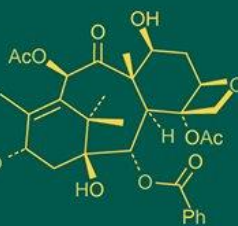
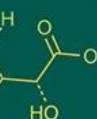
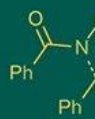
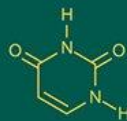
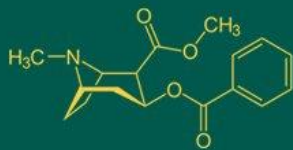


International Journal of Advanced Biochemistry Research



ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating (2025): 5.29
IJABR 2025; SP-9(10): 1345-1348
www.biochemjournal.com
Received: 01-07-2025
Accepted: 06-08-2025

Bhavesh Kumar Jain
M.Sc. Scholar, Department of
Fruit Science, College of
Horticulture and Research
Station, MGUVV, Durg,
Chhattisgarh, India

Sevan Das Khunte
Assistant Professor,
Department of Fruit Science,
College of Horticulture and
Research Station, MGUVV,
Durg, Chhattisgarh, India

Purnendra Kumar Sahu
Assistant Professor,
Department of Fruit Science,
College of Horticulture and
Research Station, MGUVV,
Durg, Chhattisgarh, India

Dinesh Kumar Banjare
M.Sc. Scholar, Department of
Fruit Science, College of
Horticulture and Research
Station, MGUVV, Durg,
Chhattisgarh, India

Corresponding Author:
Bhavesh Kumar Jain
M.Sc. Scholar, Department of
Fruit Science, College of
Horticulture and Research
Station, MGUVV, Durg,
Chhattisgarh, India

Studies on the effect of different varieties and preparation methods on storage durability and organoleptic parameters of Aam Pana

Bhavesh Kumar Jain, Sevan Das Khunte, Purnendra Kumar Sahu and Dinesh Kumar Banjare

DOI: <https://www.doi.org/10.33545/26174693.2025.v9.i10Sq.6009>

Abstract

The sensory quality of Aam Pana prepared from four mango varieties (Kesar, Mallika, Banganpalli, and Totapari) was evaluated during ambient storage (0, 15, 30, and 45 days) using a 9-point Hedonic scale. Significant varietal differences were observed across appearance, flavour, taste and colour. Kesar and Mallika consistently recorded higher sensory scores, with Kesar excelling in taste and colour retention, while Mallika maintained superior taste stability. Banganpalli showed good initial acceptability but declined during storage, and Totapari scored lowest in all attributes. Statistical parameters (low SEM, CV, and significant CD values) confirmed reliability and precision of the results. Overall, Kesar and Mallika were identified as the most suitable varieties for producing high-quality Aam Pana during storage.

Keywords: Aam Pana, Mango varieties, Sensory evaluation, hedonic scale, storage stability, organoleptic quality

1. Introduction

Mango (*Mangifera indica* L.), popularly known as the “king of fruits,” is one of the most important tropical fruits of India, valued for its flavor, aroma, color, and nutritional properties. India is the leading producer, contributing nearly 40% of global mango production, with major cultivation in Uttar Pradesh, Andhra Pradesh, Maharashtra, Bihar, and Telangana (Mitra, 2014; Thakor, 2019; Salunkhe, 2023) ^[1, 2, 3]. Despite high production, post-harvest losses of 20-25% occur due to inadequate handling, transportation, and processing facilities.

Mango is consumed at all stages of maturity and processed into a wide range of products such as pulp, juice, nectar, jam, squash, leather, pickles, chutneys, and beverages. Among these, Aam Pana, a traditional drink made from raw mango pulp, is highly popular for its cooling, digestive, and therapeutic properties. Its quality and shelf life are influenced by varietal characteristics (TSS, acidity, vitamin C) and preparation methods (boiling, steaming, traditional). However, scientific standardization regarding the optimal combination of mango variety and processing method for Aam Pana remains limited, necessitating further research to enhance its nutritional stability, sensory acceptability, and commercial potential.

Aam Pana, a traditional Indian summer beverage prepared from unripe mangoes (*Mangifera indica* L.), is valued for its refreshing taste and therapeutic properties such as preventing heatstroke and aiding digestion. However, its storability or shelf life is a major concern for both household and commercial preparations. The stability of Aam Pana during storage is influenced by multiple factors including the mango variety used, method of preparation, use of preservatives, sugar-acid balance, and storage conditions. Thermal processing (like pasteurization at 75-80 °C) is known to improve microbial safety and enhance the shelf life of beverages. Ravani and Joshi (2011) ^[4] reported that unripe mango beverage processed at 75±2 °C for 15 minutes with 100 ppm sodium benzoate remained stable for up to 30 days under refrigerated storage. The addition of preservatives such as sodium benzoate or potassium metabisulfite (KMS) plays a crucial role in preventing microbial growth and maintaining the beverage's physicochemical properties, including total soluble solids (TSS),

acidity, pH, and flavor (Sakhale *et al.*, 2012) ^[5]. Moreover, sugar and citric acid not only improve taste but also contribute to microbial stability by lowering water activity and maintaining acidity. Storage temperature also significantly affects shelf life—Aam Pana stored under refrigeration retains better quality than that stored at ambient conditions. Lakhanpal and Vaidya (2015) ^[6] observed that honey-based mango nectar showed extended shelf stability due to proper sugar-acid balance and mild thermal treatment. Overall, the storability of Aam Pana can be enhanced with careful processing, appropriate preservative use, hygienic packaging and cold storage, making it suitable for both domestic use and commercial marketing.

Organoleptic parameters such as taste, flavor, color and appearance are crucial for the acceptability of Aam Pana. The choice of mango variety and processing method greatly influences these sensory attributes. Vijayanand *et al.* (2013) ^[7] found that Mallika and Totapari-based drinks had better flavor and appearance scores. Ravani and Joshi (2011) ^[4] noted that proper processing and preservatives helped retain taste and aroma during storage. Additionally, the use of spices and natural sweeteners can enhance the drink's sensory appeal (Lakhanpal & Vaidya, 2015) ^[6]. Thus, optimizing these factors ensures consumer satisfaction and product quality.

2. Materials and Methods

The present investigation entitled Effect of different varieties and preparation methods on shelf life and quality parameters of Aam Pana was conducted in the year 2024-25 at College of Horticulture and Research Station, Sankara, Patan, Durg (C.G.) involved standardization of certain technological parameters for the production of good quality unripe mango beverage.

2.1 Selection and preparation methods of unripe mango

Fresh, healthy and mature unripe mangoes of four varieties Banganpalli, Mallika, Kesar and Totapari — were selected from orchards and markets in Durg district for their processing suitability and unique qualities. The preparation of Aam Pana involved sorting, washing, cooking (via boiling, steaming, or traditional methods), peeling, and pulping using a domestic mixer. The extracted pulp was diluted with water, then mixed with sugar and salt in varying proportions. The beverage was heat-treated at 75 ± 2 °C, strained through a 20-mesh sieve, and divided into two lots one with preservative and one without. Samples were filled hot into sanitized PET bottles, cooled, and stored at two conditions: room temperature (37 ± 2 °C) and refrigeration (4 ± 1 °C). Both fresh and stored samples were analyzed for physico-chemical, sensory and microbial qualities.

3.3 Selection of cooking techniques
An experiment was conducted to evaluate the most suitable cooking technique for mango pulp preparation among three methods: boiling, steaming and traditional. In the boiling method, mangoes were cooked in boiling water (six times the weight of the fruit) at 100 °C for a specific duration. In the steaming method, mangoes were steamed at a pressure of 68.96×10^3 N/m², while the traditional method followed local practices. After cooking, pulp was extracted and diluted with water in a 1:6 ratio. To this, 8.96% sugar and 0.71% salt were added, mixed thoroughly, and the product was packed in PET bottles. The suitability of each method was assessed based on pulp yield and organoleptic qualities

of the resulting RTS (Ready-to-Serve) beverage.

2.2 Pulp Extraction

Cooked fruits were manually peeled to minimize pulp loss, and the seeds were separated. The pulp was extracted using a domestic mixer grinder, and the recovered pulp was analyzed for physical characteristics.

2.3 Beverage Preparation

The extracted pulp was diluted with potable water at different dilution ratios as per the experimental design. Sugar and salt were added at specified concentrations, and the mixture was homogenized using a portable hand blender (Boss, India).

2.4 Thermal Processing

The beverage mix was subjected to thermal processing at 75 ± 2 °C for different time intervals. A control (unprocessed) sample was also prepared for comparison. After heating, the beverage was strained through a 20-mesh stainless steel sieve to remove coarse fibers.

2.5 Addition of Preservatives and Packaging

The processed beverage was divided into two portions: one lot with preservative addition and the other without preservative. The beverage was hot-filled into pre-sanitized PET bottles, sealed immediately, and cooled rapidly to ambient temperature.

2.6 Storage Studies

The bottled samples were stored under two conditions: ambient (37 ± 2 °C) and refrigerated (4 ± 1 °C). Both fresh and stored samples were subjected to regular evaluation for their physico-chemical, sensory, and microbiological quality attributes at predefined intervals.

3. Results and Discussion

The study used a factorial completely randomized design (CRD) comprising four mango varieties (Banganpalli, Mallika Kesar and Totapari) and three preparation methods (traditional, boiling and steaming). The research was structured in a multi-phase approach starting with optimization of individual factors like fruit selection, cooking techniques dilution ratio, sugar and salt concentration and preservation method followed by comprehensive evaluation during 45 days of ambient storage.

3.1 Sensory scores

Sensory quality is critical in determining market acceptability. Beverages were evaluated for appearance, flavor, taste and overall acceptability using a 9-point hedonic scale. The Kesar × Steamed (V_3M_3) treatment consistently scored the highest across all parameters followed by Banganpalli × Steamed (V_1M_3). The panel particularly appreciated the vibrant yellow color, tangy-sweet flavor and smooth consistency of the V_3M_3 sample.

Over time, there was a slight decline in sensory scores across all samples, primarily due to reductions in acidity and vitamin C content, which affect the sharpness and freshness of flavor. Nevertheless, V_3M_3 retained sensory quality above the acceptability threshold even at 45 days validating its potential for commercial processing.

The sensory evaluation showed that Mallika (V2) received the highest overall acceptability (mean score: 7.86) followed by Totapari (V4) with 7.63. Banganpalli (V1) and Kesar (V3) had slightly lower scores of 7.47 and 7.46, respectively. Among the different media, M2 provided the most favourable results (7.80), followed by M3 (7.57) and M1 (7.44). The best-performing combination was Mallika with M2, which recorded the highest sensory score of 8.23, indicating excellent compatibility between this variety and the medium. In contrast, the lowest score was observed in the combination of Kesar with M1 (7.28), suggesting comparatively lower sensory appeal.

Table 1: Effect of Preparation method on Appearance of stored Aam Pana

	M ₁	M ₂	M ₃	Mean V
V ₁	7.34	7.54	7.54	7.47
V ₂	7.62	8.23	7.72	7.86
V ₃	7.28	7.53	7.57	7.46
V ₄	7.53	7.89	7.46	7.63
Mean M	7.44	7.80	7.57	
	CD	SE(d)	SE (m)	CV
Factor (V)	0.54	0.23	0.16	5.62
Factor (M)	0.52	0.24	0.17	6.16
Factor (V X M)	0.29	0.19	0.13	4.72

The sensory evaluation indicated that Totapari (V4) had the highest overall mean score (7.49), followed closely by Kesar (V3) at 7.47. Mallika (V2) and Banganpalli (V1) scored slightly lower, with mean values of 7.43 and 7.35, respectively. Among the media, M1 resulted in the highest average sensory score (7.47), followed by M3 (7.46) and M2 (7.38), showing minimal variation across media. The best individual combination was Totapari with M1 (7.88), indicating strong sensory appeal, while the lowest score was recorded for Mallika with M1 (6.98), suggesting this pairing was less favorable. Overall, Totapari and Kesar performed better across most media, while Mallika showed improved scores particularly in M2 and M3.

Table 2: Effect of Preparation method on flavor of stored Aam Pana

	M ₁	M ₂	M ₃	Mean V
V ₁	7.28	7.07	7.71	7.35
V ₂	6.98	7.53	7.77	7.43
V ₃	7.73	7.58	7.09	7.47
V ₄	7.88	7.34	7.26	7.49
Mean M	7.47	7.38	7.46	
	CD	SE(d)	SE (m)	CV
Factor (V)	0.68	0.79	0.52	5.23
Factor (M)	0.62	0.82	0.55	5.19
Factor (V X M)	0.28	0.17	0.10	4.03

The sensory evaluation revealed that Mallika (V2) had the highest overall acceptability with a mean score of 7.73, closely followed by Kesar (V3) and Totapari (V4), both with mean scores of 7.68. Banganpalli (V1) showed slightly lower acceptability at 7.44. Among the media, M2 resulted in the highest average sensory score (7.73), followed by M1 (7.66) and M3 (7.51). The most preferred individual combination was Totapari with M1 (7.94), followed by Mallika with M2 (7.78) and Kesar with M3 (7.87), indicating strong sensory appeal in these pairings. In contrast, Totapari with M3 (7.19) and Banganpalli with M3

(7.29) received comparatively lower scores. Overall, Mallika showed consistently high performance across all media, while Totapari and Kesar also demonstrated strong sensory qualities depending on the medium.

Table 3: Effect of Preparation method on Taste of stored Aam Pana

	M ₁	M ₂	M ₃	Mean V
V ₁	7.43	7.61	7.29	7.44
V ₂	7.73	7.78	7.67	7.73
V ₃	7.54	7.62	7.87	7.68
V ₄	7.94	7.91	7.19	7.68
Mean M	7.66	7.73	7.51	
	CD	SE(d)	SE (m)	CV
Factor (V)	0.68	0.27	0.19	7.44
Factor (M)	0.62	0.30	0.21	6.25
Factor (V X M)	0.26	0.13	0.09	5.61

The sensory evaluation showed that Kesar (V3) had the highest overall acceptability with a mean score of 7.84, followed by Mallika (V2) at 7.58. Totapari (V4) and Banganpalli (V1) scored lower, with means of 7.34 and 7.10, respectively. Among the media, M3 produced the highest average score (7.68), indicating a strong positive influence on sensory quality, followed by M2 (7.39) and M1 (7.33). The best-performing combination was Kesar with M3 (8.07), showing excellent sensory appeal, while Banganpalli with M2 (6.95) received the lowest score. Overall, Kesar stood out across all media, particularly in M3, and Mallika also maintained consistently high scores, whereas Banganpalli and Totapari showed more variation depending on the medium.

Table 4: Effect of Preparation method on colour of stored Aam Pana

	M ₁	M ₂	M ₃	Mean V
V ₁	7.26	6.95	7.09	7.10
V ₂	7.48	7.44	7.83	7.58
V ₃	7.58	7.87	8.07	7.84
V ₄	7.01	7.28	7.73	7.34
Mean M	7.33	7.39	7.68	
	CD	SE(d)	SE (m)	CV
Factor (V)	0.53	0.24	0.17	6.21
Factor (M)	0.55	0.25	0.18	6.57
Factor (V X M)	0.23	0.20	0.15	6.39

4. Conclusion

From the detailed analysis and observations recorded throughout the study the following conclusions can be drawn:

1. Variety and preparation method significantly influence the chemical, sensory and physical quality of Aam Pana. Among the four varieties, Kesar demonstrated superior pulp yield, juice recovery and nutrient retention.
2. Steaming emerged as the most effective processing technique better preserving ascorbic acid, acidity, sugars and overall sensory appeal compared to traditional and boiling methods.
3. The combination Kesar × Steamed (V₃M₃) was the most suitable for Aam Pana production, offering excellent storage stability, high vitamin C content, optimal sweetness-acidity balance and superior sensory attributes throughout the 45-day storage period.

4. Storage at ambient temperature for up to 45 days resulted in modest nutrient losses and a minor decline in organoleptic quality which were within acceptable limits especially in the best-performing treatment.

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