Indian J. Hort. 68(3), September 2011: 413-418

Qualitative changes in value-added products of sapota cv. Kalipatti during storage

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ABSTRACT

The comparative studies on compositional changes in value-added sapota products such as sapota jam, butter, cheese and jelly revealed that there was increase in the level of pH, reducing and total sugars with decrease in acidity content during storage. However, no change in moisture and TSS content was observed during the storage period (six months). Among the products, sapota jelly recorded significantly the highest acidity, reducing sugar and total sugars content with lowest pH level. All the sensory parameters except colour and texture declined significantly during storage period of six months. Sapota jelly recorded the highest sensory score for flavour and taste, but remained at par with sapota butter, whereas sapota jelly and sapota cheese scored equally good marks for textural quality of the product. Based on the overall acceptability, sapota jelly was the most acceptable, but was slightly costlier as compared to sapota jam and other products.

Key words: Sapota, storage, quality, value added products.

INTRODUCTION

Sapota [*Manilkara achras* (Mill.) Fosberg] is known for its sweet delicious taste and possesses a delicate characteristic aroma when fully ripe. The fruit is a good source of digestible sugar (12 to 18%) and appreciable source of protein, fat, fibre and minerals like calcium, phosphorous and iron (Chadha, 3). Among the 41 varieties grown all over India, Kalipatti is an outstanding variety of sapota and popularly cultivated in Gujarat due to its excellent taste and aroma, soft and mellow flesh with less number of seeds, high productivity, continuous fruiting through out the year with very little incidence of insect-pests and diseases and free from physiological disorders which otherwise very common in other major fruits like mango, citrus, etc. However, poor shelf- life is the major problem during marketing of sapota fruits. Hence, value addition through processing is important for economic utilization of sapota.

Among the value-added products, fruit jam is the most popular product and is widely consumed in rural as well as urban area. Apart from the conventional types of jams and jellies, other products resembling the jams such as cheese and butter are also made occasionally from guava and apple, respectively which have commercial importance. It is therefore necessary to explore the possibility to utilize sapota fruits not only in the preparation of sapota jam and jelly, but also to introduce sapota cheese and sapota butter as innovative sapota products, if found acceptable to the consumer.

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MATERIALS AND METHODS

The fully matured sapota fruits cv. Kalipatti were procured from the sapota orchard of Regional Horticultural Research Centre, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari, Gujarat. For the preparation of sapota jam, well ripened, sound and firm 'Kalipatti' fruits were selected, washed, air-dried and peeled manually with the help of stainless steel knife. The peeled fruits were then cut into slices, and seeds as well as inner white core were removed. The sapota slices were then passed through a mixer to get homogenous pulp. Then, jam was prepared by standard method with pulp and sugar in the proportion of 1:1 and 0.5 per cent citric acid. The method of preparation of sapota butter was just like for sapota jam except the spice bag with ground spices like cinnamon and cardamom @ 3.0 g per kg of pulp each, clove and black pepper @ 1.5 g per kg of pulp each was immersed in the boiling hot mixture of sapota pulp and sugar in the ratio of 1:1 and 0.5 per cent citric acid. For the preparation of sapota cheese, butter was added @ 60 g per kilogram of the pulp when the TSS of the cheese reached 65°B and cooking was stopped at 68.5°B TSS. The sapota jelly was prepared by boiling the sapota juice extract with sugar in the proportion of 1: 1, 0.5 per cent pectin and 0.6 per cent citric acid till TSS reached to 68.5°B. The products, thus prepared were filled hot into the wide mouth pre-sterilized glass bottles of 200 g capacity, closed air-tight and stored at a cool and dry place.

The moisture content, total soluble solids, acidity, pH and sugars were estimated using the methods described by Ranganna (10). The sensory evaluation

of the product was done initially and up to six months on hedonic scale by a panel of five judges as described by Amerine (1). The cost of production of different sapota products was worked out by considering existing rates of various inputs like cost of raw material, Labour, electricity, fuel, packaging, depreciation, supervision charges and interest on the fixed capital. The data on changes in chemical composition of products and sensory qualities during storage were statistically analyzed by the standard procedure of Factorial completely randomized design (Gomez and Gomez, 4).

RESULTS AND DISCUSSION

The changes in chemical composition of sapota jam and related products are presented in Table 1a & b. In general, the sapota jam and related products did not exhibit variation in the moisture content of the products during the entire period of storage. This is due to the retention of optimum level of TSS and acidity initially at the time preparation, which prevented deteriorative reactions to influence the moisture level in the product. Koli *et al.* (6) also reported non-significant changes in the moisture content of sapota jam during storage period of 90 days. The TSS level of the product did not vary with the treatments; however, it increased significantly irrespective of the treatment by the end of six months of storage. This might be due to solubilization of pulp constituents during storage and hydrolysis of polysaccharides. Similar results were reported by Yousif and Alghamdi (16) for date jelly cv. Barni, Sogi and Singh (13) for Kinnow jam, Saravanan *et al*. (11) for papaya jam, and Baramanray and Gupta (2) for guava cheese. In the present study, the acid content was found to be higher in sapota jelly than the other products due to high level of acidity maintained in jelly initially at the time of preparation for good jelly set, as a result the pH level of jelly was also lower than all another product. The acidity level decreased significantly with corresponding increase in pH irrespective of the treatments during storage. This might be attributed to chemical reactions between organic constituents of fruit pulp induced by temperature and action of enzymes during storage (Singh *et al*., 12). Similar observations were also reported by Tomar *et al*. (15) in apple jam and Masoodi *et al*. (7) in guava jelly. Among the different products, sapota jelly recorded significantly higher reducing sugar level after 3 and 6 months of storage than all other products. This could be due to the fact that sapota jelly had more acidity level maintained initially than other products that resulted into enhanced acid hydrolysis of polysaccharides and inversion of non-reducing sugars into reducing sugars. The total sugars content was also significantly higher in sapota jelly than the other jam-like products and it increased significantly during storage period of six months. This has been attributed to the breakdown of insoluble polysaccharides into simple sugars like hydrolysis of pectin, starch etc. into simple sugars (Patel, 8). Similar observation was made by Koli *et al.* (5) for sapota jam, Tomar *et al.* (14) for raw mango jelly, Tomar *et al*. (15) for apple jam, Baramanray and Gupta (2) for guava cheese, Kannan and Thirumaran (5) for *jamun* jam, Singh *et al*. (12) for *bael*/blended *bael* jam and Masoodi *et al*. (7) for guava jelly during storage.

The data pertaining to the changes in sensory qualities of jam and related products are presented in Table 3a & b. The jam and other products had highly acceptable colour without any significant variation among them and showed a decline in score values during storage, but the changes were non-significant. Among the different treatments, the most acceptable flavour was recorded by sapota jelly, but remained at par with sapota butter. A typical honey-like flavour of jelly and spicy flavour of sapota butter was very much liked by the judges. However, the flavour acceptability declined significantly irrespective of the treatments during storage period of six months due to loss of volatile compounds and enzymatic degradation of phenols and oxidative changes of sugars influenced by temperature that leads to develop undesirable flavour during storage (Mulla, 8). Analogous observations have been made by Koli *et al.* (6) on sapota jam, and Saravanan *et al*. (11) on papaya jam.

As regards textural qualities, sapota cheese recorded maximum points for texture and it was observed that addition of butter reduces grittiness due to pulp and imparts smooth texture to sapota cheese which was preferred by the panel. Due to optimum level of ingredients, sapota jelly had excellent setting property (texture) and remained at par with sapota cheese. The textural quality of the products remained unchanged throughout the storage period of six months as the moisture in the product did not exhibit any change during storage. Similar observations have been made by Mulla (7) in sapota jam.

Taste acceptability of the product was found highest in sapota jelly as well as sapota butter. Addition of spices improved the taste of the product, therefore sapota butter was most preferred to either jam or cheese by the judges. However, sensory score for taste declined significantly during storage irrespective of the treatments. These findings are in accordance with that of Koli *et al.* (6) in sapota jam, and Saravanan *et al.* (11) in papaya jam. Among the different products, sapota jelly recorded highest sensory score for overall acceptability whereas sapota butter, cheese and jam remained at par with each other. In general, sensory score for overall acceptability declined significantly throughout the storage. This has

Table 1a. Changes in chemical composition of sapota jam and other related products during storage.

Treatment	Moisture (%)				TSS (°B)				Acidity (%)			
Month	0	3	6	Mean	0	3	6	Mean	0	3	6	Mean
T1	23.49	23.41	23.55	23.48	68.63	68.65	68.85	68.71	0.51	0.47	0.41	0.461
T2	22.80	23.10	22.73	22.88	68.50	68.80	69.67	68.99	0.52	0.46	0.42	0.466
T3	23.29	23.00	22.94	23.08	68.65	68.65	69.30	68.87	0.50	0.46	0.42	0.458
T4	23.08	22.83	23.10	23.00	68.25	68.65	68.85	68.58	0.60	0.53	0.48	0.536
Mean	23.16	23.08	23.08		68.51	68.69	69.17		0.532	0.478	0.431	
Effect	T	S	T × S		T	S	T × S		T	S	T × S	
CD at 5%	NS	NS	NS		NS	0.34	NS		0.013	0.012	NS	
CV (%)	3.97				1.12				5.44			

Table 1b. Changes in chemical composition of sapota jam and other related products during storage.

Treatment	pH				Reducing sugars (%)				Total sugars (%)			
Month	0	3	6	Mean	0	3	6	Mean	0	3	6	Mean
T1	3.46	3.50	3.56	3.51	27.75	32.59	35.27	31.87	62.00	62.65	63.17	62.61
T2	3.44	3.51	3.54	3.50	28.06	31.99	34.76	31.61	61.79	62.11	63.18	62.36
T3	3.44	3.45	3.57	3.49	27.72	31.34	34.20	31.08	61.71	62.27	63.14	62.37
T4	3.39	3.43	3.49	3.44	29.11	41.17	49.15	39.81	62.97	63.46	64.86	63.76
Mean	3.43	3.47	3.54		28.16	34.27	38.35		62.12	62.62	63.59	
Effect	T	S	T x S		T	S	T x S		T	S	T x S	
CD at 5%	0.030	0.026	NS		0.81	0.70	1.40		0.62	0.53	NS	
CV (%)	1.68				4.69				1.92			

T1 = Sapota jam, T2 = Sapota butter, T3 = Sapota cheese, T4 = Sapota jelly

Table 2a. Changes in sensory qualities of sapota jam and other related products during storage.

Treatment	Sensory score											
	Colour				Flavour				Texture			
Month	0	3	6	Mean	0	3	6	Mean	0	3	6	Mean
T1	8.15	8.10	7.85	8.03	7.95	7.90	7.60	7.82	7.70	7.55	7.20	7.48
T2	8.00	7.50	7.65	7.72	8.35	8.35	7.80	8.17	7.80	7.50	7.20	7.50
T3	8.00	7.75	7.65	7.80	7.75	7.60	7.20	7.52	8.20	8.10	8.15	8.15
T4	8.40	8.25	7.85	8.17	8.15	8.05	7.55	7.92	8.30	8.20	7.85	8.12
Mean	8.14	7.90	7.75		8.05	7.98	7.54		8.00	7.84	7.60	
Effect	T	S	T x S		T	S	T x S		T	S	T x S	
CD at 5%	NS	NS	NS		0.31	0.27	NS		0.41	NS	NS	
CV (%)	9.28				7.74				10.21			

Table 2b. Changes in sensory qualities of sapota jam and other related products during storage.

Treatment	Sensory score							
	Taste				Overall acceptability			
Month	0	3	6	Mean	0	3	6	Mean
T1	7.95	7.45	7.60	7.67	7.87	7.75	7.56	7.73
T2	8.45	8.25	7.90	8.20	8.15	7.90	7.63	7.89
T3	8.15	7.90	7.50	7.85	8.03	7.84	7.63	7.83
T4	8.40	8.30	7.90	8.20	8.31	8.20	7.79	8.10
Mean	8.24	7.98	7.73		8.09	7.92	7.65	
Effect	T	S	T x S		T	S	T x S	
CD at 5%	0.31	0.27	NS		0.18	0.16	NS	
CV (%)	7.51				4.45			

T1 = Sapota jam, T2 = Sapota butter, T3 = Sapota cheese, T4 = Sapota jelly

Table 3. Cost of production of sapota jam and other related products during storage (10 kg).

Sl. No.	Particulars	T1	T2	T3	T4
1	Cost of sapota fruits @Rs.6/-kg	495	495	495	505.2
2	Labour charges @Rs.100/- per Labour	1,000	1,000	1,000	2,000
4	Sugar @Rs.18/-per kg	1,231.2	1,231.2	1,231.2	1,090.8
5	Citric acid @Rs.200/-per kg	100	100	100	121.2
6	Sodium benzoate / KMS @ Rs.300/- per kg	6	6	6	6
7	Jam bottle @Rs.20/- per bottle	3,000	3,000	3,000	3,000
8	Pectin @Rs.315/ 100g	--	--	--	1,908.9
9	Spices @Rs.0.5 per g	--	300	--	--
10	Butter @Rs.20/- per 100g	--	--	820	--
11	Fuel charges @Rs.2/- per kg	200	200	200	200
Cost of production		6,032.2	6,332.2	6,852.2	8,832.1
1	Working capital (items 1 to 7)	6,032.2	6,332.2	6,852.2	8,832.1
2	Supervision charges @10% of the working capital	603.22	633.22	685.22	883.21
3	Depreciation charges of the fixed capital item (2% on Rs.10,000/-)	200	200	200	200
4	Interest on the fixed capital(@13% on Rs.10,000/-	1,300	1,300	1,300	1,300
A.	Total cost of production	8,135.42	8,465.42	9,037.42	11,215.31
	Gross production (kg)	100	100	100	100
	Gross production (No. of bottles)	200	200	200	200
B.	Gross returns (@ Rs.70/- per 500 g bottle) (Rs.)	14,000	14,000	14,000	14,000
C.	Net profit (B-A) (Rs.)	5,864.58	5,534.58	4,962.58	2,784.69

T1 = Sapota jam, T2 = Sapota butter, T3 = Sapota cheese T4 = Sapota jelly

been due to continuous decline in flavour and taste acceptability of the product. Koli *et al.* (6) also reported decreasing trend in overall acceptability of sapota jam after 90 days of storage.

The cost of production of sapota jelly was maximum due to higher input cost, especially additional cost on pectin added for good jelly set and texture (Table 3). Thus, based on the overall acceptability, sapota jelly was most acceptable product while sapota butter was also equally good with higher net profit than jelly as well as cheese and liked by the panel of judges due to its excellent flavour and taste. All these products could be successfully stored for a period of six months with better retention of nutritional and sensory qualities.

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Received: January, 2011; Revised: May, 2011;
Accepted : June, 2011