

## Studies on textural qualities of canned banana slices

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**Abstract :** Three varieties of banana viz, Poovan, Rasthali and Red banana were canned and subjected to textural analysis which revealed that Rasthali offered more resistance to cutting, penetration and in TPA test followed by Poovan. Red banana and Poovan stored in 30°B covering syrup at 4.5 months of storage disintegrated during TPA test. Canned banana was microbiologically safe after 4.5 months of storage. The sensory evaluation showed that the overall acceptability was found to be very good.

*Key words: Cans, processing, textural qualities*

### Introduction

India produces 45.49 million tonnes of fruits annually which accounts for about 10 per cent of world' fruits production (Anon, 2002). However, for various reasons, this abundance of production is not fully or satisfactorily utilized as it should be. About 25 to 30 per cent of it is wasted due to improper handling, lack of transportation and storage facilities and by spoilage.

Banana has a very special place in diet, low in fats, chloestrol and high in calories. About 100 g of banana provides about 100 calories which is 50% more energy released by other fruits like apples, citrus fruits and others. Keeping banana as a whole fruit for long time is not feasible due to its poor shelf life quality. Hence, with growing importance of production of banana products and its preservation, a study on canning of banana was taken up. The present paper deals with the textural aspects of Banana stored under canning.

### Materials and Methods

#### *Acquisition, preparation and canning of banana*

The study was carried out on three varieties of banana namely Poovan, Red banana and Rasthali. Fully matured fruits were procured, washed in tap water to remove the extraneous matter and shade dried. Damaged and bruised fruits were culled out. Ripened banana fruits were manually peeled and sliced using a stainless steel knife. The tapered ends were discarded and the middle portion of the fruit was cut into uniform slices of 10 mm thickness. The procured cans were reformed, flanged and seamed using the machineries can reformer, can flanger and can seamer respectively. The fruit slices were dipped in sugar and jaggery syrup each of 20°B, 25°B, and 30°B. To obtain 20,25 and 30°B of sugar syrup, 254, 338 and 436 g of sugar were dissolved in one litre of water respectively (Lai *et al.*, 1998). The jaggery syrup of 20,25 and 30°B were obtained by trial and error method. The filled and seamed cans were processed for 25 minutes in pressure cooker.

**Table 1. The levels of variables for canning of banana.**

S.No.	Factors	Level
1.	Variety	Poovan, Rasthali and Red banana.
2.	Syrup type	Sugar and Jaggery
3.	Syrup concentration	20°B, 25°B and 30°B
4.	Months of storage	0, 1.5, 3 and 4.5
5.	Replications	2

**Table 2. Texture analyzer settings for the different types of test.**

Settings	Type of Test		
	Cutting force	Penetration force	TPA
Type of probe used	Guillotine blade	Penetration rig	P/75 compression platen
Test module	Measure force in compression	Measure force in compression	TPA
Test option	Return to start	Return to start	Return to start
<i>Parameters</i>			
Pre test speed	2.0 mm/S	2.0 mm/S	2.0 mm/S
Test speed	1.0 mm/S	1.0 mm/S	1.0 mm/S
Post test speed	2.0 mm/S	2.0 mm/S	2.0 mm/S
Distance	10 mm	5 mm	25%
Trigger force	5g	5g	5g
Load cell capacity	5 kg	5 kg	5 kg

### *Storage studies*

The cans were kept at ambient conditions for storage studies. The ambient temperature ranged from 20 to 32°C and relative humidity varied between 66 and 93 per cent during the study period. The textural and microbial analyses were made for canned banana for the regular interval of one and half months of storage. The observations were statistically analysed in FCRD using the package IRRISTAT, to study the influence of variety, type of

syrup, syrup concentration and months of storage on textural and microbial qualities of canned banana. The factors and the levels of variables are listed in table 1.

### *Textural Analysis*

The texture of the raw and canned slices of banana was determined using the texture analyzer. It measures force, distance and time, thus providing three-dimensional product analysis. Forces may be measured to achieve set distances

and distances may be measured to achieve set forces. The various tests viz., test for finding out the cutting force, force required for penetration at a set depth and Texture Profile Analysis (TPA) test were conducted for the canned samples (Table 2).

#### *Sensory analysis*

Organoleptic evaluation of the product was done by a panel of twelve untrained judges for colour, flavour, texture, taste and overall acceptability using 9 point hedonic scale (Ranganna, 1977). Comparison was made within the samples obtained by different treatments. Statistical analysis of the samples were carried out using completely randomized design (CRD) using the package IRRISTAT.

#### *Microbial Characteristics*

The microbial load of the samples was tested as per the procedure outlined by Anonymous (1967).

Media used for isolation of different organisms are

- Bacteria - Nutrient agar medium (Allen, 1953)
- Fungi - Martin's rose Bengal agar medium (Martin, 1950)
- Yeast - Malt extract agar medium (Phaff, 1990).

## **Results and Discussion**

### *Textural qualities of canned banana*

Effect of type and concentration of covering syrup on cutting force of canned banana. It is inferred from table 3 that, as the concentration of covering syrup increases, the shear strength gets reduced for all the selected three varieties of banana. The reduction in cutting strength was more pronounced for Poovan stored at sugar syrup of all concentrations than for jaggery syrup. The statistical analysis revealed that all the treatments were significant.

### *Effect of type and concentration of covering syrup on penetration force for canned Banana*

The effect of type of syrup on force of penetration was more for sugar syrup than for jaggery syrup in case of Poovan (Table 3). The ANOVA showed that the effect of months of storage, syrup type and concentration and variety on penetration was found to be significant.

### *Effect of type and concentration of covering syrup on Force in TPA of Canned Banana*

In all the cases, the minimum force required was at higher syrup concentration of 30°B and at higher months of storage at 4.5 months. The Poovan slices stored in jaggery syrup showed a lower resistance in TPA than for sugar syrup (Table 3) The same results were obtained for Rasthali whereas for Red banana, the fruit stored in sugar syrup showed lower resistance than jaggery syrup. Except for the variety Rasthali, Poovan and Red banana showed breakage during the TPA test at 4.5 months of storage for slices canned at 30°B sugar and jaggery syrup. This represents that the texture of canned Poovan and Red banana slices got more affected when compared to Rasthali. The texture suffered most for higher syrup concentration. The result was in accordance with Beerch and Rane (1983).

The ANOVA for force in TPA of canned banana shows that the effect of months of storage, concentration and type of syrup and variety on force in TPA were found to be significant. All the interaction effects were found to be significant.

### *Microbiological studies on Canned banana*

The total bacterial, yeast and fungal count in the canned banana slices were analysed and listed in the table 4. The bacterial count

**Table 3. Effect of different treatments on Textural qualities of Canned Banana.**

Variety	Syrup type	Syrup TSS (°B)	Cutting force (g)				Penetration force (g)				Force (g) in TPA			
			Months of storage				Months of storage				Months of storage			
			0	1.5	3	4.5	0	1.5	3	4.5	0	1.5	3	4.5
Poovan	Sugar	20	567.5	504.0	494.5	474.5	26.10	20.85	18.25	14.35	1623.5	1595.5	1587.5	1569.5
		25	554.0	502.5	480.0	470.0	22.85	19.15	17.65	13.30	1596.5	1576.0	1562.5	1514.0
		30	545.5	497.0	474.0	458.0	20.00	17.75	16.75	11.85	1495.5	1484.0	1473.5	1448.0
	Jaggery	20	568.0	537.0	518.0	516.0	25.05	23.75	22.00	19.65	1694.5	1658.0	1592.5	1556.0
		25	563.0	517.5	510.0	499.0	22.85	21.00	19.50	18.00	1615.0	1595.0	1485.5	1457.5
		30	560.5	499.5	485.5	483.0	20.40	19.15	17.65	16.15	1541.0	1514.0	1448.5	1427.0
Rasthali	Sugar	20	727.0	717.0	711.5	677.5	56.00	51.25	48.95	46.75	1927.5	1706.5	1597.0	1359.0
		25	719.0	676.0	671.5	663.0	54.60	47.75	46.85	45.35	1753.0	1512.5	1481.0	1286.5
		30	712.5	672.0	665.5	662.0	53.15	45.00	44.85	41.65	1645.0	1405.0	1423.5	1157.0
	Jaggery	20	725.0	714.0	713.0	676.0	60.35	57.85	55.95	52.35	1851.5	1814.5	1785.5	1445.0
		25	724.0	699.5	661.0	651.0	57.45	56.15	55.65	51.00	1817.5	1765.5	1693.5	1315.0
		30	715.5	675.5	652.5	642.0	55.00	52.95	51.85	49.45	1753.0	1655.5	1612.5	1230.0
Red Banana	Sugar	20	300.0	275.5	254.5	232.0	15.95	14.15	13.35	12.00	1228.5	1057.0	0953.5	0885.0
		25	293.0	247.5	235.0	227.0	13.85	12.45	11.15	10.00	1156.0	0990.0	0926.0	0855.0
		30	289.5	237.5	221.0	215.0	11.50	09.00	08.25	08.05	1117.0	0927.0	0827.5	0792.5
	Jaggery	20	307.0	294.5	266.5	248.0	17.50	15.50	14.50	13.85	1333.5	1257.0	1047.5	0925.5
		25	299.0	270.5	264.0	249.0	15.35	13.95	12.55	12.00	1235.5	1124.0	0948.0	0918.5
		30	289.5	262.0	260.5	217.5	14.35	12.00	11.05	10.50	1164.5	0987.5	0919.5	0854.0

**Table 4. Microbial load on canned banana after 4.5 months of storage.**

Variety	Type of syrup	Concentration (°B)	Bacteria X10 <sup>3</sup>	Yeast X10 <sup>3</sup>	Fungi X10 <sup>3</sup>
Poovan	Sugar	20	12	12	15
		25	15	16	18
		30	9	14	17
	Jaggery	20	16	18	21
		25	18	14	24
		30	11	11	19
Rasthali	Sugar	20	16	14	18
		25	17	15	22
		30	12	21	16
	Jaggery	20	15	22	18
		25	21	23	21
		30	22	21	25
Red Banana	Sugar	20	15	15	18
		25	16	18	16
		30	4	19	14
	Jaggery	20	15	18	21
		25	14	16	21
		30	5	14	25

in Poovan, Rasthali and Red banana at different treatments varied from  $9 \times 10^3$  to  $18 \times 10^3$ ,  $12 \times 10^3$  to  $22 \times 10^3$  and  $4 \times 10^3$  to  $16 \times 10^3$  per gram of the sample respectively. These counts were within the permissible limits of  $30 \times 10^3$  for canned fruits (Sharma and Desai, 1978). Hence the canned banana slices were found to microbiologically safe after 4.5 months of storage.

#### *Effect of different treatments on sensory qualities of Canned Banana*

Sensory evaluation showed that Rasthali slices stored in sugar syrup was found to be the best in colour. The flavour and taste of Red banana in sugar was found to be the best. For texture, Poovan in sugar syrup was found to be the best. However, the overall acceptability was best for Red banana in sugar

syrup. The recipe (fruit pudding) made from Poovan stored in 25°B jaggery syrup was acceptable.

Texturally the variety Rasthali was most suited for canning followed by Poovan. These varieties undergo less deterioration in texture when compared to Red banana which got disintegrated during the TPA test. The sensory evaluation using 9 point hedonic scale showed that Red banana stored in sugar syrup was found to be best in flavour, taste and overall acceptability. Rathali stored in sugar syrup was best in colour and Poovan in sugar syrup was found to be best in texture.

The microbial counts were within the permissible limits and hence the canned banana was microbially safe after 4.5 months of storage.

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