Int.J.Curr.Microbiol.App.Sci (2018) *7*(1): 827-833

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 7 Number 01 (2018)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2018.701.101

Studies on Physico-chemical Characteristics in Squash Prepared from Different Mango Cultivars

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Keywords

Squash, Pulp, Storage and concentration

Article Info

Accepted:
10 December 2017
Available Online:
10 January 2018

A B S T R A C T

The experiment was conducted with four mango cultivars *i.e*. Dasherhari, Langra, S.B. Chausa and Amrapali in Fruit Technology Laboratory of the Department of Horticulture, CCS Haryana Agricultural University, Hisar to assess the storage of squash at room temperature prepared from fresh mango pulp of three concentration *i.e*. 25% pulp, 30% pulp and 35% pulp. The TSS (46.6%) and Acidity (0.892%) was recorded maximum in squash prepared from cultivar S.B. Chausa. TSS content of squash increased significantly from 45% on 0 day to 47.6% on 180 days of storage, irrespective of cultivar and pulp content. Acidity was found maximum (0.892%) and minimum (0.890%) in squash prepared from 25% and 35% pulp content respectively, irrespective of cultivar and storage period. Ascorbic acid and total carotenoid content decreased with increase in storage period. Maximum ascorbic acid content was observed in cv. Langra and minimum in cv. S.B. Chausa. Total sugar content of squash was increased with increase in storage period.

Introduction

Mango is the most popular fruit of India. It is also known as "King of Indian Fruits". Which is one of the most important tropical fruits commercialized and consumed worldwide fresh or processed, having an attractive colour and distinct taste and aroma (Singh *et al.*, 2000). Mango is rich source of vitamin A, C and has recently been found to be high in anticancer antioxidants and phenols. The fruits contain carbohydrates (13.2 to 20.0 g), proteins (0.30 to 0.80 g), fat (0.10 to 0.27 g), fibre (0.60 to 1.80 g), vitamin A (765 mg), vitamin C (14 to 62 mg), minerals like potassium (156 mg), phosphorus (10 to 15 mg), magnesium (9 mg) 2 and fair amount of iron (0.10 to 0.20 mg) and provides 225 to 350 KJ energy per 100 g of pulp (Janick and Paull, 2006). Post-harvest losses of fruits and vegetables in our country are very high *i.e*. 20 to 30% every year (Saigal, 2001). However only 2% of the total production is used for processing, whereas this figure is more than 50% in developed countries (Roy, 2001). Mangoes are classified as climacteric fruit and ripen quite rapidly after harvest. Disease problems, sensitivity to low temperature storage and the severe perishable nature of the fruit limit the transport of fresh fruit from the

site of harvest to distance places (Lizada, 1993). These losses can be minimized by utilizing green fruits for making pickle or chutney or as a sundried acidifying condiment (AMCHUR) whereas ripe fruit is used for preserve, jam, squash etc. (Srivastva, 1998).

Several processed foods are prepared from mango in which squash plays an important role which is mainly used during summer season as a beverage.

Keeping in view the above facts, the experiment was conducted to study the storage of mango squash regarding cultivars, storage period and pulp concentration.

Materials and Methods

The experiment was conducted to make squash from four mango cultivars *i.e.* Dashehari, S.B. Chausa, Langra and Amrapali using three concentration of pulp *i.e.* 25%, 30% and 35% for 0 to 180 days storage. TSS was fixed 45% and acidity 0.9% at the time of preparation of squash. The observations were recorded by the following methods:

Total soluble solids of squash were observed at ambient temperature by hand refractometer.

Total acids were estimated by Titration against N/10 sodium hydroxide (Ranganna, 1977).

Ascorbic acid content was determined by the method of A.O.A.C. (1990).

$$\text{Ascorbic Acid} = \frac{\text{Volume of dye used} \times \text{Volume made}}{\text{Dye factor} \times \text{weight of sample} \times \text{Vol. of Aliquot taken}} \times 100$$

Sugars were determined by "The Ferricyanide Method" as suggested by Hulme and Narain (1931) with some modifications in the estimation.

Total carotenoids were estimated by the method of A.O.A.C. (1990).

Mango squashes were evaluated for colour, appearance, aroma, texture, taste, overall acceptability as method described by Ranganna (1986) at monthly interval of storage period.

The data were tabulated and statistically analyzed as per the method described by Snedecor and Cochran (1980). The design for tabulation of data followed was factorial completely randomized design (C.R.D.) and the data collected under each study was subjected to statistical analysis.

Results and Discussion

Total soluble solids content of squash increased significantly from 45% on 0 day to 47.6% on 180 days of storage, irrespective of cultivar and pulp content (Table 1). Among different cultivars, maximum TSS (46.6%) was recorded in squash prepared from S.B. Chausa and minimum (46.1%) in that of Amrapali which was at par with Langra and Dashehari irrespective of pulp content and storage period. Among the pulp content, maximum (46.5%) and minimum (46.1%) TSS was found in squash prepared from 35% and 25% pulp content respectively. The increase in TSS content with the increase in storage period, irrespective of pulp content and cultivars may possibly be due to partial hydrolysis of polysaccharides like cellulose, starch and pectic substances into simple soluble substances. Similar trend in change of TSS was found in Karonda squash (Deen and Singh, 2012) and in blended squash of mango and aloe vera (Chaudhary *et al.*, 2017).

Acidity of squash decreased significantly from 0.900% on 0 day to 0.879% on 180 days of storage irrespective of cultivar and pulp content (Table 2).

Table.1 Effect of pulp percentage of different cultivars on TSS (%) during storage of squash

Days	25% Pulp					30% Pulp					35% Pulp					Overall Mean
	D	L	C	A	Mean	D	L	C	A	Mean	D	L	C	A	Mean	
0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0
30	45.3	45.3	45.7	45.3	45.4	45.3	45.3	45.7	45.3	45.4	45.7	45.3	45.7	45.3	45.5	45.4
60	45.7	45.7	46.0	45.3	45.7	46.0	45.7	46.3	45.7	45.9	46.3	45.7	46.3	45.7	46.0	45.9
90	46.0	46.0	46.3	45.7	46.0	46.3	46.3	46.7	46.0	46.3	46.7	46.3	47.0	46.3	46.6	46.3
120	46.3	46.3	46.7	46.0	46.3	46.7	46.7	47.0	46.3	46.7	47.0	47.0	47.3	46.7	47.0	46.7
150	46.7	46.7	47.0	46.7	46.8	47.0	47.0	47.3	47.0	47.1	47.3	47.3	47.7	47.3	47.4	47.1
180	47.3	47.0	47.7	47.0	47.3	47.7	47.3	48.0	47.3	47.6	48.0	47.7	48.3	47.7	47.9	47.6
Mean	46.1	46.0	46.3	45.9	46.1	46.3	46.2	46.6	46.1	46.3	46.6	46.3	46.8	46.3	46.5	
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CD at 5%
Cultivar – 0.2
Pulp content – 0.2
Storage – 0.2
Cultivar X Pulp content – N.S.
Cultivar X Storage – N.S
Pulp content X Storage – N.S.
Cultivar X Pulp content X Storage – N.S.
Mean for cultivars:
D – 46.3
L – 46.2
C – 46.6
A – 46.1

Table.2 Effect of pulp percentage of different cultivars on acidity (%) during storage of squash

Days	25% Pulp					30% Pulp					35% Pulp					Overall Mean
	D	L	C	A	Mean	D	L	C	A	Mean	D	L	C	A	Mean	
0	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900
30	0.899	0.899	0.899	0.899	0.899	0.899	0.899	0.899	0.899	0.899	0.899	0.899	0.899	0.899	0.899	0.899
60	0.897	0.896	0.897	0.897	0.897	0.895	0.894	0.895	0.896	0.895	0.894	0.893	0.894	0.895	0.894	0.895
90	0.893	0.892	0.894	0.893	0.893	0.892	0.890	0.892	0.892	0.892	0.891	0.889	0.891	0.890	0.890	0.892
120	0.888	0.887	0.890	0.890	0.889	0.887	0.886	0.889	0.888	0.888	0.885	0.884	0.887	0.886	0.886	0.888
150	0.883	0.882	0.887	0.886	0.885	0.883	0.881	0.886	0.883	0.883	0.880	0.879	0.883	0.881	0.881	0.883
180	0.880	0.877	0.884	0.882	0.881	0.878	0.875	0.883	0.879	0.879	0.876	0.873	0.880	0.877	0.877	0.879
Mean	0.892	0.891	0.893	0.893	0.892	0.890	0.889	0.892	0.891	0.891	0.890	0.888	0.891	0.890	0.890	

CD at 5%
Cultivar - 0.001
Pulp content - 0.001
Storage - 0.001
Cultivar X Pulp content - N.S.
Cultivar X Storage - N.S.
Pulp content X Storage - N.S.
Cultivar X Pulp content X Storage - 0.003
Mean for cultivars:
D – 0.891
L – 0.889
C – 0.892
A – 0.89

D- Dashehari, L- Langra, C- S.B. Chausa, A- Amrapali

Table.3 Effect of pulp percentage of different cultivars on total sugars (%) during storage of squash

Days	25% Pulp					30% Pulp					35% Pulp					Overall Mean
	D	L	C	A	Mean	D	L	C	A	Mean	D	L	C	A	Mean	
0	36.51	37.65	37.19	39.46	37.70	36.74	37.87	37.42	39.69	37.93	36.97	38.10	37.65	39.91	38.16	37.93
30	36.74	37.87	37.42	39.69	37.93	36.97	38.10	37.65	39.92	38.16	37.20	38.32	37.87	40.15	38.39	38.16
60	36.97	38.10	37.65	39.91	38.16	37.19	38.32	37.88	40.14	38.38	37.42	38.55	38.10	40.37	38.61	38.39
90	37.19	38.33	37.88	40.14	38.39	37.42	38.56	38.10	40.37	38.61	37.65	38.77	38.33	40.60	38.84	38.61
120	37.42	38.56	38.11	40.37	38.61	37.65	38.79	38.33	40.60	38.84	37.88	39.00	38.56	40.83	39.07	38.84
150	37.65	38.78	38.33	40.59	38.84	37.87	39.02	38.56	40.82	39.07	38.11	39.23	38.79	41.05	39.29	39.07
180	37.88	39.01	38.56	40.83	39.07	38.10	39.23	38.78	41.05	39.29	38.33	39.46	39.01	41.28	39.52	39.29
Mean	37.20	38.33	37.88	40.14	38.39	37.42	38.56	38.10	40.37	38.61	37.65	38.78	38.33	40.60	38.84	

CD at 5%
Cultivar - 0.12
Pulp content - 0.10
Storage - 0.16
Cultivar X Pulp content - N.S
Cultivar X Storage - N.S.
Pulp content X Storage - N.S.
Cultivar X Pulp content X Storage - N.S

Mean for cultivars: D – 37.42, L – 38.55, C – 38.10, A – 40.37

D- Dashehari, L- Langra, C- S.B. Chausa, A- Amrapali

Table.4 Effect of pulp percentage of different cultivars on ascorbic acid (mg/100 ml) during storage of squash

Days	25% Pulp					30% Pulp					35% Pulp					Overall Mean
	D	L	C	A	Mean	D	L	C	A	Mean	D	L	C	A	Mean	
0	14.05	28.05	15.05	16.05	18.30	15.07	29.10	16.10	17.08	19.34	16.10	30.12	17.07	18.08	20.34	19.33
30	13.05	27.05	14.05	15.05	17.30	14.05	28.05	15.05	16.05	18.30	15.05	29.05	16.05	17.05	19.30	18.30
60	12.05	26.05	13.05	14.05	16.30	13.05	27.05	14.05	15.05	17.30	14.05	28.05	15.05	16.05	18.30	17.30
90	11.05	25.05	12.05	13.05	15.30	12.05	26.05	13.05	14.05	16.30	13.05	27.05	14.05	15.05	17.30	16.30
120	10.05	24.05	11.05	12.05	14.30	11.05	25.05	12.05	13.38	15.38	12.05	26.05	13.05	14.05	16.30	15.33
150	9.05	23.05	10.05	11.20	13.34	10.05	24.05	11.05	12.05	14.30	11.05	25.05	12.05	13.05	15.30	14.31
180	8.05	22.05	9.05	10.05	12.30	9.05	23.05	10.05	11.05	13.30	10.05	24.05	11.05	12.05	14.30	13.30
Mean	11.05	25.05	12.05	13.07	15.31	12.05	26.06	13.06	14.10	16.32	13.06	27.06	14.05	15.06	17.31	

CD at 5%
Pulp content - 0.30
Cultivar - 0.35
Storage - 0.46
Pulp content X Cultivar - N.S.
Pulp content X Storage - N.S.
Cultivar X Storage - N.S.
Pulp content X Cultivar X Storage - N.S.

Mean for cultivars: D – 12.05, L – 26.06, C - 13.05, A – 14.08

Table.5 Effect of pulp percentage of different cultivars on carotenoid content (mg/100 ml) during storage of squash

Days	25% Pulp					30% Pulp					35% Pulp					Overall Mean
	D	L	C	A	Mean	D	L	C	A	Mean	D	L	C	A	Mean	
0	2.75	3.05	2.55	4.95	3.32	3.24	3.55	2.95	5.75	3.87	3.74	4.05	3.45	6.15	4.35	3.85
30	2.65	2.94	2.45	4.82	3.22	3.14	3.43	2.85	5.64	3.77	3.64	3.95	3.35	6.05	4.25	3.74
60	2.54	2.85	2.34	4.75	3.12	3.04	3.35	2.75	5.55	3.67	3.54	3.88	3.25	5.95	4.15	3.65
90	2.47	2.77	2.27	4.67	3.04	2.96	3.27	2.67	5.47	3.59	3.46	3.75	3.17	5.87	4.06	3.57
120	2.39	2.69	2.19	4.59	2.97	2.88	3.19	2.59	5.39	3.51	3.38	3.67	3.12	5.81	3.99	3.49
150	2.33	2.63	2.11	4.51	2.90	2.82	3.11	2.51	5.33	3.44	3.32	3.59	3.03	5.75	3.92	3.42
180	2.27	2.57	2.05	4.45	2.84	2.76	3.05	2.45	5.27	3.38	3.26	3.51	2.97	5.69	3.86	3.36
Mean	2.49	2.79	2.28	4.68	3.06	2.98	3.28	2.68	5.49	3.61	3.48	3.77	3.19	5.89	4.08	

CD at 5% Pulp content - 0.02
Cultivar - 0.02
Storage - 0.02
Cultivar X Storage - N.S.
Pulp content X Cultivar - 0.03
Pulp content X Storage - N.S.
Pulp content X Cultivar X Storage - N.S

Mean for cultivars: D – 2.98
L – 3.28
C – 2.72
A – 5.35

D- Dashehari, L- Langra, C- S.B. Chausa, A- Amrapali

Table.6 Effect of pulp percentage of different cultivars on organoleptic rating during storage of squash

Days	25% Pulp					30% Pulp					35% Pulp					Overall Mean
	D	L	C	A	Mean	D	L	C	A	Mean	D	L	C	A	Mean	
0	7.7	7.0	7.3	8.0	7.5	8.0	7.3	7.7	8.3	7.8	8.3	7.7	8.0	8.7	8.2	7.8
30	7.3	6.7	7.0	7.7	7.2	7.7	7.0	7.3	8.0	7.5	8.0	7.3	7.7	8.3	7.8	7.5
60	6.7	6.3	6.7	7.3	6.8	7.3	6.7	7.0	7.7	7.2	7.7	7.0	7.3	8.0	7.5	7.1
90	6.3	6.0	6.3	7.0	6.4	6.7	6.3	6.7	7.3	6.8	7.3	6.7	7.0	7.7	7.2	6.8
120	6.0	5.7	6.0	6.7	6.1	6.3	6.0	6.3	7.0	6.4	7.0	6.3	6.7	7.3	6.8	6.4
150	5.7	5.3	5.7	6.3	5.8	6.0	5.7	6.0	6.7	6.1	6.7	6.0	6.3	7.0	6.5	6.1
180	5.3	5.0	5.3	6.0	5.4	5.7	5.3	5.7	6.3	5.8	6.3	5.7	6.0	6.7	6.2	5.8
Mean	6.4	6.0	6.3	7.0	6.4	6.8	6.3	6.7	7.3	6.8	7.3	6.7	7.0	7.7	7.2	

Mean for cultivars: D – 6.9
L – 6.3
C – 6.7
A – 7.3

D- Dashehari, L- Langra, C- S.B. Chausa, A- Amrapali

Acidity was recorded maximum (0.892%) and minimum (0.889%) in S.B. Chausa and Langra respectively. Among pulp content, maximum (0.892%) and minimum (0.890%) acidity was found in squash prepared from 25% and 35% pulp content respectively. This reduction in acidity with the increase in storage period might be due to hydrolysis of polysaccharides and non-reducing sugars in the presence of organic acid. Kannan and Thirumaran (2001) also opined that reduction in acidity during storage might be due to chemical reaction taking place between organic acids and pigments. Total sugar content of squash increased significantly from 37.93% on 0 day to 39.29% on 180 days of storage irrespective of cultivar and pulp content (Table 3). The maximum (40.37%) and the minimum (37.42%) total sugar was recorded in squash prepared from Amrapali and Dashehari respectively. Squash prepared from 35% and 25% pulp content showed maximum (38.84%) and minimum (38.39%) total sugar respectively. The increase in total sugar content of squash during storage might be due to hydrolysis of polysaccharides like pectin, starch etc. into simple sugars. This could be attributed to gradual inversion of non-reducing sugars (Jain *et al.,* 1988). Similar trend in change of total sugar was found in Karonda squash (Deen and Singh, 2012).

Ascorbic Acid content of squash decreased significantly from 19.33 mg/100 ml on 0 day to 13.30 mg/100 ml on 180 days of storage irrespective of cultivar and pulp content (Table 4). Among the pulp content, maximum (17.31 mg/100 ml) and minimum (15.31 mg/100 ml) ascorbic acid was found in squash prepared from 35% and 25% pulp content respectively irrespective of cultivars and storage period. The reduction in ascorbic acid content of squash during storage might be due to thermal oxidation during processing and subsequent oxidation in storage. Similar changes in ascorbic acid content were reported in bael fruit squash (Kaushik *et al.,* 2002) and in jamun squash (Das, 2009). Decrease in ascorbic acid was also recorded in squash from guava-mango blends (Yadav *et al.,* 2015). Carotenoid content of squash decreased significantly from 3.85 mg/100ml on 0 day to 3.36 mg/100ml on 180 days of storage irrespective of cultivar and pulp content (Table 5). Among different cultivars, maximum (5.35 mg/100ml) and minimum (2.72 mg/100 ml) carotenoid content was recorded in squash prepared from Amrapali and S.B. Chausa respectively irrespective of pulp content and storage period. This decrease in carotenoid content of squash during storage was probably due to the effect of high temperature and enzyme activation on the pigments.

Organoleptic rating of squash decreased significantly from 7.8 on 0 day to 5.8 on 180 days of storage irrespective of cultivar and pulp content (Table 6). Among different cultivars, maximum (7.3) and minimum (6.3) organoleptic rating was recorded in squash prepared from Amrapali and Langra respectively when considered irrespective of pulp content and storage period. Regarding the pulp content, maximum (7.2) and minimum (6.4) organoleptic rating was found in squash prepared from 35% and 25% pulp content respectively irrespective of cultivar and storage period. This might be due to changes in chemical constituents or certain enzymatic and non-enzymatic changes in the beverages during storage. Similar decrease in organoleptic rating was also reported in squash from guava-mango blends (Yadav *et al.,* 2015).

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How to cite this article:

Satish Kumar, R.K. Godara, Suresh Kumar and Jagat Singh. 2018. Studies on Physico-chemical Characteristics in Squash Prepared from Different Mango Cultivars. *Int.J.Curr.Microbiol.App.Sci.* 7(01): 827-833. doi: https://doi.org/10.20546/ijcmas.2018.701.101