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spp.)*

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Research Journal of Agricultural Sciences  
An International Journal

P- ISSN: 0976-1675

E- ISSN: 2249-4538

Volume: 13

Issue: 03

*Res. Jr. of Agril. Sci. (2022) 13: 902–905*





## Studies on Development, Quality Evaluation and Storage Stability of Banana Jam (*Musa spp.*)

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Received: 27 Apr 2022 | Revised accepted: 22 Jun 2022 | Published online: 25 June 2022

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### ABSTRACT

The present investigation on the “Studies on development, quality evaluation and storage stability of banana jam (*Musa spp.*)” was carried out at Department of Horticulture, Faculty of Agriculture, Annamalai University, Annamalai Nagar during 2018-2020. The experiment was carried out in completely randomized design with four formulations and five replications. Banana was processed into jam and the effect of processing on the nutritional quality and sensory quality of jam was determined. The sensory evaluation was carried out at monthly intervals for three months during storage. Banana jam was prepared with four formulations viz., T<sub>1</sub>- Poovan, T<sub>2</sub>- Nendran, T<sub>3</sub>- Karpuravalli, T<sub>4</sub>- Peyan. Poovan banana jam (T<sub>1</sub>) was stored upto three months. The highest values for TSS (70.29%), total sugar (62.81%), protein content (0.45%) and lowest value for moisture (28.24%) were recorded in jam prepared from Poovan banana. The highest value for pH (5.35) was recorded in jam prepared from Karpuravalli banana (T<sub>3</sub>). The highest scores for organoleptic evaluation were obtained by Poovan jam. Banana jam had the shelf life of up to 3 months. The cost economics for production of banana jam was 1.71.

**Key words:** Banana jam, Poovan, Nendran, Karpuravalli, Peyan

Banana, a wonderfully sweet fruit with firm and creamy flesh that come prepackaged in a yellow jacket, available for harvest throughout the year consists mainly of sugars and fibers which make it a source of immediate and slightly prolonged energy. When consumed, reduces depression, anemia, blood pressure, stroke risk, heartburns, ulcers, stress, constipation and diarrhea. In the tropics banana is most widely cultivated and consumed. Banana is valued worldwide for its flavor, nutritive value and availability throughout the year. Banana is highly perishable fruit crop and the shelf life is very short. Therefore, suitable measures have to be carried out in order to increase the storage life of banana, so there is an urgent need to preserve this fruit for preparing value added products. Hence, this study was conducted to develop jam from banana and for extending the storage life.

### MATERIALS AND METHODS

The present investigation on the “Standardization of protocols for development of jam from banana (*Musa spp.*)” was carried out at Department of Horticulture, Faculty of Agriculture, Annamalai University, Annamalai Nagar during

2018-2020. The experiment was carried out in Completely Randomized Design with four formulations and five replications. Banana was processed into jam and the effect of processing on the nutritional quality and sensory quality of jam was determined. The sensory evaluation was carried out at monthly intervals for three months during storage. Banana jam was prepared with four formulations viz., T<sub>1</sub>- Poovan, T<sub>2</sub>- Nendran, T<sub>3</sub>- Karpuravalli, T<sub>4</sub>- Peyan. Poovan banana jam (T<sub>1</sub>) was stored upto three months.

Well matured, ripe banana fruits were selected for making banana jam. The fruits were washed in water thoroughly so that the fruits were free from any contamination. Then the fruit slices were blanched till it became soft. Then water was added and blended with the fruit in a mixer or grinder and then the pulp was extracted. After extraction suitable quantity of sugar, pectin and citric acid were added then the mixture was boiled until judging of the end point (when jam flowed like a sheet). Then addition of preservative, KMS was done. After addition of preservative, jam was allowed to cool. Then jam was filled in bottles and stored in a cool place.

The organoleptic quality of banana processed products were evaluated by the panellists for sensory attributes such as colour, taste, flavour, and also overall acceptability. As explained by [1] a nine-point hedonic scale was used ranging from like extremely (9) to dislike extremely (1). All samples were presented before the panellists at ambient temperature under normal lighting conditions. Spoons and drinking water were provided to the panelists for tasting and oral rinsing. Nutritional quality such as pH, TSS (°Brix), total sugars (%),

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protein (%) and moisture (%) were determined. Total sugars (%) and protein (%) were analyzed by the method of AOAC [2]. pH was determined through pH meter as per the method of [3]. Moisture (%) was analyzed by the method of [4].



Prepared banana jam

## RESULTS AND DISCUSSION

The results revealed that the highest values for TSS (70.29%), total sugar (62.81%), protein content (0.45%) and lowest value for moisture (28.24%) were recorded in jam prepared from Poovan banana. The highest value for pH (5.35) was recorded in jam prepared from Karpuravalli banana ( $T_3$ ). The best scores for organoleptic evaluation were recorded in Poovan jam (Table 1). Banana jam had the shelf life of up to 3 months. The cost economics for production of banana jam was 1.71.

The pH of banana plays a role in preservation. The low pH level reduces the microbial growth. The pH of the banana is also an important factor to attain the gel condition. Among the four varieties used, the lowest value of pH was recorded in poovan banana jam. The highest value of pH was recorded in jam prepared from the Karpuravalli banana. The variation in pH of the mango varieties corresponded to the changes in the acidity of the respective varieties as reported by [5]. Similar observations were recorded by [6] in jackfruit jam blended with avocado and kokum.

Table 1 Effect of varietal difference on nutritional quality of banana jam

Treatments	pH	Tss (°B)	Total sugar (%)	Protein (%)	Moisture %
T <sub>1</sub> : Poovan	4.41	70.29	62.81	0.45	28.24
T <sub>2</sub> : Nendran	4.78	63.32	56.46	0.41	33.43
T <sub>3</sub> : Karpuravalli	5.35	66.82	59.67	0.38	31.76
T <sub>4</sub> : Peyan	5.06	60.22	52.78	0.31	30.09
S. Ed.	0.11	1.41	1.28	0.013	0.68
C. D. (P=0.05)	0.24	3.00	2.72	0.030	1.45

Banana jam prepared with different varieties was subjected to sensory evaluation at monthly interval for a period of three months. A hedonic scale of 9 points was used to access

the quality attributes viz., taste, colour, flavor and overall acceptability. The scores obtained were presented in (Table 2-4).

Table 2 Sensory scoring for banana jam at 1<sup>st</sup> month of evaluation (October, 2019)

Taste panel (TP) S	T <sub>1</sub> (Poovan)				T <sub>2</sub> (Nendran)				T <sub>3</sub> (Karpuravalli)				T <sub>4</sub> (Peyan)			
	Taste	Colour	Flavour	Overall acceptancy	Taste	Colour	Flavour	Overall acceptancy	Taste	Colour	Flavour	Overall acceptancy	Taste	Colour	Flavour	Overall acceptancy
TP1	9	8	8	9	7	6	8	7	8	8	8	8	7	6	8	7
TP2	9	7	8	8	6	6	9	7	6	6	8	7	8	7	8	8
TP3	8	7	8	8	5	7	8	7	7	7	7	7	6	7	7	7
TP4	8	8	8	8	9	7	8	8	8	8	7	8	7	6	7	7
TP5	9	9	8	9	8	6	8	7	8	7	8	8	8	8	8	8
TP6	8	8	8	8	8	8	7	8	7	6	8	7	8	8	7	8
TP7	9	8	7	8	5	7	8	7	7	8	8	8	7	7	7	7
TP8	8	9	9	9	7	6	6	6	8	6	6	7	8	6	9	8
TP9	9	8	9	9	6	8	8	8	6	8	7	7	7	7	8	7
TP10	8	9	8	8	5	6	7	6	7	7	8	7	8	7	7	7
Grand Total	85	81	81	80	66	67	77	71	72	71	75	71	74	69	76	74
Average	8.5	8.1	8.1	8.0	6.6	6.7	7.7	7.1	7.2	7.1	7.5	7.1	7.4	6.9	7.6	7.4

The average score for taste (8.5), colour (8.1), flavor (8.1) and overall acceptability (8.0) were highest in the treatment T<sub>1</sub> in the first month of sensory evaluation. The scores were highest in this treatment during all the three months of sensory evaluation. The treatment T<sub>3</sub> obtained the second-best score for sensory characters taste (8.1), colour (8.1), flavor (8.0) and overall acceptability (8.2).

The lowest sensory scores were recorded in treatment T<sub>4</sub> in taste (6.5), colour (6.6), flavor (6.7) and overall acceptability (6.5) during first month of sensory analysis. The scores were

lowest in this treatment during all the three months of sensory evaluation. The sensory scores of banana jam rapidly reduced during the third month of sensory analysis, irrespective of treatments.

To retard the microbial growth, brix of 68° is recommended as reported by [7]. Sabato *et al.* [8] reported that TSS and acidity of mango fruit usually associated with metabolism and significantly affected by the ripening process, therefore dependent on the maturity index of the fruit. Among the recorded values of total soluble solids, the jam prepared



from poovan banana had more TSS content. The lowest value of the TSS was recorded in jam prepared from Peyan banana. The similar range of TSS was reported by [9] in jam prepared from banana and ginger.

The total sugar content varied in the jam produced as this might be due to the varieties used for jam preparation. One of the most important constituents of fruits is sugar which act as a

natural food preservative as reported by [10]. Difference in sugar content occur between varieties might be due to physiological changes and polysaccharide metabolism during ripening process reported in mango varieties by [8]. The highest value of total sugar content was seen in poovan banana jam and the lowest value of total sugar content was noticed in the peyan banana jam.

Table 3 Sensory scoring for banana jam at 2<sup>nd</sup> month of evaluation (November, 2019)

Taste panel (TP) S	T <sub>1</sub> (Poovan)				T <sub>2</sub> (Nendran)				T <sub>3</sub> (Karpuravalli)				T <sub>4</sub> (Peyan)			
	Taste	Colour	Flavour	Overall acceptancy	Taste	Colour	Flavour	Overall acceptancy	Taste	Colour	Flavour	Overall acceptancy	Taste	Colour	Flavour	Overall acceptancy
TP1	8	7	7	8	8	7	7	7	7	8	7	7	5	6	6	6
TP2	7	7	8	7	6	6	5	6	6	7	6	6	5	5	5	5
TP3	7	6	8	8	7	6	6	6	8	7	8	8	6	6	4	5
TP4	8	8	8	8	5	7	6	6	7	8	7	7	6	6	5	6
TP5	8	7	6	8	8	7	8	8	6	7	6	6	5	5	5	5
TP6	7	8	8	8	6	8	6	7	8	8	7	8	6	4	5	5
TP7	8	7	7	8	7	6	7	7	8	5	7	7	6	6	6	6
TP8	8	8	8	8	8	6	5	7	7	8	8	8	5	5	6	5
TP9	8	8	7	8	7	8	7	7	8	7	6	7	7	4	5	6
TP10	7	7	8	7	6	6	8	7	7	8	7	7	5	6	4	5
Grand Total	76	73	75	74	68	67	65	68	72	71	69	71	56	53	51	54
Average	7.6	7.3	7.5	7.4	6.8	6.7	6.5	6.8	7.2	7.1	6.9	7.1	5.6	5.3	5.1	5.4

Table 4 Sensory scoring for banana jam at 3<sup>rd</sup> month of evaluation (December, 2019)

Taste panel (TP) S	T <sub>1</sub> (Poovan)				T <sub>2</sub> (Nendran)				T <sub>3</sub> (Karpuravalli)				T <sub>4</sub> (Peyan)			
	Taste	Colour	Flavour	Overall acceptancy	Taste	Colour	Flavour	Overall acceptancy	Taste	Colour	Flavour	Overall acceptancy	Taste	Colour	Flavour	Overall acceptancy
TP1	4	6	5	5	4	5	5	4	5	5	4	5	2	4	3	3
TP2	5	5	6	5	5	3	5	4	3	4	5	4	3	3	4	3
TP3	4	5	6	5	3	4	3	3	5	5	5	5	3	4	4	4
TP4	5	3	4	4	5	3	2	4	4	4	4	4	3	3	3	3
TP5	6	4	5	5	4	3	4	4	4	3	3	3	2	2	2	2
TP6	5	5	6	5	5	5	4	5	4	5	4	4	7	2	4	4
TP7	4	6	5	5	3	4	3	3	5	4	3	4	2	3	4	3
TP8	6	4	4	5	5	3	2	3	3	4	4	4	2	3	4	3
TP9	3	5	5	5	4	4	4	4	4	5	3	4	4	3	4	4
TP10	4	4	5	5	4	5	6	4	5	3	5	4	5	3	5	5
Grand Total	46	47	46	49	42	39	38	38	45	42	40	41	33	31	36	34
Average	4.6	4.7	4.6	4.9	4.2	3.9	3.8	3.8	4.5	4.2	4.0	4.1	3.3	3.1	3.6	3.4

The protein content of jam ranged between 0.31- 0.45%. Similar values of protein were reported by [11] in mixed fruit jam. The variation in protein is dependent on the nature of the variety used for jam preparation. The protein content of the jam varied between different varieties of guava as reported by [12]. The highest protein content was recorded in Poovan jam and the lowest value of the protein content was seen in peyan jam.

The moisture content varied among the varieties used for banana jam. The difference in moisture content is expected because of the heating process involved during heating as reported by [13]. Moisture content in any food plays a key role in deciding the shelf life as reported by [14]. The lower level of the moisture content was recorded in jam prepared from poovan

banana. The highest moisture content was recorded in the nendran banana jam. The range of moisture content recorded was similar to the moisture content recorded in jam prepared from banana and ginger, as reported by [9].

The organoleptic quality of banana jam varied according to the variety used. The score of jam decreased rapidly during storage. The highest scores with regard to taste, colour, flavor and overall acceptability was given for poovan banana jam. The lowest values for organoleptic quality were received by peyan banana jam.

Regarding shelf life, jam from poovan banana recorded the highest shelf life of 3 months. After three months, the product got deteriorated. The high sugar content of the poovan



banana combined with the addition of extra sugar might have increased the shelf life of jam. Sugar is used for preserving jam which replaces the water activity of the food to a point where the microbial growth is impossible. It also raises the osmotic pressure for the solution and causes plasmolysis of microbial cells, thus the water activity of the food reduced and check the growth of microorganisms [15]. The other three treatments recorded the shelf life upto 2 months. After two months there was gradual deterioration of the products. This might be due to the lower sugar content when compared to the poovan banana.

Benefit cost ratio obtained through production of banana jam was found to be 1.71.

## CONCLUSION

Hence it is concluded that jam developed from Poovan was considered as the best formulation with respect to nutritional value as well as sensory scores and processing of banana into banana jam can be used for commercial exploitation.

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