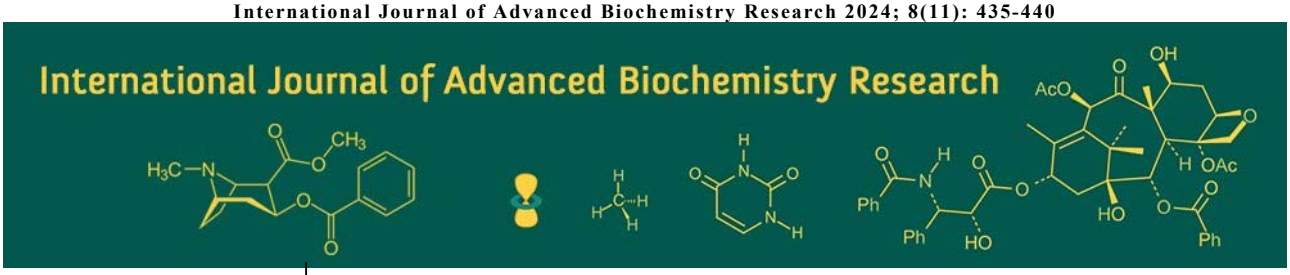

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Study on sensory quality of mango (*Mangifera indica* L.) milk cake

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Abstract
An investigation was conducted at the Dairy Science Laboratory of Department of Animal Husbandry and Dairy Science at College of Agriculture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Maharashtra. This study focused on the preparation of milk cake using fresh buffalo milk, which was further enriched with varying levels of mango pulp. For all treatments, sugar was added at a rate of 5% of the original milk quantity. The base material remained constant i.e., 100 grams across all variations. The treatments differed in the amount of mango pulp added: T_0 contained no mango pulp, T_1 has 4 percent, T_2 includes 8 percent, T_3 has 12 percent and T_4 contains 16 percent mango pulp. The results indicated that the most acceptable quality of milk cake was achieved with the addition of 12% mango pulp.

Keywords: Milk cake, mango, milk products, sensory evaluation, heat desiccated products

Introduction
India is undoubtedly the world's largest milk producer. India produces 230.6 million metric tons of milk, accounting for 23 percent of global milk output (Basic Animal Husbandry Statistics, 2022-23) [1]. Milk is a highly perishable product that can spoil quickly if not handled properly. In addition to its direct consumption as market milk, surplus milk is often transformed into a variety of dairy products. These include delicious recipes that utilize desiccated, coagulated, fermented and frozen forms of milk (De, Sukumar) [2]. Mango (*Mangifera indica* L.), widely known as the 'king of fruits,' is a stone fruit produced by various tropical tree species. Renowned for its distinctive flavor, aroma and taste, mangoes are also valued for their numerous health benefits, making them one of the most beloved fruits in tropical regions. They are rich in vitamins A and C, contributing significantly to nutritional health (Waikar Maleeha, 2023) [7].

India is home to over a thousand commercially cultivated mango varieties, with the Alphonso mango standing out as a premier cultivar. Known as the 'Pride of the Konkan', the Alphonso mango is highly sought after for both its exceptional taste as a table fruit and its suitability for processing (Surve, 2022) [6].

Milk cake, a traditional dairy delicacy primarily originating from North India, is predominantly produced in the unorganized sector, where the skill of the manufacturer significantly influences product quality. In Hyderabad, this confection is referred to as 'Ajmeri Kalakand'. The characteristic appearance of milk cake features a dark brown centre that gradually lightens toward the edges. Many sweet manufacturers produce milk cake in small batches, selling it as a fresh product. It is typically displayed in open trays at retail outlets, with sales based on consumer demand.

Given the nutritional significance of milk and the abundant availability of mangoes in the Konkan region, the present investigation will focus on the preparation of milk cake using buffalo milk and varying concentrations of mango pulp. This study aims to enhance the flavor profile and nutritional value of the milk cake, tapping into the unique attributes of both ingredients to create a delightful and healthful dessert.

Materials and Methodology

The study conducted at the Department of Animal Husbandry and Dairy Science, College of Agriculture, Dapoli, Dist. Ratnagiri, named "Process Standardization for Mango (*Mangifera indica* L.) Milk Cake" during the academic year 2023-2024.

Procurement and collection of ingredients

Milk

Fresh buffalo milk was obtained from the Instructional Dairy Farm of College of Agriculture Dapoli, Dist.-Ratnagiri (M S).

Citric acid

Good quality food grade citric acid (GRAS) was obtained from an approved dealer and utilised as a coagulant in the manufacture of milk cake.

Sugar

Good quality cane sugar was procured from the local market.

Mango Pulp

Mango pulp was purchased from PHM unit of College of Agriculture, Dapoli.

Sensory evaluation of Mango Milk Cake

A panel of 8–10 semi-trained judges used a 9-point hedonic scale for assessing the product's sensory qualities, encompassing colour and appearance, flavour, body and texture, in compliance with IS: 6273, Part-II (1971) [4].

Treatment combination

During present investigation, four different levels of Mango pulp were utilized for equal quantity of base material. Thus, there were five treatment combination as stated below:

Thus, there were five treatment combination as stated below

Treatments	Base material (gm)	Mango pulp (%)
T_0	100	-
T_1	100	4
T_2	100	8
T_3	100	12
T_4	100	16

Replications: The trial was conducted with five replications.

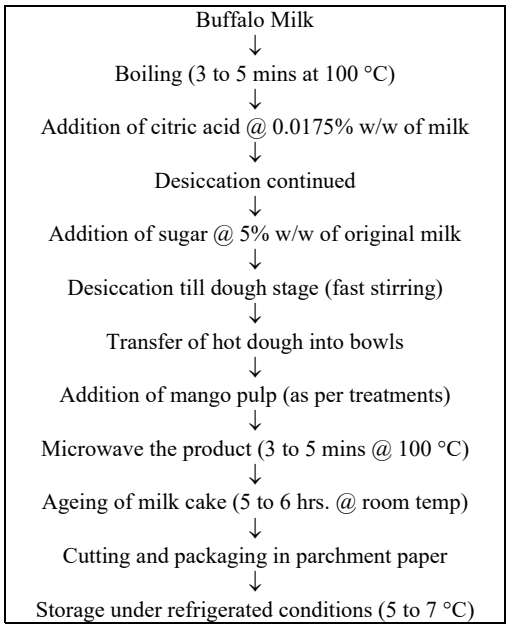

Fig 1: Preparation of Mango Milk Cake

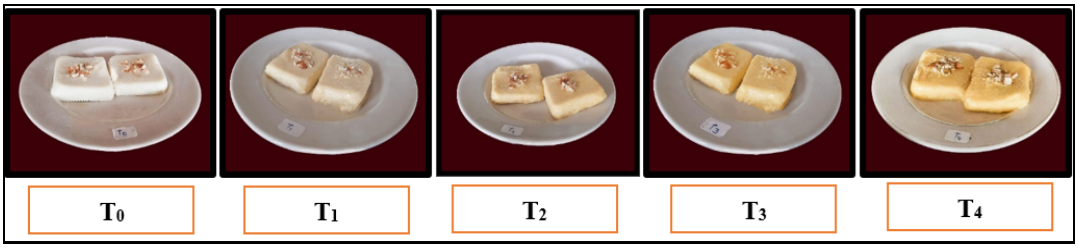

Plate 1: Mango Milk Cake prepared with different levels of Mango Pulp

Result and Discussion

Sensory evaluation of any consumable product is the best method of judging its acceptability by the consumers. The assessment was done by studying the characters like colour and general appearance, flavour, body & texture and overall acceptability of product by the panel of ten judges by using Nine Point Hedonic Scale score card. Each sample was bearing a code number so as to avoid its identity and have impartial results

Colour and appearance

Colour and appearance are crucial sensory attributes that influence consumer acceptance of milk products. Ideal milk cake should have a creamy white to light brown colour, while mango milk cake should be bright yellow with a lustrous finish to reflect its flavor.

As shown in Table 1.1, treatment T3, featuring 12% mango pulp, achieved the highest colour and appearance score (8.36), while the control treatment T_0, which contained no mango pulp, received the lowest score (6.82). Statistical analysis confirmed significant differences in colour and appearance across the samples at both the 1% and 5% significance levels, indicating a positive relationship between mango pulp concentration and these scores.

The mango milk cake with 12% pulp presented a pleasing yellowish hue and a clean overall appearance, favoured by judges. In contrast, lower concentrations resulted in a pale colour, and higher concentrations produced a darker shade, both of which negatively impacted scores.

Ghadge Meenakshi (2006) [3] noted that the control sample scored lowest (6.85) in colour and appearance, while milk cake with 15% mango pulp and 3% sugar achieved the highest score (8.03) among various treatments, outperforming those with 5% and 10% mango pulp.

Effect of different levels of mango pulp on colour and appearance of mango milk cake (out of nine)

Treatments	Replications					
	R1	R2	R3	R4	R5	MEAN
T_0	6.59	7.25	6.65	6.76	6.88	6.82
T_1	6.74	7.36	7.64	7.14	7.41	7.26
T_2	7.85	7.87	8.49	7.89	8.16	8.05
T_3	7.81	8.39	8.47	8.73	8.39	8.36
T_4	8.18	6.15	8.27	7.47	7.13	7.44

ANOVA Table

SV	DF	SS	MSS	Cal F	Tab F (5%)	Result	Tab F (1%)	Result
Treatment	4	7.598	1.900	8.461	2.866	S	4.431	S
Error	20	4.490	0.224	-	-	-	-	-
Total	24	12.088	-	-	-	-	-	-

	SEd	SEm	CD	CV
5%	0.299	0.211	0.852	6.245
1%	-	-	0.625	-

Body and texture

Each dairy product has distinctive mouth feel qualities that are typically described in terms of body and texture. The mango milk cake has a firm texture, graininess and the surface is fine, smooth and lustrous.

The sensory evaluation data for the body and texture of mango milk cake showed that treatment T_3, with 12 percent mango pulp achieved the highest score (8.05), whereas the control treatment T_0, without mango pulp received the lowest score (7.28). Statistical analysis confirmed significant differences at both 1% and 5% levels, indicating that increased mango pulp positively affects body and texture. Previous studies, including Ghadge Meenakshi (2006) [3], found that a milk cake with 10% mango pulp scored highest among treatments, and Pawar Supriya (2016) [5] noted that kalakand with 7.50% Kesar mango pulp achieved a score of 7.89 compared to 7.19 for the control. Overall, all mango pulp treatments outperformed the control.

Effect of different levels of mango pulp on body and texture of mango milk cake (out of nine)

Treatments	Replications					
	R1	R2	R3	R4	R5	MEAN
T_0	6.81	7.65	7.23	7.27	7.44	7.28
T_1	7.15	7.91	7.49	7.55	7.66	7.55
T_2	7.44	8.38	8.21	7.81	8.11	7.99
T_3	7.87	8.34	8.27	8.26	8.19	8.19
T_4	8.17	8.14	7.87	7.91	8.16	8.05

ANOVA Table

SV	DF	SS	MSS	Cal F	Tab F (5%)	Result	Tab F (1%)	Result
Treatment	4	2.894	0.723	9.886	2.866	S	4.431	S
Error	20	1.463	0.073					
Total	24	4.357						

	SEd	SEm	CD	CV
5%	0.171	0.120	0.487	3.463
1%			0.357	

Flavour

Edible products must match their intended flavors, with taste and smell working together to create the overall flavor profile. High-quality milk cake typically features a blend of intense sweetness, caramel, and medium notes of milk solids and cooked flavors. In sensory evaluations, the milk cake with 12% mango pulp (T_3) achieved the highest flavor score of 8.12, while the control sample without mango pulp (T_0) received a lower score of 6.59. Statistical analysis confirmed significant flavor differences among samples at both 1% and 5% significance levels, indicating that higher mango pulp content improves flavor scores. Previous studies, such as Ghadge Meenakshi (2006) [3], found that the control milk cake scored 6.86, lower than variants with mango pulp, with the best performing cake featuring 10% mango pulp and 4% sugar, scoring 7.98. Similarly, Pawar Supriya (2016) [5] reported that kalakand with 7.50% Kesar mango pulp received a score of 7.86, while the control without pulp scored 6.80. Overall, increased mango pulp correlates with enhanced flavor quality.

Effect of different levels of mango pulp on flavour of mango milk cake (out of nine)

Treatments	Replications					
	R1	R2	R3	R4	R5	MEAN
T_0	6.21	6.74	6.83	6.45	6.71	6.59
T_1	7.13	7.71	7.64	7.33	7.65	7.49
T_2	7.82	8.24	8.35	7.74	8.25	8.08
T_3	7.57	8.48	8.29	7.94	8.34	8.12
T_4	7.54	7.91	7.62	7.75	7.71	7.71

ANOVA Table

SV	DF	SS	MSS	Cal F	Tab F (5%)	Result	Tab F (1%)	Result
Treatment	4	7.760	1.940	26.926	2.866	S	4.431	S
Error	20	1.441	0.072	-	-	-	-	-
Total	24	9.201	-	-	-	-	-	-

	SEd	SEm	CD	CV
5%	0.170	0.120	0.483	3.532
1%	-	-	0.354	-

Overall acceptability

The findings indicate that the milk cake containing 12% mango pulp (T_3) achieved the highest overall acceptability score of 8.10, while the control sample without mango pulp (T_0) received the lowest score of 6.95. Statistical analysis confirmed that these differences in overall acceptability are significant at both the 1% and 5% levels, demonstrating that higher mango pulp content positively influences overall acceptability scores.

In line with these results, Ghadge Meenakshi (2006) [3] identified the treatment combination M2S2, which included 10% mango pulp and 4% sugar, as the best option for overall acceptability, scoring 7.89%, compared to a lower score of 6.8% for the control. Similarly, Pawar Supriya (2016) [5] found that kalakand with 7.50% Kesar mango pulp (T_1L_3) had the highest overall acceptability score, while kalakand made with 2.50% Ratna mango pulp (T_2L_1) recorded the lowest score of 7.19.

Effect of different levels of mango pulp on overall acceptability of mango milk cake (out of nine)

Treatments	Replications					
	R1	R2	R3	R4	R5	MEAN
T_0	6.54	7.12	7.23	6.74	7.14	6.95
T_1	6.84	7.40	7.43	7.13	7.44	7.25
T_2	7.52	7.83	8.52	7.60	8.11	7.92
T_3	7.45	8.54	8.26	7.91	8.33	8.10
T_4	8.17	8.24	7.56	8.19	7.87	8.01

ANOVA Table

SV	DF	SS	MSS	Cal F	Tab F (5%)	Result	Tab F (1%)	Result
Treatment	4	5.220	1.305	11.064	2.866	S	4.431	S
Error	20	2.360	0.118	-	-	-	-	-
Total	24	7.580	-	-	-	-	-	-

	SEd	SEm	CD	CV
5%	0.217	0.154	0.618	4.492
1%	-	-	0.453	-

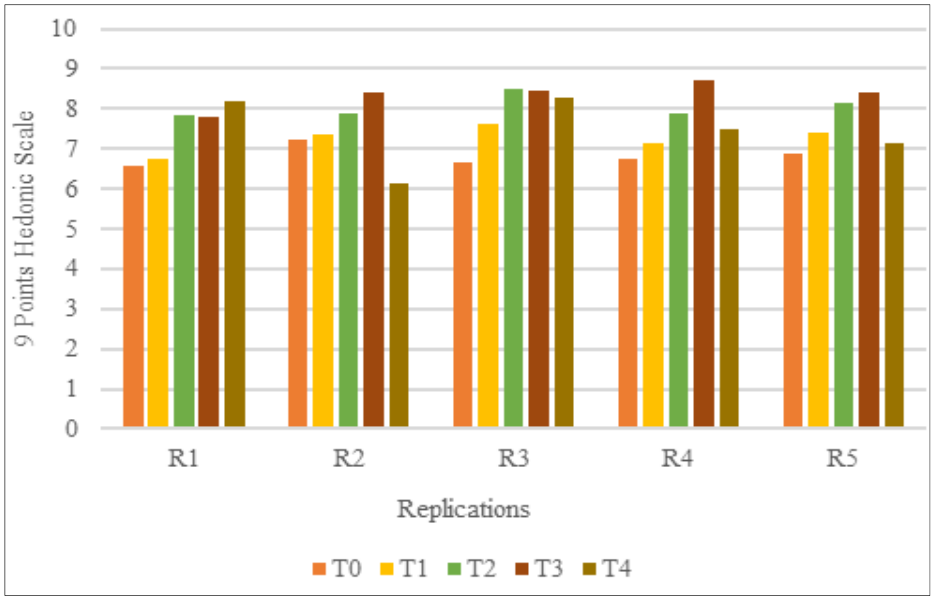

Fig 1: Score for colour and appearance of mango milk cake (out of nine)

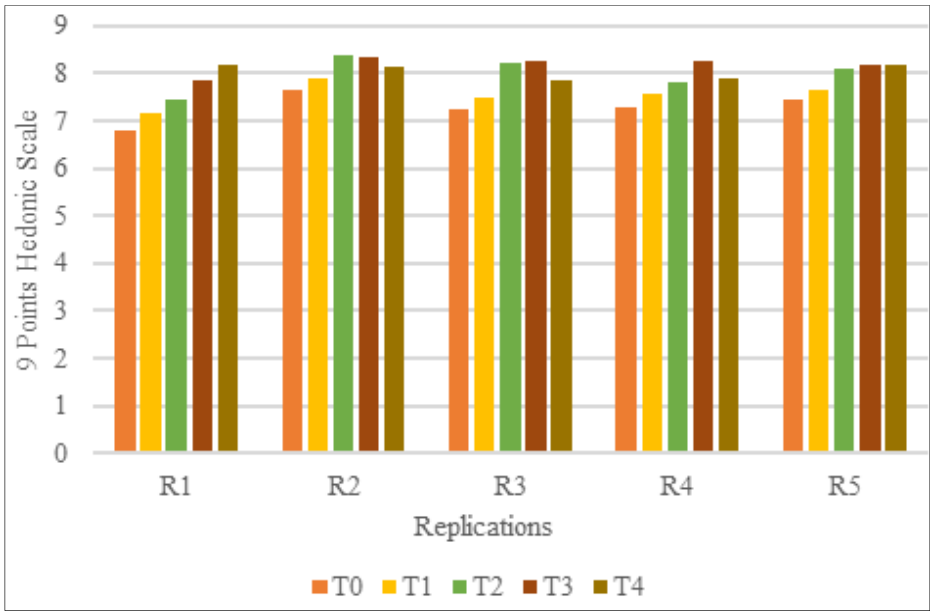

Fig 2: Score for body and texture of mango milk cake (out of nine)

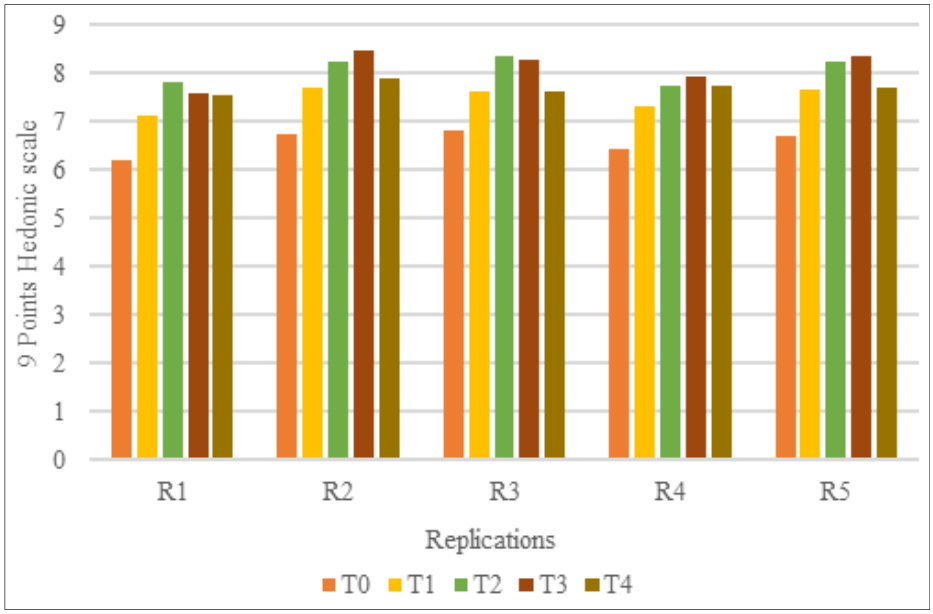

Fig 3: Score for flavour of mango milk cake (Out of nine)

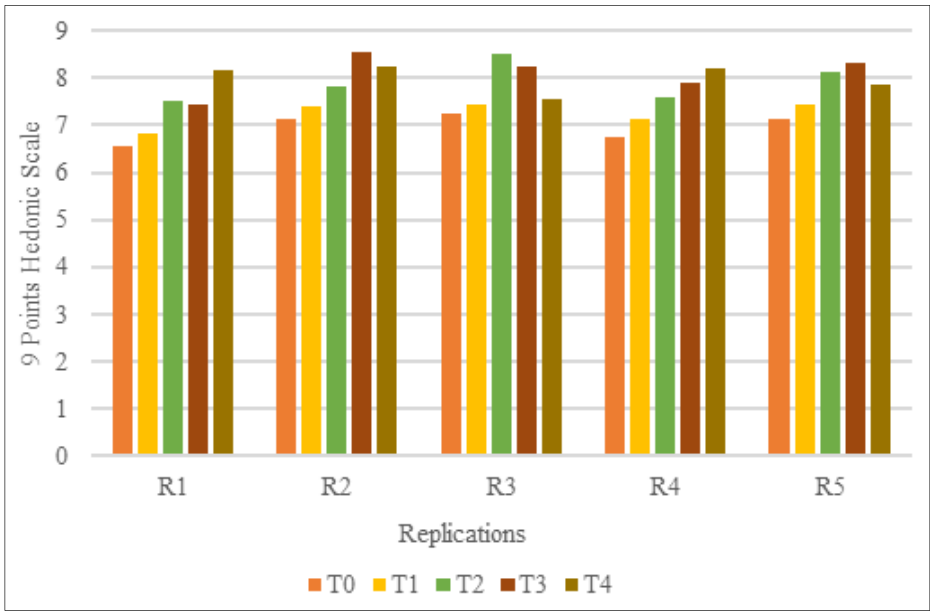

Fig 4: Score for overall acceptability of mango milk cake (out of nine)

Conclusion

The investigation titled "Process Standardization for Mango (*Mangifera indica* L.) Milk Cake" concludes that the successful development and optimization of mango milk cake using Danedar khoa as the base material with buffalo milk and varying levels of mango pulp is feasible. Treatment T_3, which comprised 12% mango pulp, excelled in all sensory attributes, including colour and appearance, body and texture, flavor, and overall acceptability, compared to other treatment levels. It was observed that treatments with mango pulp levels below 12 percent (T_0, T_1, T_2) did not exhibit a strong mango flavor or colour, whereas treatment T_4, which contained 16 percent mango pulp, resulted in an over masking effect on colour and flavor. The incorporation of mango pulp at 12 percent was found to be the most acceptable level for milk cake preparation.

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