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Original Research Article

Evaluation of Some Late Varieties of Mango (*Mangifera indica* L.) for Nectar Product Processing

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Keywords

Langra, Amrapali, Totapuri, Neelum, Neeleshan and Nectar Quality

A B S T R A C T

The experiment on 'evaluation of some late varieties of mango (*Mangifera indica* L.) for nectar product processing' was carried out at the PHT Laboratory, N.M. College of Agriculture NAU, Navsari during2010-11.An experiment was conducted with five late varieties of mango *viz*., Langra, Amrapali, Totapuri, Neelum and Neeleshan in C.R.D. with three repetitions. In respect of TSS, total sugars, reducing sugar and acidity were found higher in nectar of Neeleshan in late variety, which was found increased during 6 months of storage. While, non-reducing sugar and ascorbic acid content was found higher in nectar of Amrapali and Neelumin late varieties, which was found decreased during 6 months of storage.

Introduction

The mango [*Mangifera indica* L.] is a major fruit crop of South Gujarat. From mango different processed product are made. Nectar is one of the important products of them. Mango fruit nectar could be very nutritious, commercially popular and economical. However, there are large numbers of mango varieties in India and their nectar quality may differ depending upon the flavor and other characteristics of the cultivar.

In India, area under mango cultivation is 25.05 lakh hectares with annual production of 137.92 lakh MT. The major growing states are Uttar Pradesh, Andra Pradesh, Bihar, Karnataka, Tamilnadu, Kerala, Maharashtra, Orisa, West Bengal and Gujarat. In Gujarat total area under mango cultivation is about 1.09 lakh ha with a production of about 9.30 lakh M.T (Anon., 2009). Mango is mostly consumed as fresh fruit, but due to its perishable nature it cannot be stored for longer time. In order to enhance availability during the off season, mango pulp is processed into soft drinks, juice, nectar, squash, RTS beverages, syrup, jam, jelly, chutney, powder, mango bar, toffees and canned mango slices. (Hashmi *et al.*, 2007; Desai, 2006 and Hussain *et al.*, 2003).

Materials and Methods

The extraction of the pulp select healthy, disease as well as pest free fruits then selected fruits washed with water. The pulp was extracted by squeezing by hand collect them in well cleaned container to avoid any

microbial attack. Then pulp was strained through 1 mm mesh stainless steel sieve. Mango nectar prepared by using mango pulp, sugar, citric acid to obtain subsequent percentage.

Mango nectar

Mango pulp - 20%
TSS - 20%
Acidity - 0.3%

The prepared nectar will be heated up to 85^0 C and potassium metabisulphite @ 100 mg/kg of final product was added and filled into the clean and sterilized plain glass bottle of 200 ml. The bottle will be sealed with crown cork immediately. The filled bottle were pasteurized in boiling water for 15 minute and cooled then stored in room temperature for further storage studies.

Results and Discussion

The data regarding physical characters of fresh mango ripe fruit of late group variety are furnished in Table 1.

In late varieties, fruit weight was found higher (388.000 g) in Totapuri. The lowest (112.000 g) fruit weight was found in the Amrapali. Pulp was found maximum (287.000 g) in Neeleshan and minimum (64.000 g) in Amrapali. Peel was found maximum (83.000 g) in Totapuri and minimum (24.000 g) in the Amrapali. Stone was found maximum (58.000 g) in Totapuri and minimum (26.000 g) in Langra. Similar findings were found by, Anonymous (2005) in cv. Sonpari, Amrapali and Sindhu; Jain *et al.,* (1996) in cv. Kesar and Amrapali.

The data on changes in TSS,total Sugar and reducing sugarof mango nectar was affected by various treatments during the storage have been presented in Table 2.

The perusal of data recorded at six months of storage revealed that maximum (20.966%) TSS was recorded in Neeleshan which was statistically at par with Langra, Totapuri and Neelum variety. However, Langra was also at par with Totapuri and Neelum variety. The minimum (20.633%) TSS was recorded in nectar of Amrapali which was at par with Neelum variety.

The mean value of all the three and six months of storage period indicate that the maximum TSS was obtained in Neeleshan as well as Langra and Totapuri while lowest level of TSS showed by nectar of Amrapali variety. This may be due to the physico-chemical constituent of fresh mango pulp of respective varieties. Similarly, Chakraborty and Debnath (2004) observed that the fourteen diverse cultivars of mango and assessed for their suitability for juice making.

The chemical composition of juice showed a slight increase trend was observed in TSS content in all the cultivars. It is evidence of present finding. At the initial stage non-significant difference of TSS was found among different processing of mango nectar. These variable results in TSS are in good agreement with the TSS remained unchanged. Further Verma and Gaur (2006) found that the TSS of phalsa nectar did not change in the first month of storage and thereafter, a slight increase was observed up to end of storage period. Further Jain *et al.,* (2007) observed that the TSS of aonla nectar increased continuously during storage. This might be happened due to acidic effect of added citric acid on nectar product lead to more hydrolysis of complex polysaccharides into simple sugar. Whereas, it was decreased with the lower level of acidity in Kesar this might be happened due to partial hydrolysis of complex polysaccharides in to simple sugar. Further Ahmed *et al.,* (2008) reported

that the TSS of mandarin RTS increased gradually during storage studies.

The total sugar content at 6 months of storage was observed maximum (19.200 %) in Langra which was at par with Neeleshan and followed by Neelum and Totapuri. While, lowest (18.733 %) total sugar was recorded in Amrapali which was at par with Totapuri and Neelum variety.

Looking to the initial status of the total sugars of mango nectar, the maximum (18.400 %) total sugar was found in Neeleshan and it slowly increased throughout the storage and remained highest (18.714 %) in mean value. At initial stage the lowest (17.500 %) total sugar content found in variety Totapuri and slowly increased up to 6 months and remained lowest (18.766 %) than other varieties. In respect of higher total sugars content of nectar of Neeleshan, Langra and Neelum variety was found equally good.In general, the total sugars in mango nectar recorded steady increased during storage period, which was a function of breakdown of insoluble polysaccharides into simple sugars. In this treatment it contained highest levels of TSS consist of cellulose which is mainly form of sucrose are broken down into simple sugar and raised the level of total sugar. This finding is in agreement with those of Altaf *et al.,* (2006) who had observed that the total sugars content in mango nectar showed the minimum change during storage.

At 0, 3 and 6 months of storage, significantly maximum (8.533%) value of reducing sugars was observed in Totapuri which was at par with Neeleshan and Neelum variety. The lowest (7.766 %) reducing sugar was found in Langra variety which was at par with Amrapali. Looking to the initial status of the mango nectar product with respect to reducing sugar content Totapuri recorded the highest (6.230 %) reducing sugar which increased and remained higher (8.533 %) as compared to other varieties throughout the storage period. The lowest (5.670 %) reducing sugar was found in Langra variety. In respect to higher reducing sugar content in nectar of Totapuri and Neeleshan was equally good.

The nectar of Totapuri in late variety also showed the more increased in reducing sugar among the treatments having same level of acidity because having the highest levels of TSS, this increase in reducing sugars with the advancement of different varietal treatment could be mainly due to the deteriorative effect of high ambient temperature on product leading to inversion part of sucrose into glucose and fructose. Whereas, the late variety nectar of Amrapali exhibited less increased in reducing sugar contained lowest level of TSS. This might be associated with low level of TSS to less available of polysaccharides responsible for the conversion into the reducing sugar. Analogous trends in reducing sugars were also recorded by Altaf *et al.,* (2006) had observed that the reducing sugars content in mango nectar showed the minimum changes during storage. Further Jain *et al.,* (2007) had also observed that the reducing sugars of aonla nectar increased continuously during storage.

Data regarding changes in non-reducing sugar, ascorbic acid and acidity in the mango nectar affected by various treatments during the storage have been presented in Table 3.

The non-reducing sugar content showed significantly at highest level (11.433 %) was found in Langra which was at par with Amrapali variety and followed by Neeleshan and Neelum. While, the lowest (10.233 %)

level of non-reducing sugar was recorded in Totapuri variety, which was at par with Neelum and Neeleshan at 6 months of storage of mango nectar.

Looking to the initial status of the non-reducing sugars content of mango nectar, the variety Langra found the highest (12.696 %) non-reducing sugars which decreased and remained lowest (11.433 %) as compared to other varieties throughout the storage period. At initial stage the lowest level (11.270 %) was found in Totapuri. While trend of decreasing in non-reducing sugar was highest during three months of observation and then slowly decline with storage period increased. In respect to non-reducing sugar in nectar of Langra variety was found superior than rest of the varieties.

In general, the non-reducing sugar percent in mango nectar gradually decreased on prolongation of storage period decreased. This decrease may be due to significant increase in reducing sugar at the expense of non-reducing sugar. While, the same treatment showed highest decline in non-reducing sugar as the decreased in the levels of acidity showed in late variety nectar of Langra. Similar type of results were revealed by Ahmed *et al.,* (2008) reported that non-reducing sugar of mandarin was decreased gradually during storage studies.

At 6 months of storage, the significantly maximum (7.666 mg/100 g) ascorbic acid content was found in Amrapaliand it was at par with Neelum which was followed by Langra, Neeleshan and Totapuri variety. The significantly lowest (5.666 mg/100 g) level of ascorbic acid content was recorded in Totapuri and Neeleshan variety which was at par with Langra.

Looking to the change in ascorbic acid content in different varieties over a period of time it showed decreasing trend in all varieties. However, the mean value of all the three storage periods indicated that maximum level of ascorbic acid content was recorded in Amrapali which was followed by Neelum, Langra and Neeleshan variety. However statistically ascorbic acid content of nectar was higher in Amrapali as well as in Neelum variety which was equally good up to 3 months.

In general, there has been a significant decrease in ascorbic acid in mango nectar during storage period. This reduction might be due to oxidation of ascorbic acid into dehydroascorbic acid by oxygen. Ascorbic acid content of mango nectar beverages declined continuously during storage period. The highest inclined in ascorbic acid was recorded in late variety nectar of Amrapali variety, while lowest ascorbic acid observed in nectar of Totapuri variety. These losses of ascorbic acid were attributed to the effect of processing, storage time and exposure to light. These various observations confirmed by Ahmed *et al.,* (2008) studied that the declining trend in ascorbic acid contents of mandarin drink was increased as a function of storage. Similarly, Das (2009) reported that the ascorbic acid content of jamun nectar products declined continuously during storage.

At 6 months of storage acidity content in mango nectar, showed significant differences among all the mango varieties under study. The Totapuri variety was found significantly superior in relation to the highest (0.363 %) acidity content. While, the low (0.326 %) acidity content was found in Amrapali which was at par with Neelum variety.

The mean value of all the three and six months of storage period indicated that the maximum acidity was observed in Totapuri

as well as in Neeleshan followed by Langra variety. The increasing trend was initially at slow rate but it become faster with prolongation of storage period. While the lowest level of acidity was observed in nectar of Amrapali and Neelum varieties.

But, its pattern of increase varied according to the effect of varietal treatments. This increase in acidity percentage might be due to the accelerated degradation of pectin substances in nectar. These various findings are accordance with Altaf *et al.,* (2006) studied that the acidity content in mango nectar showed the minimum change during storage. In the present investigation little amount increase in acidity percentage was observed in late variety nectar of Amrapali.

This happening might be associated with the lowest level of acidity content in the product. As a result the late variety nectar of Totapuridue to pertaining highest TSS, consequently more increase in acidity. Whereas, the minimum acidity was observed in late variety nectar of Amrapali because it contained lowest levels TSS therefore less increased in acidity.

The variety-wise cost of production, benefit: cost ratio, net profit and saleprice of mango nectar were calculated per 100 litre basis and presented in Table 4. The net profit and B: C ratio was the highest (38.30 % and 1.38 respectively) in LV_3 (Totapuri) and at par with LV_2 (Amrapali) followed by LV_4 and LV_5 and being lowest (28.58% and 1.28, respectively) in LV_1 (Langra). The sale price with 20 per centprofit margin was the highest in LV_1 (Langra).

The evaluation of mango nectar product processing processed from different early mango varieties viz., Langra, Amrapali, Totapuri, Neelum and Neeleshan with respect to status of nectar in bio-chemical parameters like total soluble solids, total sugar, reducing sugar, non-reducing sugar, acidity and ascorbic acid at different storage period indicated that among different varieties under evaluation the late variety Amrapali and Neelum exhibited its superiority by recording nutritional composition viz., lower amount of total soluble solids and total sugar, higher amount of ascorbic acid and non-reducing sugar, minimum acidity and reducing sugar content, at initial, 3 and 6 months of storage than rest of the varieties.

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Table.1 Physical parameters of ripe fruit of Late Group mango varieties

Treatments		Av.wt of fruit	Peel	Stone	Pulp
LV_1	Langra	247.000	27.000	26.000	138.000
LV_2	Amrapali	112.000	24.000	26.000	64.000
LV_3	Totapuri	388.000	83.000	58.000	268.000
LV_4	Neelum	253.000	57.000	40.000	194.000
LV_5	Neeleshan	336.000	41.000	50.000	287.000

Table.2 Effect of various treatments on TSS, total sugar and reducing sugar mango nectar during storage

Treatments		TSS (%) [Storage periods]				Total sugar (%) [Storage periods]				Reducing sugar (%) [Storage periods]			
		0 Months	3 Months	6 Months	Mean	0 Months	3 Months	6 Months	mean	0 Months	3 Months	6 Months	mean
LV_1	Langra	20.066	20.866	20.900	20.588	18.366	18.400	19.200	18.655	5.67	6.163	7.766	6.533
LV_2	Amrapali	20.066	20.533	20.633	20.388	18.233	18.266	18.733	18.410	5.7	6.200	7.800	6.566
LV_3	Totapuri	20.033	20.766	20.833	20.533	17.500	18.300	18.766	18.188	6.23	6.843	8.533	7.202
LV_4	Neelum	20.066	20.600	20.800	20.466	18.333	18.433	18.800	18.522	6.12	6.480	8.273	6.957
LV_5	Neeleshan	20.066	20.966	20.966	20.644	18.400	18.633	19.110	18.714	6.2	6.600	8.383	7.061
	S.Em. ±	0.084	0.090	0.057	-	0.148	0.068	0.123	-	0.054	0.074	0.091	-
	CD at. 5%	NS	0.275	0.175	-	0.449	0.207	0.375	-	0.164	0.225	0.276	-
	CV %	0.73	0.76	0.48	-	1.41	0.64	1.13	-	1.57	1.99	1.94	-

Table.3 Effect of various treatments on non-reducing sugar, ascorbic acid and acidity mango nectarduring storage

Treatments		Non-reducing sugar (%) [Storage periods]				Ascorbic acid (mg/100g pulp) [Storage periods]				Acidity (%) [Storage periods]			
		0 Months	3 Months	6 Months	Mean	0 Months	3 Months	6 Months	mean	0 Months	3 Months	6 Months	Mean
LV_1	Langra	12.696	12.236	11.433	12.121	8.733	7.666	6.333	9.11	0.306	0.336	0.343	0.326
LV_2	Amrapali	12.533	12.066	10.933	11.844	10.000	8.666	7.666	8.73	0.306	0.316	0.326	0.314
LV_3	Totapuri	11.270	11.456	10.233	10.986	7.666	7.166	5.666	7.19	0.300	0.360	0.363	0.341
LV_4	Neelum	12.213	11.953	10.526	11.564	9.000	8.333	6.666	7.68	0.300	0.326	0.336	0.320
LV_5	Neeleshan	12.200	12.033	10.726	11.653	8.666	7.200	5.666	6.95	0.303	0.346	0.350	0.332
	S.Em. ±	0.160	0.099	0.179	-	0.438	0.378	0.421	-	0.002	0.0039	0.0039	-
	CD at. 5%	0.487	0.302	0.543	-	1.329	1.149	1.278	-	NS	0.011	.0119	-
	CV %	2.29	1.45	2.88	-	8.61	8.41	11.41	-	1.69	2.02	1.99	-

Table.4 Cost of production of mango nectar (100 KG)

Sr.No.	Particulars	LV_1	LV_2	LV_3	LV_4	LV_5
1	Cost of mango fruits @Rs10/-kg	200	150	100	150	150
2	Labour charges @ Rs100/- per Labour	1200	1000	1000	1100	1100
3	Glass bottles @Rs2/-	930	940	930	940	930
4	Sugar @Rs30/-per kg	205.38	206	228	209	221
5	Citric acid @ Rs200/-per kg	60	60	60	60	60
6	KMS @ Rs300/- per kg	3	3	3	3	3
7	Crown caps @Rs1.00/piece	465	470	465	470	465
8	Fuel charges @ Rs. 2/- per kg	200	200	200	200	200
	Cost of production	3263.38	3029	2986	3132	3129
1	Working capital (item 1 to 10)	3263.38	3029	2986	3132	3129
2	Supervision charges @10%of the working capital	326.33	302.90	298.60	313.20	312.90
3	Depreciation charges of the fixed capital item (2%on Rs 5000/-)	100	100	100	100	100
4	Interest on the fixed capital(@13% on Rs 5000/-	650	650	650	650	650
A.	**Total cost of production**	4339.71	4081.9	4034.6	4195.2	4191.9
	Gross production (kg)	100	100	100	100	100
	Gross production (No. of bottles)	465	470	465	470	465
B.	Gross returns (**@ Rs 12/-** per 200ml bottle)	5580	5640	5580	5400	5300
C.	**Net profit (B-A) (Rs)**	1240.29	1558.1	1545.4	1444.8	1388.1
	Per cent net profit	28.58	38.17	38.30	34.43	33.11
	Benefit : Cost ratio	1.28	1.38	1.38	1.34	1.33
	Sale price per 100g (if profit margin is 20%)	11.19	10.41	10.4	10.7	10.81

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