Research Article

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Standardization of juice concentration for preparation of phalsa nectar and changes during storage

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ABSTRACT

The experiment on preparation of phalsa nectar was conducted at Regional Research Station, Bawal. The ripe fruit of phalsa were harvested, sorted and blended with 0.5 litre water per kilogram fruit. It was heated to 70°C and filtered to extract juice. The required amount of juice, sugar and citric acid were added to fix the concentration of juice (20.0, 22.5 and 25.0 %), TSS (15°B) and titratable acidity (0.3%). After preparation of nectar, it was pasteurized and stored for 90 days to study the changes during storage. The TSS of the nectar increased up to 30 days of storage later on it decreased significantly. Titratable acidity and ascorbic acid content in nectar decreased with increase in storage period. However, sensory rating increased up to 60 days of storage and thereafter it was at par with 60 days of storage. Ascorbic acid content increased with increase in juice concentrations in nectar. Ascorbic acid content in all the concentrations of juice decreased with the increase in storage period. However, sensory rating decreased at 25% juice concentrations in the nectar. Overall, the phalsa nectar was rated as "moderately liked" or better by consumers and remained acceptable for up to 90 days of storage.

Introduction

Phalsa (*Grewia subinaequalis* DC.) is an important fruit crop, originated in India and Southern Asia, belongs to the family Tiliaceae. It is one of the few hardy tropical fruit crops because its cultivation needs least inputs and care; and yields delicious fruit of edible quality. Phalsa is a subtropical, drought tolerant and hardy fruit plant that can be grown in a wide range of climatic conditions throughout the country except for high altitude regions. It is comparatively less attacked by diseases and pests. In North India, the plants are deciduous and normally shed leaves during winter season; however, in warm regions it remains evergreen. Good amount of sunlight is required for fruit ripening and development of appropriate colour, which ultimately leads to the good eating quality of phalsa. Optimum growth is observed at a temperature ranging from 3°C to 45°C and it can tolerate light frost also.

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The fruits are delicious, sour to sweet, with a mild pleasant flavor and ripe fruit contain 50-60 per cent juice, 10-11 per cent sugars and 2.0-2.5 per cent acids and good source of vitamin A and C. Fruits are low in calories and fat, while high in vitamins, minerals and fibers. This is also a fair source of phosphorus 24.2 mg/100 g (Yadav, 1999) and iron 140.8 mg/100 g fresh fruit weight (Khan *et al*., 2006). Ripened fruit become soft and tender. Fruits are consumed during summer for cooling effect to stomach. Due to its perishable nature the phalsa fruit can be stored hardly 24 to 48 hr. Therefore, these fruits are to be consumed fresh or processed in soft drinks *viz.,* squash, juice, syrup, *etc*., but the recopies for preparation of phalsa products is not yet standardized. The availability of fruit is also for a limited period if processed their taste can be enjoyed for a longer period by the consumers. Processing of fruit also reduce/ minimize the post-harvest losses as well as reduces fruit glut in the market, growers can also get better returns and consumer get value added products (Kumar *et al*., 2015).

Materials and Methods

The experiment was conducted in the Horticulture Laboratory, Regional Research Station, Bawal. The ripened fruit, attained deep purple colour were procured from experimental orchard CCS HAU, Regional Research Station, Bawal. Healthy and equally ripened phalsa fruit were crushed to prepare juice by adding 0.5 litre water per kilogram of ripe fruit. Fruits were blended and heated up to 70°C, thereafter stained for juice. Phalsa nectar was prepared with different concentrations of juice *viz*., 20.0, 22.5 and 25.0 per cent. The total soluble solids (TSS) and titratable acidity were fixed to 15° Brix and 0.3 percent, respectively and adjusted with the help of sugar and citric acid.

The nectar was filled in glass bottle of 300 ml capacity and these were pasteurized after botting with air tight seal. The nectar bottles were stored for three months at ambient temperature and analyzed for changes in TSS, titratable acidity, ascorbic acids content and sensory rating at monthly intervals. TSS was measured with the help of ERMA made hand refractometer (0- 32°B). Titratable acidity was estimated by using phenolphthalein indicator and titrated against N/10 NaOH (A.O.A.C., 2000). Ascorbic acid content was also estimated using the method explain in A.O.A.C. (2000). Sensory rating was estimated by jury of 10 members on nine hedonic scale bases.

The marking was done on the basis of colour, appearance, aroma, texture, taste and overall acceptability. The average of the sensory score on 9 hedonic scale was considered as, liked extremely (9), liked very much (8), liked moderately (7), liked slightly (6), neither liked nor disliked (5), disliked slightly (4), disliked moderately (3), Disliked very much (2) and disliked extremely (1). The sensory evaluation was judged by 10 jury members of different age group.

Statistical analysis: The statistical method described by Panse and Sukhatme (1985) was used for analyses of data and it was calculated with the help of '*Opstat*' software available on website (*www.hau.ac.in*) CCS HAU, Hisar. The comparative performance of the data was judged with the help of critical difference at 5 per cent level of significance (Fisher, 1958) in a completely randomized block design.

Results and Discussion

Total soluble solids (TSS): The nectar prepared with 20.0, 22.5 and 25.0 % concentration of juice, 15°B TSS and 0.3 % titratable acidity. It was stored at ambient temperature for three months (90 days). The changes in physico-chemical and sensory rating were analyzed at monthly interval. Initially the TSS was fixed to 15°B and it increased significantly during storage upto 30 days of storage thereafter it started declining but remained higher than initial value. Increase in the TSS during the storage of guava RTS was also observed by Nagpal (2002). Initial increase in TSS may be due to breakdown of left-over complex sugars or polysaccharides (starch, cellulose and pectic substances) into soluble/ simple sugars (Kumar *et al*., 2009). However, it started declining after 30 days of storage may be due to losses of sugars during browning process. TSS of nectar in different concentrations of juice was not affected significantly. The interaction of juice concentration with storage period was also observed non-significant.

Titratable acidity: The titratable acidity during the storage of the nectar was decreased significantly as compared to initial level. Titratable acidity after 60 days after storage was observed at par with 30 and 90 days after storage, however it decreased significantly at 90 days of storage as compared to 30 days after storage. The concentration of titratable acidity in nectar decreased during storage may be due to utilization of acids during chemical reactions (Millard reaction) taking place between organic acids and sugars to form brown pigments (Kannan and Thirumaran, 2002; Kumar *et al*., 2009). It may also be due the chemical interaction with organic constituents of the fruit and reversal glycolytic pathway. The value of titratable acidity was not differed significantly in different concentrations of juice. The titratable acidity in interaction of storage period with juice concentration was also observed non-significant.

Ascorbic acid: Ascorbic acid content in the nectar of phalsa increased with increase in the concentration of juice.

Increase in ascorbic acid content in higher concentration of juice might be due to higher amount of juice used for preparation of nectar and the juice was the source of the ascorbic acid in the nectar. Decrease in ascorbic acid content during storage might be due to thermal oxidation during processing, oxidation into dehydro-ascorbic acid or furfural or hydroxyl methyl furfural at room temperature (Aruna *et al*., 1997). It decreased with increase in storage duration from 0 to 90 days of the storage. Decrease in ascorbic acid content and titratable acidity were also observed during storage of phalsa RTS (Kumar *et al*., 2020). Ascorbic acid content was also increased in all the storage period with increase in the amount of juice used.

Sensory evaluation: Initial sensory rating of the phalsa nectar was at par with the rating at 30 and 90 days after storage, but it increased to maximum level at 60 days after storage but remained above moderately liked range. It was acceptable upto 90 days after storage; however, it was slightly more acceptable at 60 days after storage, which was at par with acceptability at 30 and 90 days after storage. Sensory rating of the nectar decreased with increase in the concentration of the juice from 20.0 to 25.0 %, however the sensory rating of nectar having 22.5 % juice was at par with the nectar of 20 % juice concentration.

On the overall basis, the nectar prepared with 22.5 % juice content was acceptable, however nectar prepared with 25 % concentration of juice was slightly less acceptable as compared to lower concentration juice. Nectar prepared from different concentrations of juice and observed for change in sensory rating during storage upto 90 days and found above liked moderately (>7.0) sensory rating because the jury were not habitual to consume (taste of tongue) phalsa nectar and it has less flavour as a genetic character of the fruit. Jury members had never tested phalsa nectar earlier to this hedonic evaluation test.

Table 1. Effect of different juice concentrations on TSS (°B) during storage of phalsa nectar

Juice concentrations (%)	Days after storage				Mean
	0	30	60	90	
20.0	15.00	15.30	15.21	15.01	15.13
22.5	15.00	15.37	15.23	15.03	15.16
25.0	15.00	15.40	15.26	15.07	15.18
Mean	15.00	15.36	15.23	15.04	

CD (p=0.05)

Factors	Juice concentrations	Storage	Storage x Juice concentrations
CD (p=0.05)	NS	0.06	NS
SE(m)	0.02	0.02	0.04

Table 2. Effect of different juice concentrations on titratable acidity (%) during storage of phalsa nectar

Juice concentrations (%)	Days after storage				Mean
	0	30	60	90	
20.0	0.300	0.282	0.279	0.276	0.284
22.5	0.300	0.280	0.276	0.273	0.282
25.0	0.300	0.279	0.273	0.270	0.281
Mean	0.300	0.280	0.276	0.273	

CD (p=0.05)

Factors	Juice concentrations	Storage	Storage x Juice concentrations
CD (p=0.05)	NS	0.005	NS
SE(m)	0.001	0.002	0.003

Table 3. Effect of different juice concentrations on ascorbic acid content (mg/100 ml juice) during storage of phalsa nectar

Juice concentrations (%)	Days after storage				Mean
	0	30	60	90	
20.0	5.92	5.44	4.64	3.50	4.88
22.5	6.56	5.92	5.12	3.84	5.36
25.0	7.20	6.24	5.28	4.16	5.72
Mean	6.56	5.87	5.01	3.83	

CD (p=0.05)

Factors	Juice concentrations	Storage	Storage x Juice concentrations
CD (p=0.05)	0.05	0.06	0.11
SE(m)	0.02	0.02	0.04

Table 4. Effect of different juice concentrations on sensory rating (on nine hedonic scale basis) during storage of nectar

Juice concentrations (%)	Days after storage				Mean
	0	30	60	90	
20.0	7.2	7.3	7.5	7.3	7.3
22.5	7.0	7.2	7.4	7.2	7.2
25.0	6.9	7.0	7.1	7.0	7.0
Mean	7.0	7.2	7.3	7.2	

CD (p=0.05)

Factors	Juice concentrations	Storage	Storage x Juice concentrations
CD (p=0.05)	0.1	0.1	NS
SE(m)	0.03	0.03	0.06

Conclusion

Phalsa is highly perishable fruit, which can be stored only upto 48 hours mainly because of ambient temperature that peaks up to 40°C at the time of fruit harvest during the month of June. The post-harvest interventions, attempted to address this constraint through the present study, revealed preference for the nectar prepared by using phalsa juice. Thus, the study provides scientific leads regarding value addition that can reduce the post-harvest losses and can promise to increase the income of the farmers.

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