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Evaluation of guava cultivars for processing and biochemical changes in nectar beverage during storage

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Abstract

The beverages are becoming more popular in comparison to synthetic or carbonated drinks which are available in the market. In view of this, fruit beverages of guava have a great potential in processing industry due to its excellent flavour and nutritive value. Looking to the demand of natural beverages, the present study was carried out during the year 2003-04. The experimental material consisted of four cultivars of guava and six recipes maintained for making nectar beverage with varying levels of TSS per cent. The prepared nectar was kept under ambient condition for storage study up to 150 days. The beverage prepared from the cultivar L-49 had highest content of ascorbic acid and also scored highest organoleptic value. While, acidity, reducing and total sugar were found to be highest in cultivar R-72. Among various recipes tried in this investigation, the nectar prepared from 20 per cent pulp, 0.3 per cent acidity and 17 per cent TSS recorded highest ascorbic acid and organoleptic value. During storage of nectar, the acidity, reducing sugar and total sugar showed an increasing trend with increasing period of storage (0 to 150 days) under ambient condition. While, there was a decreasing trend of ascorbic acid and organoleptic score during storage period upto 150 days under ambient condition.

Key words: *Ambient condition, biochemical changes, guava cultivars, nectar, recipes and storage*

Introduction

Guava (*Psidium guajava* L.), a very popular fruit is indigenous to tropical America and belongs to family 'Myrtaceae'. It is one of the important fruit crops of India and ranks fourth in area and production after mango, banana and citrus. It excels most of the other fruit crops in productivity, hardiness, adaptability and vitamin C content of the fruits (Tandon *et al.*, 1983; Singh *et al.*, 1993). Apart from vitamin C, it is also a rich source of pectin and minerals like calcium, phosphorus and iron. Besides, the fruit contains substantial quantity of vitamin A, pantothenic acid, riboflavin, thiamin and niacin. Although, guava fruit is nutritious but it is highly perishable in nature and can not be transported to distant places for marketing. Fruits are available in plenty during fruiting season but it is sold at unremunerative prices. Besides using as fresh, its fruits are being processed mainly for making jelly. Hence, due to its excellent flavour and nutritive value, there is a great potential in processing of guava beverages which could be economical and made available to a large population. Therefore, the present study was undertaken to evaluate the guava cultivars for processing into nectar beverage alongwith its storage under ambient condition.

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Materials and methods

The present investigation was carried out in the Department of Horticulture, IGAU, Raipur (C.G.) during the year 2003-04 to study the storage stability of nectar beverage prepared from four cultivars of guava viz., Apple Colour (AC), Allahabad Safeda (AS), Lucknow-49 (L-49) and Rewa-72 (R-72). Six recipes were maintained with 20 per cent pulp, 0.3 per cent acidity and varying levels of TSS i.e., 15,16,17,18, 19 and 20 per cent. The experiment consisted 24 treatment combinations in completely randomized design with factorial arrangement and replicated thrice.

Fifteen years old guava trees were used as experimental materials and all the trees were provided with same cultural practices. Firm ripe fruits were selected and a fine fruit pulp was obtained devoid of seeds and skin for the preparation of nectar. The prepared nectar beverage was filtered to obtain a product of uniform consistency and it was filled into sterilized crown bottles of 250 ml capacity and corked air tight. After pasteurization of bottles at 100°C, the product was kept at ambient condition for further study upto 150 days.

The chemical composition of nectar was analyzed at the time of preparation (0 day) and at 30 days interval up to 150 days. The acidity and ascorbic acid were estimated by

the methods suggested by Ranganna (1997). Total sugar and reducing sugar were determined by the method of Lane and Eynon as described by Ranganna (1997). Organoleptic quality of nectar was subjected to sensory evaluation by a pannel of five judges for appearance, flavour and taste following the hedonic rating scale as described by Ranganna (1997). The statistical analysis of data recorded on various aspects was done as given by Panse and Sukhatme (1985).

Results and discussion

Ascorbic acid

The ascorbic acid content in guava nectar showed a decreasing trend with increasing period of storage (Table 1) upto 150 days at ambient condition under all the cultivars and recipe treatments. The nectar of cultivar L-49 had significantly higher ascorbic acid (6.17 mg/100 ml) followed by Allahabad Safeda, Apple Colour and R-72 at the time of preparation of product. Thereafter, a similar trend was observed upto 150 days of storage. At the end of storage (150 days), the nectar of cultivar L-49 contained maximum ascorbic acid (4.71 mg/100 ml) followed by Allahabad Safeda, Apple Colour and R-72. The nectar having the recipe T_3 (20% pulp, 0.3% acidity and 17% TSS) had significantly higher ascorbic acid (6.58 mg/100 ml) at the time of preparation, but it was noted least (3.69 mg/100 ml) under the treatment T_5 (20% pulp, 0.3% acidity and 19% TSS). Thereafter, a similar trend was observed upto 150 days of storage under ambient condition and the product maintained supremacy by retaining maximum ascorbic acid (4.77 mg/100 ml) under the recipe T_3. The combined effects of cultivar and recipe showed similar response to ascorbic acid as observed with individual treatments alone. The decrease in ascorbic acid in nectar during storage might be due to oxidation or irreversible conversion of L-ascorbic acid into dehydro ascorbic acid in the presence of enzyme ascorbic acid oxidase (ascorbinase) caused by trapped or residual oxygen in the glass bottles. Similar reduction in ascorbic acid content has also been reported in guava beverages (Baramanray *et al.*, 1995; Pandey and Singh, 1998; Pandey, 2004).

Acidity

The acidity in guava nectar increased in all the cultivars and recipe treatments under ambient condition at increasing period of storage upto 150 days (Table 2). However, the acidity was not influenced significantly at the time of preparation due to cultivars and recipe in nectar. Subsequently, at 30 days of storage, it increased significantly and the cultivar R-72 retained its higher level (0.46%) followed by Apple Colour, Allahabad Safeda and L-49. Thereafter, the same trend was observed upto 150 days of storage. The nectar having recipe T_6 (20% pulp, 0.3% acidity and 20% TSS) had significantly higher level (0.46%) of acidity at 30 days of storage, while lowest content (0.34%) was noted under the recipe T_3 and the same trend was observed upto 150 days of storage. The interaction of cultivar and recipe showed an increasing trend of acidity with increasing period of storage upto 150 days.

The increase in acidity in nectar during 150 days of storage may be due to formation of organic acids by ascorbic acid degradation as well as progressive decrease in the pectin content. Similar findings were also reported in the beverages of papaya (Kumar, 1990), mango (Rabbani, 1992) and guava (Baramanray *et al.*, 1995; Pandey and Singh, 1998; Pandey, 2004).

Reducing and Total Sugar

The reducing and total sugar content in guava nectar showed an increasing trend with all the cultivars and recipe treatments at increasing period of storage upto 150 days under ambient condition (Table 3 and 4). The nectar

Table 1. Effect of different cultivars and recipes on ascorbic acid (mg/100 ml) of stored guava nectar

Treatments	Storage period (in days)									
Cultivar / Recipe	0 (at the time of preparation)					150				
	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean
T_1	4.25	5.25	6.67	4.50	5.17	2.27	3.67	5.25	2.00	2.29
T_2	5.83	5.92	6.58	5.08	5.85	3.67	4.42	5.42	3.00	4.12
T_3	6.58	6.92	7.58	5.25	6.58	4.33	5.08	5.67	4.00	4.77
T_4	5.83	6.08	5.67	4.33	5.48	3.66	4.83	4.17	2.67	3.83
T_5	3.50	4.58	4.42	2.25	3.69	2.00	2.50	3.00	1.13	2.16
T_6	3.25	4.75	6.08	4.18	4.57	1.33	3.50	4.75	1.33	2.73
Mean	4.87	5.58	6.17	4.27	5.22	2.88	4.00	4.71	2.35	3.48
			CD at 5%					CD at 5%		
Cultivar			0.019					0.022		
Recipe			0.023					0.027		
Cultivar x Recipe			0.047					0.038		

Table 2. Effect of different cultivars and recipes on acidity (%) of stored guava nectar

Treatments	Storage period (in days)									
Cultivar	0 (at the time of preparation)					150				
Recipe	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean
T_1	0.32	0.32	0.32	0.33	0.32	0.87	0.76	0.63	1.03	0.82
T_2	0.31	0.32	0.33	0.33	0.32	0.83	0.72	0.58	0.97	0.77
T_3	0.32	0.32	0.32	0.32	0.32	0.77	0.65	0.49	0.90	0.70
T_4	0.33	0.32	0.33	0.33	0.33	0.90	0.81	0.68	1.06	0.86
T_5	0.32	0.32	0.32	0.34	0.33	0.94	0.86	0.74	1.09	0.91
T_6	0.32	0.34	0.33	0.33	0.33	0.98	0.90	0.79	1.11	0.94
Mean	0.32	0.32	0.32	0.33	0.32	0.88	0.78	0.65	1.02	0.83
			C D at 5%					C D at 5%		
Cultivar			NS					0.011		
Recipe			NS					0.014		
Cultivar x Recipe			NS					NS		

prepared from cultivar R-72 contained significantly higher reducing sugar and total sugar followed by Apple Colour, Allahabad Safeda and L-49 from the time of preparation (0 day) to 150 days of storage. The treatment T_6 (20% pulp, 0.3% acidity and 20% TSS) had a higher amount of reducing and total sugar, while recipe T_1 (20% pulp, 0.3% acidity and 15% TSS) recorded the minimum fraction of both the sugars from the time of preparation (0 day) to end of the storage period (150 days).

The increase in different fractions of sugar might be due to hydrolysis of polysaccharides like starch, pectin and inversion of non-reducing sugar into reducing sugar, as increase in reducing sugar was correlated with the decrease in non-reducing sugar. The increased level of total sugar was probably due to conversion of starch and pectin into simple sugars. The present findings are in agreement with the report of Murari and Verma (1989) and Baramanray *et al.* (1995) in guava nectar and Shrivastava (1998) in mango beverages.

Organoleptic evaluation of nectar

The organoleptic score decreased with all the cultivar and recipe treatments at increasing period of storage (Table 5). The nectar prepared from cultivar L-49 had a higher score (24.28) followed by Allahabad Safeda (23.28) at the time of preparation and the product of both the cultivars were highly acceptable upto 150 days of storage. The nectar prepared with the recipe T_3 (20% pulp, 0.3% acidity and 17% TSS) had highest organoleptic score followed by T_2 (20% pulp, 0.3% acidity and 16% TSS) upto 150 days of storage. The combined effects of cultivar and recipe also showed similar response to organoleptic score for nectar upto 150 days of storage. The nectar had a gradual decrease in organoleptic quality during storage period at ambient condition.

There was considerable decrease in sensory mean

Table 3. Effect of different cultivars and recipes on reducing sugar (%) of stored guava nectar

Treatments	Storage period (in days)									
Cultivar	0 (at the time of preparation)					150				
Recipe	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean
T_1	4.46	4.15	4.00	4.70	4.33	7.00	6.86	5.65	8.86	7.09
T_2	5.37	5.00	4.85	5.55	5.19	7.79	7.66	6.49	9.66	7.90
T_3	6.17	5.85	5.75	6.35	6.03	8.63	8.40	7.24	10.40	8.67
T_4	7.59	7.35	7.15	7.85	7.48	10.23	10.02	8.84	12.08	10.29
T_5	8.70	8.50	8.25	9.00	8.61	11.52	11.24	10.10	13.27	11.53
T_6	9.87	9.75	9.35	10.10	9.77	13.02	12.43	11.27	14.43	12.79
Mean	7.03	6.77	6.56	7.26	6.90	9.69	9.43	8.27	11.45	9.71
			CD at 5%					CD at 5%		
Cultivar			0.0085					0.0233		
Recipe			0.0102					0.0284		
Cultivar x Recipe			0.0205					0.0569		

Table 4. Effect of different cultivars and recipes on total sugar (%) of stored guava nectar

Treatments	Storage period (in days)									
Cultivar / Recipe	0 (at the time of preparation)					150				
	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean
T_1	14.25	14.15	14.05	14.35	14.20	14.63	14.58	14.46	14.76	14.61
T_2	15.25	15.15	15.05	15.35	15.20	15.58	15.52	15.41	15.64	15.55
T_3	16.25	16.15	16.05	16.35	16.20	16.52	16.45	16.35	16.64	16.49
T_4	17.25	17.15	17.05	17.35	17.20	17.70	17.61	17.53	17.80	17.66
T_5	18.25	18.15	18.05	18.35	18.20	18.78	18.67	18.60	18.87	18.73
T_6	19.25	19.15	19.05	19.35	19.20	19.93	19.72	19.66	20.66	19.87
Mean	16.75	16.65	16.55	16.85	16.70	17.19	17.09	17.00	17.31	17.15
			CD at 5%					CD at 5%		
Cultivar			0.04					0.0076		
Recipe			0.05					0.0960		
Cultivar x Recipe			NS					0.1960		

Table 5. Effect of different cultivars and recipes on organoleptic quality (score) of stored guava nectar (based on a scale 36)

Treatments	Storage period (in days)									
Cultivar / Recipe	0 (at the time of preparation)					150				
	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean
T_1	21.80	23.92	24.93	20.82	22.87	16.52	18.29	20.27	16.00	17.77
T_2	23.76	25.93	25.96	22.27	24.48	18.83	19.00	21.55	17.89	19.32
T_3	25.22	26.97	27.00	24.27	25.87	19.65	21.65	23.44	20.15	21.22
T_4	20.23	21.99	24.00	18.87	21.29	15.29	17.00	19.32	14.83	16.61
T_5	19.12	20.93	22.90	17.17	20.03	13.93	15.98	18.00	13.00	15.23
T_6	18.09	19.91	20.87	16.09	18.74	15.54	14.32	16.79	11.82	13.87
Mean	21.37	23.28	24.28	19.92	22.21	16.13	17.71	19.89	15.61	17.34
			CD at 5%					CD at 5%		
Cultivar			0.0220					0.0410		
Recipe			0.0270					0.0500		
Cultivar x Recipe			0.0540					0.0990		

T_1: 20% pulp, 0.3 % acidity and 15% TSS ;T_2: 20% pulp, 0.3 % acidity and 16% TSS; T_3: 20% pulp, 0.3 % acidity and 17% TSS; T_4: 20% pulp, 0.3% acidity and 18% TSS; T_5: 20% pulp, 0.3 % acidity and 19% TSS; T_6: 20% pulp, 0.3 % acidity and 20% TSS

score for taste, flavour and overall acceptability during storage. The sensory mean score for each attributes was highest on the day of preparation, which decreased with increasing period of storage. There are many extrinsic factors which determine the storage stability of products and temperature plays an important role among them. There are certain biochemical changes which occurs under low pH and high temperature that leads to formation of brown pigment and produces off flavour in the beverages.

The other possible reasons could be the loss of volatile aromatic substances responsible for flavour and taste which decreased acceptability in storage at ambient condition. The present findings are in accordance with the view of Baramanray *et al.* (1995) in guava nectar and Thakur and Barwal (1998) in kiwi fruit squash.

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