist using 9 point hedonic scale. In the present investigation treatment T₀, T₁, T₂ and T₃ were formulated in which goat milk. Lassi was prepared by using 14% sugar blended dahi, sapota pulp and betel leaf extract was in the ratio of (100:00:00, 94:5:1, 88:10:2 and 82:15:3) respectively. The sensory score for overall acceptability of goat milk lassi of treatments T₀, T₁, T₂ and T₃ were 7.25, 6.75, 7.75 and 6.25 respectively. It was found that among all treatments T₂ (7.75) scored higher in sensory evaluation and was considered as optimized product of goat milk Lassi. The highest overall acceptability score of goat milk lassi of treatment T₂ was (7.75) as compared to control T₀ (7.25) From the result proximate analysis of lassi, the antioxidant content (54.93%) got find in final product of goat milk lassi which is more beneficial for health. The moisture (80.76%), total solid (19.12%), fat (2.77%), protein (2.93%), carbohydrate (12.97%), acidity (0.512%), and ash (0.443%) respectively in optimized goat milk lassi. The yeast and mould were found 1.69 Cf/gm and coliform count was absent in the product as per FSSAI standard.

Keywords: Lassi, sapota pulp, betel leaf extract, microbial evaluation

Introduction

Fermented milks are widely produced in many countries. This type of process is one of the oldest methods used to extend the shelf-life of milk, and has been practised by human beings for thousands of years. The exact origin(s) of the manufacture of fermented milks is difficult to establish, but it is safe to assume that it could date to more than 10,000 years ago as the way of life of humans changed from food gathering to food producing (Pederson, 1979). This change also included the domestication of certain mammals such as the cow, sheep, goat, buffalo and camel. Fermented dairy products have a special place in Indian diet: Products such as Dahi, Lassi, Shrikhand, *Chhach* are consumed throughout the country on regular basis. Lassi is becoming popular worldwide. Fermented milk product has played an important role in human consumption as refreshing beverages and nutritious food in many parts of the world since the earliest ages. Fermented foods and beverages possess various nutritional and therapeutic properties. The health benefits of fermented milk include prevention of gastrointestinal infections, reduction of serum cholesterol levels and anti-mutagenic activity. The fermented products are recommended for consumption by lactose intolerant individuals and patients suffering from atherosclerosis. There are several varieties of fermented milk prepared according to local traditional practices and known under various names such as acidophilus milk, Bulgarian milk, cultured milk, dahi, kefir, kumis, lassi, yoghurt, etc. Lassi is proven to be an extraordinary nutritional material with all essential and non-essential amino acids. Moreover, these drinks are light, refreshing, healthful, and nutritious but less acidic than fruit juices and offer a good profit margin. Lassi has been mentioned as one of the best among milk products due to its immense therapeutic, immunostimulatory activity, and nutritional value. Several health benefits associated with the consumption of live probiotic bacteria are in controlling intestinal infections, improved

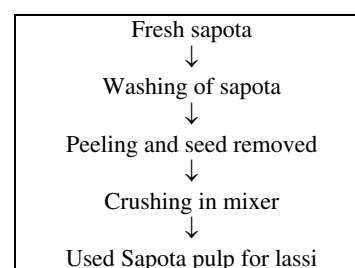
digestion, improved lactose utilization, prevention of colon cancer, lowering of blood pressure, cholesterol, and reduced inflammation, etc. A goat is universally called as "Poor man's cow" (Iqbal *et al.*, 2008) [15]. Goat milk simply refers to the milk of a goat. It is a common drink throughout the world, especially in South Asia. Goat milk is one of the most consumed milk drinks in the world. But in terms of availability, goats produce only 2% of the world milk supply. It is cheaper because it does not require homogenization. Goat milk is a good source of B vitamins (especially riboflavin/vitamin B2) and vitamin A. Goat milk is an excellent source of protein, vitamins, and minerals. Calcium, vitamin B2, and phosphorus concentrations are particularly notable. It is an ideal food and is high in nutrients, vitamins and minerals. Goat milk mild lactose intolerance as goat milk has comparatively less sugar. Goat milk has a lower concentration of lactose than cow milk. Initial research suggests that goat milk is easier to digest than cow milk. It also appears to cause fewer sensitivity issues. It does not cause acidity or other stomach ailments. An important characteristic of goats' milk is the unique 'goaty' flavour. Goat milk contains the enzyme caproic acid, which causes it to turn "goaty" with age. Fresh goat and cow milk should taste basically the same. However, if goat milk has a "goaty" flavour, it can be attributed to a variety of causes: some harmless, some not so much, which may raise a red flag in terms of goat health, care, diet and environment (Park *et al.*, 1990) [28]. In India for all the classes of people the fruits like sapota, pomegranate, pineapple, mango, guava etc. are popular and regularly consumed fruits. Sapota is one of the most important fruits available throughout the year and containing a higher percentage of Vitamin C. Sapota is considered as one of the most important energy producing food and having high nutritive value. It is a good source of digestible sugar, which ranges from 12 to 18 percent. Hence, the present study was under taken to evaluate the sensory quality of *lassi* prepared with different proportion of sapota pulp. Sapodilla is one of the high calorie fruits (100gm provides 83 calories) also similar calories in sweet potato and banana. In addition, it is an excellent source of dietary fibre (5.6 g/100 g) which provides relief from constipation. The people of India used it for anti-bacterial and anti-viral properties. It maintains the overall health as it is loaded with various nutrients. Along with the fruit, other parts are also used to treat colds and cough because it contains antidiarrheal, diuretic, anti-hyperglycaemic, antibiotic and hyper cholesteraemic effects. There are abundant health benefits so people should consume not just for its taste but also health point of view. In India, Betel leaf (BL) plays an important role since ancient culture. Its use in India dates back to 400 BC. As per ancient books of Ayurveda, Charaka, Sushruta, Samhitas, and Kashyapa, Bhojanakalpa, the practice of chewing BL after meals became common between 75 AD and 300 AD. Toward the 13th century, European traveller Marco Polo recorded betel chewing among kings and nobles in India. The betel (*Piper betel* L.) is the leaf of a vine belonging to the Piperaceae family. In India, Betel leaves are considered auspicious and extensively used during religious functions in Asia. Piper betel leaf is grown abundantly in many parts of India, betel is an evergreen herb that needs warm and moist growth conditions for its growth (Arani Datta *et al.*, 2011) [3]. In India, it is found in Bihar, Bengal, Orissa and Karnataka. The betel plant is an evergreen and perennial creeper, with

glossy heart-shaped leaves and white catkin (The Wealth of India, 1969). Piper betel contains a wide variety of biologically active compounds and this concentration depends on the variety of the plant, season and climate. Piper betel leaves extract contains large numbers of bioactive molecules (Devjani Chakraborty, 2011) [7]. Betel leaf is the most valuable home remedy for common illness.

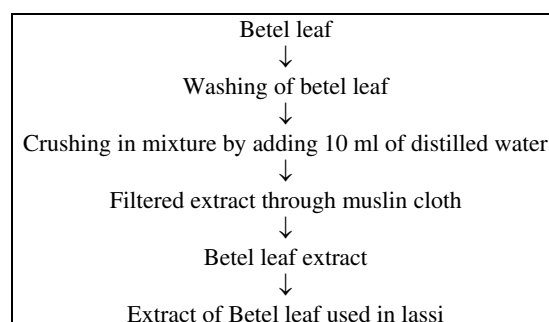
Materials and Methods

Goat milk, Sapota fruit and Bettel leaves were purchased from the local farmer at Prayagraj. Sugar was procured from the local market of Prayagraj. Starter Culture used is of Essdee brand for curd formation and it was purchased from Essdee Marketing Pune (Type – XT), mixed strain of *Lactobacillus delbrueckii* subsp. *bulgaricus* and *Streptococcus thermophilus* were present. The study "Development of Goat Milk Lassi By Using Sapota Pulp (*Manilkara zapota*) and Betel leaf extract (*Piper beetle*)" was carried out in the laboratory of dairy technology, Warner College of Dairy Technology, Sam Higgin bottom University of Agriculture, technology and Sciences.

Preparation of Sapota pulp



Extraction of Betel leaf extract



Treatment Mix Ratio

T₀: Control sample is normal lassi prepared from goat milk (100:00:00).

T₁: Experimental lassi sample prepared from goat milk, sapota pulp, betel juice (94:5:1).

T₂: Experimental lassi sample prepared from goat milk, sapota pulp, betel juice (88:10:2).

T₃: Experimental lassi sample prepared from goat milk, sapota pulp, betel juice (82:15:3).

Physico-Chemical analysis of Goat milk lassi

Fat-(Gerber method): Determination of fat content was done as per the procedure (IS: 1224 -PART-1, 1977) (Reaffirmed 2012). Protein: Determination of protein content was done as per the procedure (kjeldahl method) (ISO8968-2:2001/IDE20-2:2001) Carbohydrate- Determination of carbohydrate was done as per the procedure (Lane Eynon method) (FSSAI Manual) 2016. Ash - Determination of ash

content was done as per the procedure laid down in (IS: 14433, Part 1) (Reaffirmed 2005). Moisture- Determination of moisture content was done as per the procedure AOAC (2000). Acidity- Determination of acidity content was done as per the procedure laid down in BIS (IS: 1479, part: 1) 2016. Antioxidant - Determination of antioxidant capacity was done as per the procedure (DPPH Method) (FSSAI Manual) 2016.

Microbial analysis

- Yeast and mould were determined as per procedure described in IS: 5403 (1999) (reaffirmed 2005) using Potato Dextrose Agar.
- Coliform was determined as per procedure described in IS: 5401-1 (2012) using McConkey's Agar.

Statistical Analysis

The data will be analysed using analysis of variance (ANOVA) at 5% level of significance and critical difference (C.D) in WASP/OPSTAT software and excel software according to the method explained by Snedecor and Cochran (1994) [45]. The significance was evaluated on basis of critical difference.

Results and Discussion

The present work was based to elaborate "Development of Goat milk lassi by using sapota pulp and betel leaf extract. The data collected on different aspects, as per the methodology were tabulated and analyzed statistically. The significant and nonsignificant differences observed are analyzed critically within and between the treatment combinations. The results obtained are discussed below in the following.

Physico-chemical parameters

Moisture content

The values regarding moisture percentage of control and experimental Goat Milk Lassi sample of different treatments

are presented in table 1. That average moisture content in goat milk Lassi T₀ (81.88), T₁ (81.765), T₂ (80.87) and T₃ (80.00). The highest average value of moisture content is (81.8825) was observed in treatment T₀. Kedaree *et al.* (2021) [22] reported that the highest level of moisture content was noticed at treatment T₀ i.e. without kiwi pulp, lowest 89.57% at T₃ 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.

Fat content

The values regarding Fat percentage of control and experimental Goat Milk Lassi sample of different treatments are presented in table 1. That average fat content in goat milk Lassi T₀ (3.30), T₁ (3.05), T₂ (2.77) and T₃ (2.42). The highest average value of fat content is (3.30) was observed in treatment T₀. Shaikh *et al.* (2016) [41] reported that the fat content of lassi decreased from 5.40% to 4.50% as the proportion of sapota pulp in the lassi was increased. Avatade *et al.* (2007) [46], who also noted that with the increased in pomegranate juice level there is proportionate decreased in the fat content of lassi.

Protein content

The values regarding protein percentage of control and experimental Goat Milk Lassi sample of different treatments are presented in table 1. That average protein content in Goat Milk Lassi T₀ (3.34), T₁ (3.06), T₂ (2.93) and T₃ (2.85). The highest average value of Protein content is (3.34) was observed in treatment T₀. Kahandal *et al.* (2020) [21] reported that the protein content of lassi decreased from 3.49% to 2.71% as the proportion of strawberry pulp in the lassi was increased. Similar results were reported by Shuwu *et al.* (2011) [39] observed that there was decrease in protein percentage with addition of fruit pulp control (2.20), Honey (2.00), pineapple (1.98), Banana (2.10) protein percentage was observed.

Table 1: Showing data obtained on different parameters of control and experimental Goat Milk Lassi by Using Sapota Pulp (*Manilkara zapota*) and Betel Leaf Extract (*Piper betle*) samples of different treatment.

Parameter	Score/value based on mean value of different parameter of treatment				C.D. value at 0.5%
Treatments	T ₀	T ₁	T ₂	T ₃	
Physico-Chemical Analysis					
Moisture %	81.88	81.76	80.87	80.00	0.12
Total solid %	18.11	18.23	19.12	19.99	0.15
Fat %	3.30	3.05	2.77	2.42	0.20
Protein %	3.34	3.06	2.93	2.85	0.08
Carbohydrates %	11.07	11.68	12.97	14.26	0.15
Acidity %	0.54	0.52	0.51	0.49	0.01
Ash %	0.39	0.43	0.44	0.45	0.02
Antioxidant %	20.57	47.90	54.93	61.00	0.87
Microbial analysis					
Yeast and Mould (cfu/gm)	1.46	1.51	1.69	1.82	0.22
Coliform	Nil	Nil	Nil	Nil	Nil
Sensory attributes					
Colour and appearance	7.50	7.00	7.25	6.00	1.07
Flavour and taste	6.75	6.00	6.50	5.75	0.71
Consistency	7.50	6.50	7.25	6.00	0.97
Overall acceptability	7.75	6.75	7.25	6.25	0.77

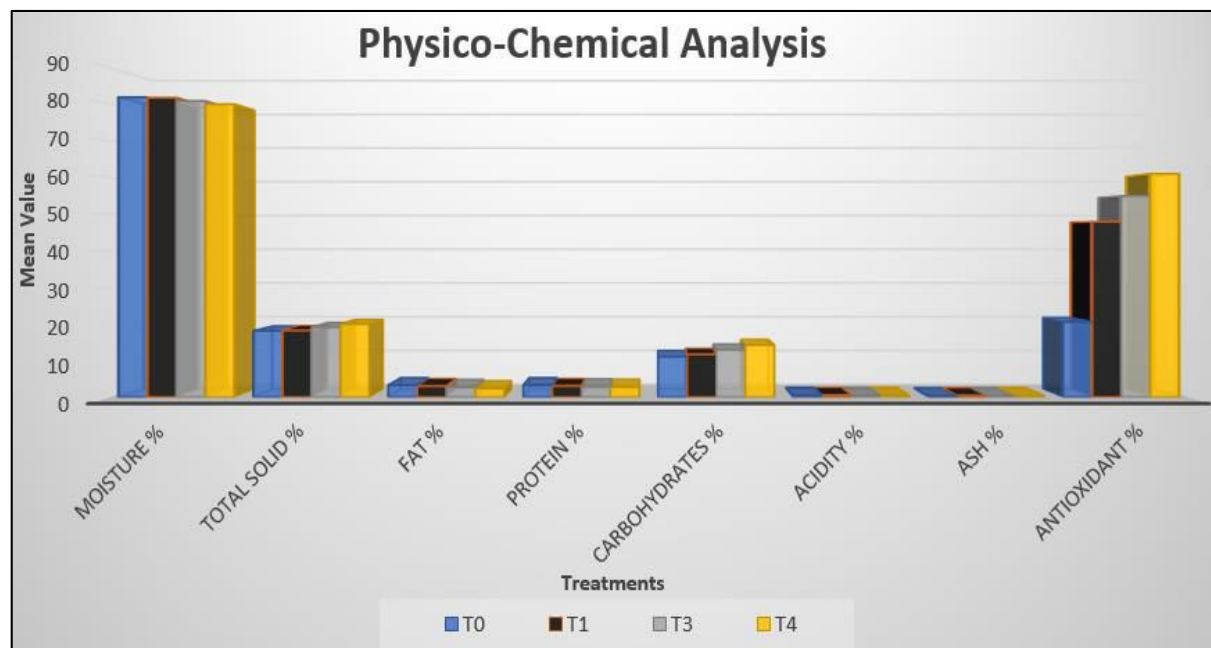


Fig 1: Average physico-chemical analysis

Acidity content

The values regarding Acidity percentage of control and experimental Goat Milk Lassi sample of different treatments are presented in table 1. That average acidity content in goat milk Lassi T₀ (0.54), T₁ (0.52), T₂ (0.51) and T₃ (0.49). The highest average value of acidity content is (0.54) was observed in control treatment T₀. Kahandel *et al.* (2020) [21] reported that the acidity percentage was highest 1.02% in lassi prepared without addition of strawberry pulp (T₁) while acidity content was lowest 0.62% in lassi prepared with addition of 20 percent strawberry pulp (T₅). It was observed that addition of different level of strawberry pulp had decreases on acidity of lassi.

Ash content

The values regarding Ash percentage of control and experimental goat milk Lassi sample of different treatments are presented in table 1. That average ash content in goat milk Lassi T₀ (0.39), T₁ (0.43), T₂ (0.44) and T₃ (0.45). The highest average value of ash content is (0.45) was observed in treatment T₃. Kahandel *et al.* (2020) [21] reported that the ash percentage was significantly highest 1.09% in lassi prepared with strawberry pulp (T₅) while ash content was lowest 0.72% in lassi prepared without addition of strawberry (T₀).

Total Solid content

The values regarding Total Solid percentage of control and experimental goat milk Lassi sample of different treatments are presented in table 1. That average total solid content in goat milk Lassi T₀ (18.11), T₁ (18.23), T₂ (19.12) and T₃ (19.23). The highest average value of fat content is (19.23) was observed in treatment T₃. Kedaree *et al.* (2021) [22] it was observed that the total solid content showed gradual increase with the increase in level of kiwi pulp. This simultaneous increase from T₀ to T₃ 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 T₀ i.e. lassi without kiwi pulp, while the highest total solid content was observed at T₃ i.e. lassi blended with 7.5% kiwi pulp.

Carbohydrate content

The values regarding Carbohydrate percentage of control and experimental goat milk Lassi sample of different treatments are presented in table 1. That average carbohydrate content in Goat Milk Lassi T₀ (11.07), T₁ (11.68), T₂ (12.97) and T₃ (14.26). The highest average value of Carbohydrate content is (14.26) was observed in treatment T₃.

Antioxidant content

The values regarding Antioxidant percentage of control and experimental Goat Milk Lassi sample of different treatments are presented in table 1. That average antioxidant content in goat milk Lassi T₀ (23.32), T₁ (47.90), T₂ (54.93) and T₃ (61.00). The highest average value of antioxidant content is (61.00) was observed in treatment T₃.

Microbial analysis

Yeast and Mould

The values regarding yeast and mould percentage of control and experimental goat milk Lassi sample of different treatments are presented in table 1. That average Yeast & mould content in goat milk Lassi T₀ (1.45), T₁ (1.51), T₂ (1.68) and T₃ (1.81). The highest average value of Yeast & mould content is (1.81) was observed in treatment T₃. Kedaree *et al.* (2021) [22] the microbial results indicate the yeast and mould was varying among the different treatments. Overall, the lassi was acceptable at 1st day because the count was within the acceptable limit.

Coliform Count

The mean value for coliform count was found nil in the product in all the treatments.

Sensory Attributes

Colour and Appearance The average colour and appearance content in goat milk lassi T₀ (7.25), T₁ (7), T₂ (7.50) and T₃ (6.00). The highest average value of colour and appearance content is (7.50) was observed in treatment T₂. The data obtained in colour and appearance is judged by a panel of five judges using 9-point hedonic scale mentioned in table 1.

Flavour and Taste

The average flavour and taste content in goat milk lassi T₀ (6.75), T₁ (6.00), T₂ (7.00) and T₃ (5.75). The highest average value of flavour and taste content is (7.00) was observed in treatment T₂. The data obtained in flavour and taste is judged by a panel of five judges using 9-point hedonic scale mentioned in table 1.

Consistency

The average consistency content in goat milk lassi T₀ (7.25), T₁ (6.50), T₂ (7.50) and T₃ (6.00). The highest average value of consistency content is (7.50) was observed in treatment T₂. The data obtained in consistency is judged by a panel of five judges using 9-point hedonic scale mentioned in table 1.

Overall Acceptability

The average overall acceptability content in goat milk lassi T₀ (7.25), T₁ (6.75), T₂ (7.75) and T₃ (6.25). The highest average value of overall acceptability content is (7.75) was observed in treatment T₂. The data obtained in overall acceptability is judged by a panel of five judges using 9-point hedonic scale mentioned in table 1.

Conclusion

The present research has shown that the goat milk can be successfully used to prepare lassi by using sapota pulp and betel leaf extract. Out of the different treatments T₂ with 10% Sapota pulp and 2% Betel leaf extract was found to be the best with the desired incorporated goat milk lassi as per sensory attributes. Thus, it can be concluded that Sapota pulp and Betel leaf tried in this study could be successfully incorporated in Goat milk lassi without adversely affecting the sensory quality of the existing lassi. The lassi prepared was found to be safe on microbiological parameters and can be safely consumed. By adding Sapota pulp and Betel leaf extract we are trying to increase the health benefit of the traditional beverage lassi. Ingredients like Goat milk, Sapota and Betel leaf have beneficial role in to improve platelet count in the blood during dengue diseases, and natural antioxidants, which are effective in reducing the risk of heart disease, cancer, and processes.

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