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Effect of Different Pulp Concentrations on Changes in Chemical Constituents of Guava Nectar Cv. Lalit under different Storage Conditions

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Abstract: *An experiment entitled Effect of different pulp concentrations on changes in chemical constituents of guava nectar cv. Lalit under different storage conditions was carried out during the year 2015-2016 at Post Harvest Technology Laboratory, Horticulture Section, College of Agriculture, Dr. P.D.K.V., Akola by using Lalit variety of Guava with the objectives to study the effect of pulp concentration on guava nectar under different storage conditions, to assess the chemical changes of guava nectar under different storage conditions and to find out the suitable pulp concentration and storage condition for guava nectar. The experiment was laid out in Factorial Completely Randomized Design which consists of five concentrations of guava pulp viz. 14%, 16%, 18%, 20% and 22% and two storage conditions viz. refrigerated and ambient conditions with three replications. The prepared guava nectar as per treatments was filled in 300 ml pre-sterilized glass bottles and stored at refrigerated and ambient storage conditions. The results indicated that, there was a gradual increased in TSS, reducing sugars, total sugars and pH content of the guava nectar in both the storage conditions. However, the titrable acidity, non-reducing sugars and ascorbic acid were decreased. The minimum changes in chemical composition of guava nectar were observed in refrigerated condition as compared to ambient storage conditions. The guava nectar prepared with 18 per cent guava pulp having 15.11°B TSS and 0.3 per cent acidity stored in refrigerated storage showed minimum changes in all chemical parameters.*

Keywords*: Guava, Pulp, Nectar, Bio-chemical parameters and Storage.*

INTRODUCTION

Guava (*Psidium guajava* L.) which belongs to the family Myrtaceae. It is claims to be the fourth most important fruit in area and production after mango banana and citrus. Guava is an important fruit crop of India. It is also known as 'Poor man's apple of tropics (Kamath *et al*., 2008). It is normally consumed fresh as a dessert fruit or processed into puree, juice, concentrate, jam, jelly, nectar or syrup (Jagtiani *et al*. 1988). Guava fruit consists of 20% peel, 50% flesh portion and seed core. It also contains 74-84% moisture, 13-26% dry matter, 0.8-1.5% protein, 0.4-0.7% fat and 0.5-1.0% ash and the fruit is considered as an excellent source of vitamin C (299 mg/100 g) and pectin (1.15%). The fruit has an appreciable amount of minerals such as phosphorus (23 - 37 mg/100 g), calcium (14 - 30 mg/100 g), iron (0.6 - 1.4 mg/100 g) as well as vitamins like niacin, thiamine, riboflavin and vitamin A (Mahendran, 2010).

Nectar is one of the refreshing beverages having zero carbonation, relatively few preservatives and excellent source of several important vitamins and minerals and is used as health drink, (Khurdiya and Sagar, 1991) which contains about 20 per cent fruit pulp and 15 per cent total soluble solids and about 0.3 per cent acid and are not diluted before serving. 'Lalit' is one of the most popular and commercial variety for preparation of nectar due its

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attractive pulp colour, flavour and taste. Many synthetic drinks containing saccharine are consumed which have very low nutritive value. Use of guava pulp may increase nutritive value of drink considerably. Also our country is witnessing a shift in consumer trend for synthetic drink of fruit based product. Therefore, scientific approach in preparation and preservation of guava nectar is required. Similarly storage stability study of nectar at the different conditions is essential. Thus, keeping in view the potentialities of guava nectar the experiment was conducted on the Effect of different pulp concentrations on changes in chemical constituents of guava nectar cv. Lalit under different storage conditions.

MATERIALS AND METHOD

An experiment was conducted in Post Harvest Technology Laboratory, Horticulture Section, College of Agriculture, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (MS) during the year 2015-16. For the experimentation, fully ripe, uniform size guava fruits were selected. The guava fruits were cut into slices with stainless steel knife. The pulp was obtained by homogenizing the slices into homogenizer with addition of small quantity of water. The seed and pulp are separated by passing juice through 60 mm stainless steel sieve.

The experiment was laid out in Factorial Completely Randomized Design which consists of five concentrations of guava pulp *viz.* 14%, 16%, 18%, 20%, and 22% and two storage conditions *viz.* refrigerated and ambient conditions with three replications. The guava nectar was prepared by using above different concentrations of pulp having 15°B TSS and 0.3% with using Sodium benzoate 300 ppm as preservative.

Guava nectar was filled into the pre-sterilized bottles of 300 ml capacity and sealed air tight using crown corks and stored as per treatment for further observations. Different proportions of nectars were analyzed for different biochemical parameters viz; TSS (°Brix), titrable acidity (%) and reducing sugars (%), total sugars according to the procedure reported by (Ranganna, 1986) at initial stage and 90th days of storage.

RESULT AND DISCUSSION

(A) TSS (°Brix)

Effect of recipes

The data presented in Table 1 exhibited significant differences in respect of total soluble solids due to different recipes at initial stage and 90th day of observation. In general, the total soluble solids of guava nectar were gradually increased in all the recipes. Significantly minimum increase (from 15.11 to 15.27°B) in total soluble solids at 90 days of storage was observed in treatment P_3 (18% guava pulp) which was followed by treatment P_4 (20% guava pulp). However, the change in total soluble solids was found to be more (from 13.00 to 13.41°B) in treatment P_1 (14% guava pulp). Thus, minimum total increase (0.16°B) in total soluble solids during 90 days of storage was noticed when guava nectar was prepared with 18 per cent pulp.

Effect of storage conditions

The data presented in Table 1 with respect of total soluble solids as influenced by different storage conditions shows significant differences in respect of total soluble solids at 90th days of observation. However, at initial stage, the data was found to be non-significant. The increase in total soluble solids of guava nectar during storage for 120 days was found to be significantly minimum (15.11 to 15.44°B) at refrigerated storage conditions as compared to ambient storage conditions (from 15.11 to 15.47 °B). The guava nectar remained in good condition for only 90 days thereafter it was spoiled.

Interaction effect

An interaction effect of recipes and storage conditions on total soluble solids content of guava nectar was found to be significant at both the stages of observation (Table 2). Significantly less change in total soluble solids (0.21°B) of guava nectar was observed in treatment combination P_3S_1 (18% guava pulp + refrigerated storage). It was followed by treatment combination P_4S_1 (20% guava pulp +refrigerated storage). However, maximum change (0.54°B) in total soluble solids was noticed with the treatment combination P_1S_2 (14% guava pulp +ambient storage).

Table 1
Changes in TSS, Acidity, Reducing sugars, Total sugars and pH of guava nectar as influenced by different recipes and storage

	TSS			*Acidity*			*Reducing sugars*			*Total sugars*			*pH*		
	Storage period (Days)														
Treatment	*Initial*	*90th*	*Increase in TSS (°B) after 90 days*	*Initial*	*90th*	*Decrease in acidity (%) after 90 days*	*Initial*	*90th*	*Increase in Reducing sugars (%) after 90 days*	*Initial*	*90th*	*Increase in Total sugars (%) after 90 days*	*90th*	*Initial*	*Increase in pH after 90 days*
P_1 – 14% Guava pulp	13.00	13.41	0.41	0.27	0.10	0.17	3.67	4.81	1.13	12.18	12.94	0.76	3.14	3.35	0.21
P_2 - 16% Guava pulp	14.05	14.40	0.34	0.29	0.11	0.18	4.28	5.39	1.12	12.85	13.56	0.71	3.12	3.31	0.19
P_3 - 18% Guava pulp	15.11	15.27	0.16	0.30	0.21	0.09	4.69	5.30	0.60	13.45	13.85	0.40	3.09	3.20	0.11
P_4 - 20% Guava pulp	16.17	16.38	0.21	0.33	0.20	0.13	5.21	5.96	0.75	14.67	15.15	0.48	3.07	3.23	0.16
P_5 - 22% Guava pulp	17.23	17.50	0.27	0.35	0.21	0.14	5.60	6.46	0.87	16.55	17.12	0.56	3.05	3.22	0.18
F test	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig
SE(m)±	0.0078	0.0091	0.0013	0.006	0.005	0.010	0.0105	0.0348	0.0243	0.012	0.014	0.002	0.008	0.011	0.002
CD at 5%	0.0229	0.0265	0.0037	0.016	0.014	0.029	0.0306	0.1016	0.0710	0.036	0.041	0.005	0.024	0.031	0.007
Storage Conditions															
S_1-Refrigerated storage	15.11	15.31	0.15	0.31	0.18	0.12	4.69	5.37	0.68	13.94	14.41	0.47	3.09	3.21	0.12
S_2 -Ambient Storage	15.11	15.47	0.36	0.31	0.15	0.16	4.69	5.80	1.11	13.94	14.64	0.70	3.09	3.28	0.18
F test	NS	Sig	Sig	NS	Sig	Sig	NS	Sig	Sig	NS	Sig	Sig	NS	Sig	Sig
SE(m)±	0.0045	0.0053	0.0007	0.003	0.003	0.006	0.0061	0.0201	0.0140	0.007	0.008	0.001	0.005	0.006	0.001
CD at 5%	0.0132	0.0153	0.0021	0.009	0.008	0.017	0.0177	0.0587	0.0410	0.021	0.024	0.003	0.014	0.018	0.004

Table 2
Changes in TSS, Acidity, Reducing sugars, Total sugars and pH of guava nectar due to interaction of recipes and storage conditions

	TSS			*Acidity*			*Reducing sugars (%)*			*Total sugars (%)*			*pH*		
	Storage period (Days)														
Treatment	*Initial*	*90th days*	*Increase in TSS (°B) after 90 days*	*Initial*	*90th days*	*Decrease in acidity (%) after 90 days*	*Initial*	*90th days*	*Increase in Reducing sugars (%) after 90 days*	*Initial*	*90th days*	*Increase in Total sugars (%) after 90 days*	*90th days*	*Initial*	*Increase in pH after 90 days*
P_1S_1	13.00	13.28	0.28	0.27	0.11	0.15	3.67	4.53	0.85	12.18	12.79	0.61	3.14	3.33	0.19
P_2S_1	14.05	14.29	0.24	0.29	0.12	0.17	4.28	5.08	0.80	12.85	13.39	0.54	3.12	3.29	0.17
P_3S_1	15.11	15.23	0.13	0.30	0.24	0.06	4.69	5.15	0.46	13.45	13.77	0.32	3.09	3.18	0.09
P_4S_1	16.17	16.33	0.16	0.33	0.22	0.11	5.21	5.81	0.60	14.67	15.07	0.40	3.07	3.21	0.14
P_5S_1	17.23	17.43	0.21	0.35	0.23	0.12	5.60	6.27	0.67	16.55	17.01	0.46	3.05	3.21	0.16
P_1S_2	13.00	13.53	0.54	0.27	0.09	0.18	3.67	5.08	1.41	12.18	13.09	0.91	3.14	3.37	0.23
P_2S_2	14.05	14.50	0.45	0.29	0.10	0.19	4.28	5.71	1.43	12.85	13.72	0.87	3.12	3.33	0.20
P_3S_2	15.11	15.31	0.20	0.30	0.18	0.12	4.69	5.44	0.75	13.45	13.94	0.48	3.09	3.22	0.13
P_4S_2	16.17	16.43	0.27	0.33	0.17	0.16	5.21	6.11	0.90	14.67	15.24	0.57	3.07	3.24	0.17
P_5S_2	17.23	17.56	0.28	0.35	0.19	0.16	5.60	6.66	1.06	16.55	17.22	0.67	3.05	3.24	0.19
'F' test	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig
SE(m)±	0.0101	0.0117	0.0016	0.007	0.006	0.013	0.014	0.045	0.018	0.016	0.018	0.002	0.011	0.014	0.003
CD at 5%	0.0295	0.0343	0.0048	0.020	0.018	0.037	0.040	0.131	0.054	0.047	0.053	0.007	0.031	0.040	0.009

The results mentioned above are in conformity with the findings of various research workers. Deka *et al.* (2005) reported that, the increase in TSS was slow under low temperature and cool chamber as compared to ambient temperature. Shrinivas *et al.* (2007) observed that, the TSS of pomegranate squash was increased during storage period. This might be due to hydrolysis of polysaccharides like starch, cellulose and pectin substance into simple substance. This kind of observations are closely proximate with Murari and Verma (1989) in guava nectar, Kalra *et al.* (1991) in mango nectar, Pandey (2004) in guava beverages, Choudhary *et al.* (2008) in guava nectar.

(B) Acidity

Effect of recipes

Change in acidity of stored guava nectar at 90 days due to different recipes was found to be significant. In general, acidity of guava nectar was gradually decreased in all the recipes. Minimum decrease (from 0.30 to 0.21%) in acidity at 90 days of storage was observed in treatment P_3 treatment (18% guava pulp) which was followed by treatment P_4 treatment (from 0.33 to 0.20%). Thus, minimum total decrease in acidity (0.09%) during 90 days of storage noticed when guava nectar prepared with 18 per cent guava pulp.

Effect of storage conditions

Acidity of guava nectar exhibited significant changes at all the stages of observation except at initial stage when it was stored under different storage conditions. The acidity of guava nectar was decreased during storage period at all the storage conditions. The decrease in acidity of guava nectar during storage of 90 days was found to be significantly minimum (from 0.31 to 0.12%) at refrigerated storage conditions as compared to ambient storage conditions (from 0.31 to 0.16%). The reduction in acidity was significantly less (0.12%) in treatment S_1 (cold storage) as compared to ambient storage (S_2) conditions (0.16%).

Interaction effect

An interaction effect of recipes and storage conditions on acidity content of guava nectar was found to be significant at initial stage to 90th days of storage period. The guava nectar prepared from different recipes and stored in refrigerated storage showed less change in acidity at 90 days of storage as compared to stored in ambient conditions. Less change in acidity (0.06%) of guava nectar was observed in treatment combination P_3S_1 (18% guava pulp + refrigerated storage). However, maximum change (0.19%) in acidity was noticed with the treatment combination P_2S_2 (16% guava pulp stored in ambient storage).

The results mentioned above are in conformity with the findings of various research workers. Murari and Verma (1989) reported that the acidity percentage of guava nectar was decreased significantly. Chakraborthy *et al.* (1991) reported that, decreasing acidity in canned mango nectar, it might be due to partial hydrolysis of complex carbohydrate into simple sugar. A decreasing trend in acidity per cent with increasing storage period have been reported by Pandey (2004) in guava beverages. Choudhary *et al.* (2008) studied that the acidity content in guava nectar showed the minimum change during storage.

(C) Reducing sugars

Effect of recipes

Data presented in Table 1 in respect to change in reducing sugars of guava nectar due to different recipes was found to be significant. In general, reducing sugars of guava nectar was gradually increased in all the recipes. Minimum increase (from 4.69 to 5.30 %) in reducing sugars of guava nectar at 90 days of storage was observed in treatment P_3 (18% guava pulp) which was followed by treatment P_4 (20% guava pulp) *i.e.* from 5.21 to 5.96%. Thus, significantly minimum increase (0.60%) in reducing sugars was noticed in treatment P_3 (18% guava pulp) followed by treatment P_4 (20% guava pulp) during 90 days of storage. However, maximum change (1.13%) was noticed in treatment P_1 (14% pulp).

Effect of storage conditions

The data in respect of reducing sugars presented in Table 1 as influenced by the different storage condition shows significant change at 90 days of storage period under different storage conditions. However, it was non significant at initial stage. The reducing sugars of guava nectar were increased

during storage period. The increase in reducing sugars of guava nectar during storage of 90 days was found to be significantly minimum (from 4.69 to 5.71%) at refrigerated storage conditions as compared to ambient storage conditions (from 4.69 to5.80%). The increase in reducing sugars was significantly less (0.68%) in treatment S_1 (refrigerated storage) as compared to ambient storage at 90 days (S_2) conditions (1.11%).

Interaction effect

An interaction effect of recipes and storage conditions on reducing sugars content of guava nectar was found to be significant at initial and at 90 days of storage period. The guava nectar prepared from different recipes and stored in cold storage showed less change in reducing sugars at 90 days of storage as compared to stored in ambient conditions. Less change in reducing sugars (0.76%) of guava nectar was observed in treatment combination P_3S_1 (18% guava pulp + refrigerated storage conditions) followed by increase in reducing sugars (0.96%) in the treatment combination P_4S_1 (20% guava pulp + refrigerated storage conditions).

From the above data, it can be revealed that, the increasing rate of reducing sugars was significantly influenced by different treatments and storage periods. The increase in reducing sugars could be attributed to the gradual inversion of non reducing sugars into reducing sugars (Mehta and Bajaj, 1983) or might be assigned to the conversion of non reducing sugars owing to the process of hydrolysis (Jain *et al.* 1984). This kind of observations are closely proximate with Murari and Verma (1989) in guava nectar, Chakraborthy *et al.* (1991) in canned mango nectar and Kalra *et al.* (1991) in mango nectar, Pandey (2004) in guava beverages, Choudhary *et al.* (2008) in guava nectar.

(D) Total Sugars

Effect of recipe

In general total sugars of guava nectar was gradually increased in all the recipes. Significantly minimum increase *i.e.* from 13.45 to 13.85% in total sugars of guava nectar at 90 days of storage was observed in treatment P_3 (18% guava pulp) which was followed by treatment P_4 (20% guava pulp) *i.e.* from 14.67 to 15.15%. Thus, significantly minimum increase (0.40%) in total sugars was noticed in treatment P_3 (18% guava pulp), followed by treatment P_4 (20% guava pulp) during 90 days of storage.

Effect of storage conditions

Data revealed significant increase in total sugars content of stored guava nectar at 90^{th} days due to storage conditions. The increase in total sugars of guava nectar during storage of 90^{th} days was found to be significantly minimum (from 13.94 to 14.65%) at refrigerated storage conditions as compared to ambient storage condition (from 13.94 to 14.64%). Minimum increase (0.47%) in total sugars content was observed with the treatment S_1 (refrigerated storage) as compared to ambient storage (S_2) conditions (0.70%).

Interaction effect

An interaction effect of recipes and storage conditions on total sugar content of guava nectar was found to be significant at all stages of observation. The guava nectar prepared from different recipes and stored in refrigerated storage showed less change in total sugars at 90 days of storage as compared to stored in ambient conditions. Less change in total sugars (0.42%) of guava nectar was observed in treatment combination P_3S_1 (18% guava pulp + refrigerated storage condition).

Sogi and Singh (2001) recorded increasing trend in kinnow squash with the advancement of storage. They further reported that, this might be due to partial hydrolysis of complex carbohydrate and hydrolysis must have been accelerated due to high temperature and acidity. Similar types of observation for total sugar of various products have been reported by Murari and Verma (1989) in guava nectar, Chakraborthy *et al.* (1991) in canned mango nectar, Kalra *et al.* (1991) in mango nectar, Pandey (2004) in guava beverages, Chaudhary *et al.* (2008) in guava nectar.

(E) pH

Effect of recipes

The data in respect of pH content of guava nectar as influenced by different recipes and storage conditions was recorded upto 90 days of storage presented in Table 1 exhibited significant

differences. In general pH of guava nectar was gradually increased in all the recipes. Minimum increase (from 3.09 to 3.20) in pH of guava nectar at 90 days of storage was observed in treatment P_3 (18% guava pulp) which was followed by treatment P_4 (20% guava pulp) *i.e.* from 3.07 to 3.23.

Effect of storage conditions

pH content of guava nectar as influenced by the different storage conditions exhibited significant differences at 90th days of storage period. However, significant change in pH of stored guava nectar under different storage conditions was not observed at initially. In general pH of guava nectar was gradually increased during storage at both the storage conditions. The increase in pH of guava nectar during storage of 90 days was found to be significantly minimum (from 3.09 to 3.21) at refrigerated storage conditions as compared to ambient storage conditions (from 3.09 to 3.28). Minimum increase (0.17) in pH was observed in treatment S_1 (refrigerated storage) as compared to ambient storage (S_2) conditions (0.18).

Interaction effect

Data in respect of pH of guava nectar shows significant effect due to interaction effect of different recipes and storage conditions during storage. Guava nectar prepared from different recipes and stored in refrigerated storage conditions exhibited comparatively less decline in pH content at 90 days of storage than stored in ambient storage conditions. Significantly, less decline (0.09) in pH (3.09 to 3.18) was noticed in treatment combination P_3S_1 (18% guava pulp stored in refrigerated storage conditions). While, it was maximum (0.23) in treatment P_1S_2 (14% guava pulp in ambient storage)

The increase in pH of guava nectar during storage could be attributed to simultaneous increase in storage temperature. The process of increase in pH was faster in ambient storage condition as compared to refrigerated storage.

These findings are in close agreement with the findings of different research workers. Mehta and Rathore (1976) noticed that, throughout the storage life of aonla juice, the pH remained constant and did not change with time, treatments and storage temperature. Similar types of observation for total sugar of various products have been reported by Murari and Verma (1989) in guava nectar and Chakraborthy *et al.* (1991) in canned mango nectar.

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