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Studies on Physico-chemical Characteristics of Jamun (*Syzygium cuminii* Skeels) Beverages During Storage

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Jamun *(Syzygium cuminii* Skeels) is native to India. Refreshing and curative properties of jamun make it one of the useful medicinal plants. With realization of its importance, demand for jamun products is on increase. Beverages like squash and carbonated drink were prepared from jamun fruits RTS and studied for their physico-chemical characteristics during storage. The storage period showed increasing trend in the characters *viz*., TSS, pH, acidity and reducing sugar, whereas it showed decreasing trend in non-reducing sugar, total sugar, anthocyanin and ascorbic acid content. Based on the overall findings of the study, all the beverages pasteurized at 75°C for 30 seconds and treated with 0.05% citric acid and 0.07% sodium benzoate were found to be acceptable up to 60 days of storage, maintaining physico-chemical and organoleptic characters of jamun an acceptable level.

Key words: Jamun beverages, Physico-chemical, Analysis, Organoleptic score, Storage etc.

Jamun (*Syzygium cuminii Skeels*) is native to India (Singh, 1969) and the seedling trees are found almost throughout the country. The refreshing and curative properties of jamun make it one of the useful medicinal plants. Jamun is a nutritious fruit with a variety of uses. Jamun seeds contain alkaloids like jambosin and glycoside, which prevent diabetes, heart and liver troubles. Jamun is very popular as a desert fruit, because of its slight astringent sweet sour taste and excellent colour (Muhammad and Saghir, 2011). It is highly perishable in nature and is available in the market for a very short period. The untapped popularity of jamun fruits can be harnessed by processing it in to various products viz. squash, ready to serve beverage, vinegar, nectar, carbonated drink and syrup. The information available on changes occurring during storage of jamun beverages is very limited and scanty. Therefore, the present investigation was carried out to study the storage stability of jamun beverages.

Materials and Methods

The present investigation was carried out at Fruit processing centre, Horticulture Department, B. A. college of Agriculture, Anand, Gujarat during 2012-2013. The jamun variety used for experimentation was procured from university orchard. The extraction of juice was done using juice extractor and the fruit to water ratio used for extraction of juice was 1:0.50. The total soluble solids of extracted juice were determined with the help of hand-refractometer and value corrected at 27°C temperature. Acidity was determined by titrating the juice against 1N/NaOH. The pH was determined by using pH meter (Elico make). The per cent reducing sugar, non-reducing sugar, and total sugar were analyzed according to the method suggested by Ranganna (2000). Anthocyanin was estimated according to the method suggested by Thimmaiah (1999) and Ascorbic acid was determined by volumetric method suggested by Ranganna (1979). The jamun beverages like squash, ready to serve and carbonated drinks were standardized and subjected to organoleptic evaluation using nine point hedonic scale as suggested by Ranganna (1979).

The squash and ready to serve beverages were bottled (500 ml capacity) and pasteurized at 75°C for 30 sec. Carbonated drink was bottled (200ml capacity) and carbonation was done with 150-200 kg/cm^2(psi) pressure, then pasteurized at 75°C for 30 sec. The squash, ready to serve and carbonated drink preserved with sodium benzoate 0.07% and citric acid 0.05% were filled in the bottles and stored at ambient temperature (min. 27°C to max. 31°C, Table.1) and also in cool temperature (refrigerator storage, 7-9°C, Table.1). Observations were recorded just after preparation and at an interval of thirty and sixty days of storage. The data were tabulated and analyzed as per CRD factorial design (Panse and Sukhatme, 1954).

Results and Discussion

Changes during storage of jamun beverages indicated that TSS increased slightly after 30 and 60 days in respect of all the beverages (Table.2). An increase in TSS content of jamun beverages during storage may be due to the conversion of polysaccharides into sugars during the partial hydrolysis process of complex carbohydrates. Similar results were reported by Kannan and Susheela (2001), Das (2009), Sahota *et. al.* (2010), Prasad and Mali (2000), and Palaniswamy and Muthukrishan

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Table 1. Meteorological data for both ambient and cold storage during the storage period of the jamun beverages (weekly data)

Year	Standard week	Room temperature (°C)	Cold temperature (°C)	Relative Humidity (%)
2012	24	29.95	8	56.6
	25	30.25	8	58.1
	26	31.00	8	65.0
	27	29.65	8	69.3
	28	29.55	8	82.9
	29	28.45	8	86.9
	30	28.20	8	83.7
	31	28.90	8	64.7
	32	28.25	8	56.7
	33	27.70	8	54.6

(1974) in different fruits like jamun, pomegranate and lemon.

The acidity of jamun beverages showed increasing trend in respect of all the beverages after 30 and 60 days of storage (Table.2). This might be due to the degradation of pectic substances, which are the responsible for increasing the acidity of fruits. Hence, in the present study degradation of pectic substances into soluble solids might have contributed towards increase in the acidity of jamun beverages. Similar, results were reported by Das (2009), Prasad and Mali (2000) and Sethi (1993) in different fruits like jamun, pomegranate and litchi beverages. The pH was slightly influenced by the storage period for the

Table 2. Physico-chemical analysis of jamun beverages during storage

Beverages	Storage	T.S.S. (0Brix)	Acidity (%)	pH	Reducing sugar (%)	Non-Reducing sugar (%)	Total sugar (%)	Anthocyanin (mg/100g)	Ascorbic acid (mg/100g)
Initial									
Squash	Ambient	42.83	1.30	2.33	16.41	23.34	39.75	52.63	18.03
	Cold	43.16	1.32	3.13	17.00	23.43	40.43	53.02	18.46
RTS	Ambient	17.17	0.29	3.25	7.53	11.78	19.31	51.75	13.67
	Cold	18.01	0.32	3.51	7.68	11.54	19.22	52.22	13.71
Carbonated drink	Ambient	15.49	0.28	3.76	7.01	11.85	18.86	25.87	16.49
	Cold	16.16	0.30	3.94	7.70	11.23	18.93	26.39	17.75
CD at 5% 30 days	-	1.124	0.035	0.15	0.661	1.221	1.407	0.534	0.425
Squash	Ambient	43.16	1.40	2.85	17.29	21.01	38.30	47.20	17.47
	Cold	44.16	1.43	3.30	19.83	21.36	41.19	47.45	18.23
RTS	Ambient	18.66	0.33	3.68	8.04	10.31	18.35	45.39	13.22
	Cold	19.33	0.36	4.28	8.06	9.90	17.96	46.26	13.12
Carbonated Drink	Ambient	15.50	0.33	4.18	7.73	10.27	18.00	21.22	15.93
	Cold	16.33	0.34	4.33	8.09	10.15	18.24	21.75	16.97
CD at 5% 60 days	-	1.051	0.029	0.26	0.716	0.835	0.989	1.032	0.554
Squash	Ambient	43.83	1.45	2.91	17.57	19.95	37.52	38.35	17.09
	Cold	44.99	1.49	3.41	20.44	19.46	39.90	41.12	18.04
RTS	Ambient	18.99	0.42	4.08	8.10	8.70	16.80	40.48	12.41
	Cold	19.66	0.47	4.76	8.41	8.56	16.97	41.43	12.60
Carbonated drink	Ambient	16.49	0.41	4.23	7.81	8.62	16.43	18.88	15.42
	Cold	16.66	0.42	4.96	8.28	9.15	17.43	20.10	16.70
CD at 5%	-	1.051	0.029	0.12	0.541	0.706	0.639	0.929	0.381

jamun beverages. Kannan and Susheela (2001), Barot (2010) and Jain *et.al.* (1984) reported that the pH increased due to the decreased formation of acids during processing and storage.

The reducing sugar increased in all the jamun beverages as storage period prolonged (Table.2). This may be due to the gradual conversion of non-reducing sugars owing to the process of hydrolysis during storage and due to inversion process of sucrose to glucose and fructose by the acid of diet drink. Similar results were reported by Kannan and Susheela (2001), Palaniswamy and Muthukrishan (1974), Prasad and Mali (2000), Barot (2010), Roy and Singh (1979), Jain *et.al*. (1988), Ahmed *et.al.* (2008) and Khurdiya and Waskar (1987). The per cent total sugar was also decreased in all the beverages. This might be due to the hydrolysis of non-reducing sugar during storage. Similar result was reported by Kannan and Susheela (2001). The anthocyanin content decreased in jamun beverages as storage period prolonged in both cold and ambient storage (Table.2). This might be due to hydrolysis of protective 3-glucoside linkages to give unstable anthocyanin. Similar results were reported by Kannan and Susheela (2001), Khurdiya and Waskar (1987), and Khurdiya and Roy (1984). The ascorbic acid (mg/100g) was also decreased in all beverages during storages. This might be due to oxidation of ascorbic acid into dehydro-ascorbic acid by oxygen and also decreasing in ascorbic acid due to the effect of processing, storage time and exposure to light. Similar results were reported by Jain *et.al.* (1984), Das (2009), Barot (2010), Ahmed *et.al.* (2008) and Lal (2006) in different fruits beverages like jamun and aonla.

Table 3. Organoleptic score of jamun beverages during storage

Beverages	Storage	Colour	Flavor	Taste	Aroma	Average
Initial						
Squash	Ambient	6.48	6.49	6.35	6.19	6.37
	Cold	6.70	6.69	6.88	6.98	6.81
RTS	Ambient	5.63	6.34	5.86	6.08	5.97
	Cold	6.66	7.03	6.46	6.58	6.68
Carbonated drink	Ambient	6.08	6.29	5.98	5.71	6.01
	Cold	6.45	7.16	6.93	6.49	6.75
30 days						
Squash	Ambient	6.26	6.28	6.08	5.41	6.00
	Cold	6.50	6.38	6.51	6.71	6.52
RTS	Ambient	5.48	5.54	5.55	5.24	5.45
	Cold	6.14	6.66	6.21	6.06	6.26
Carbonated Drink	Ambient	5.58	5.31	5.73	5.60	5.55
	Cold	6.39	6.60	6.63	6.20	6.45
60 days						
Squash	Ambient	5.48	5.06	5.55	4.86	5.23
	Cold	6.50	6.00	6.03	5.75	6.07
RTS	Ambient	5.19	5.06	4.74	4.88	4.96
	Cold	5.95	6.33	5.58	5.66	5.88
Carbonated drink	Ambient	5.28	5.30	5.36	5.18	5.28
	Cold	6.18	6.29	6.24	5.61	6.08

Organoleptic quality determines the storage stability of jamun beverages. In the present studies there was a gradual decrease in organoleptic score of jamun beverages during storage at ambient temperature and also in cold temperature, but at a slower rate (Table.3).

The developed beverages were highly acceptable up to a period of 60 days at both room and refrigeration temperature. Temperature plays important role in inducing certain biochemical changes in the beverages. Similar results were reported by Kannan and Susheela (2001), Das (2009), Barot (2010), Prakash and Pandey (2007), Roy and Singh (1979), Lal (2006), and Khurdiya and Waskar (1987). The present investigation provides ample evidence that jamun fruit beverages could be safely stored up to 60 days with acceptable quality.

Conclusion

Jamun beverages like squash, ready to serve beverage and carbonated drink were prepared from jamun fruits as per standard procedure and studied for their physico-chemical characteristics during storage. The storage period showed increasing trend in the characters *viz*. TSS, pH, acidity and reducing sugar, whereas it showed decreasing trend in non-reducing

sugar, total sugar, anthocyanin, and ascorbic acid content. Based on the overall findings of the study, all the beverages pasteurized at 75°C for 30 seconds and treated with 0.05% citric acid and 0.07% sodium benzoate were found to be acceptable up to 60 days of storage, maintaining physico-chemical and organoleptic characters of jamun at an acceptable level.

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