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Effect of various recipes on chemical characteristics of custard apple jam

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Abstract

The study on the chemical characteristics of custard apple jam stored up to 100 days was carried out in the Post-Harvest Laboratory, Department of horticulture, JNKVV Jabalpur (M.P.) in the year 2016 - 2017. Statistical analysis and chemical evaluation of the data was carried out and it was observed that effect of storage of custard apple jam at room temperature up to 100 days on scores for chemical quality of custard apple jam viz Total Soluble Solids, Acidity, pH, Ascorbic acid, Moisture, Reducing Sugar and Total Sugar from 72.56-72.93, 1.84-2.20, 3.85-3.67, 32.00-21.0, 30.24-29.18, 23.11-25.14 and 48.31-50.34, respectively.

Keywords: custard apple, citric acid, jam, Sugar

1. Introduction

India is the seventh largest country in the world with a total geographical area of 328.73 million hectares and occupies the area of 67.05 Mha (NHB database 2014) under fruit crops. It ranks second in the world in fruit production with 76.42MT production and 11.4 MT/ha productivity. Custard apple (*Annona squamosa* Linn.) also known as Sitaphal belongs to the family *Annonaceae* one of the finest fruits gifted to India by Tropical America. Custard apple is considered as one of the delicious and nutritionally valuable fruit meant for table purpose. Annonas are mostly consumed as dessert fruits due to its soft, granular, juicy sugar pulp with mild flavour and slight acidity. Its fruits are considered for medicinal value, and have been found to be very useful for brain and nervous system, generally used in ice cream, certain milk products and in making jam, jelly and other products. It is considered as beneficial for cardiac disease, diabetes and cancer. The seeds contain about 30% oil which can be used in soaps and paint industry. In India, it is cultivated mainly under rainfed conditions and covers more than 42,000 ha area with an annual production of 31,500 tonnes while in Madhya Pradesh it is grown in about 265 ha area with an annual production of 1987.50 tonnes (Anonymous, 2015)^[2]. It contains about 28-55% of edible portion consisting of 73.30% moisture, 1.60 protein, 0.30% fat, 0.70% mineral matter, 23.90% carbohydrates, 0.20% calcium, 0.40% phosphorus, 1.0% iron, 12.4-18.15% sugar, 0.26-0.65% acidity and with caloric value of 105 K. Cal/100g.

2. Material and Methods

The fresh, uniform sized, mature fruits of custard apple were procured during the monsoon season (2016-17) from the whole sale fruit market (mandi) and used for experimentation. The unripe, sorted diseased, damaged and off type fruits were discarded. The good quality/sorted fruits were picked up and used for the purpose of experimentation.

2.1 Experimental details

Crop	:	Custard apple
Treatment	:	Factor A - 4 level of fruit pulp ratio + 4 level of sugar Factor B - 3 level of citric acid
Total No of treatment	:	12 (4x3)
Design	:	Completely Randomized Design (CRD).

S. No	Factor A (Pulp Ratio)	Notation
1.	70% Custard apple pulp + 30g Sugar	G1
2.	60% Custard apple pulp + 40g Sugar	G2
3.	50% Custard apple pulp + 50g Sugar	G3
4.	40% Custard apple pulp + 60g Sugar	G4

S. No	Factor B (Sugar Level)	Notation
1.	0.75g	C1
2.	1.0g	C2
3.	1.25g	C3

Details of treatment combination

Treatment	Combinations	Custard apple pulp (%)	Papaya pulp (%)	Sugar (g)
T1	G1C1	70	30	0.75
T2	G1C2	70	30	1.0
T3	G1C3	70	30	1.25
T4	G2C1	60	40	0.75
T5	G2C2	60	40	1.0
T6	G2C3	60	40	1.25
T7	G3C1	50	50	0.75
T8	G3C2	50	50	1.0
T9	G3C3	50	50	1.25
T10	G4C1	40	60	0.75
T11	G4C2	40	60	1.0
T12	G4C3	40	60	1.25

Procedure of pulp preparation

2.2 Preparation of fruits for pulping

The fruits were washed in running tap water for removing the adhering dirt. After washing of fruits, The pulp was extracted using the following procedure.

2.3 Extraction of pulp from custard apple

Fully ripened fruits were selected and the pulp was extracted manually under hygienic conditions. The seeds and pulp were separated from each other by rubbing the mixture on a 30 mesh sieve leaving the seeds and the covering sheath of the capillary pulp.

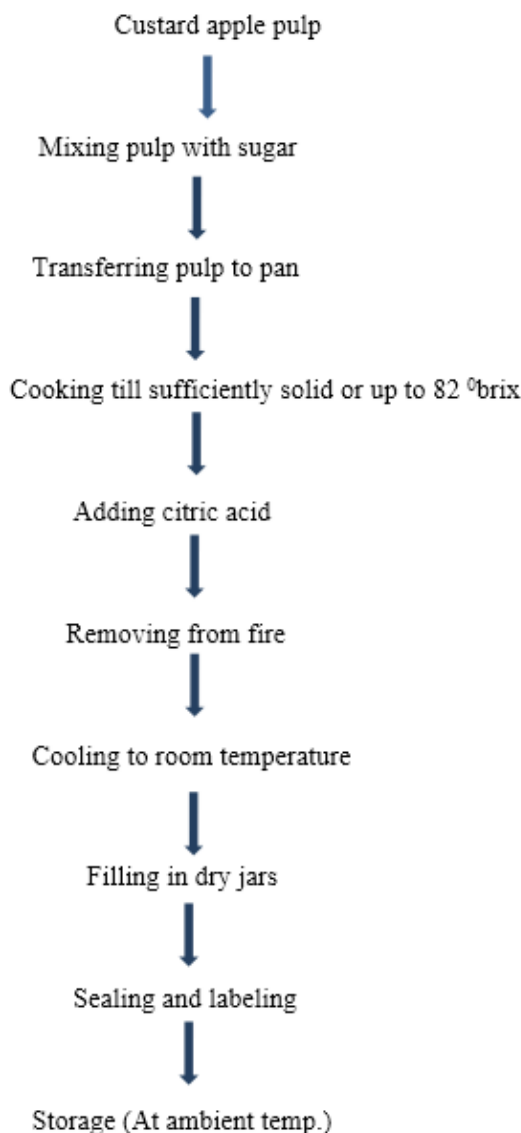
2.4 Pulp percent in fruit

The pulp from known weight of custard apple fruit were extracted out. The weight of both fruit pulp was recorded separately. It was done in 3 replications to minimize the experimental error. The weight of pulp in relation to weight of whole fruit was recorded.

2.5 Storage

The prepared custard apple jam was stored in dried place at ambient temperature which ranged from 18.20 °C (minimum) to 31.90 °C (maximum).

Flow sheet for the preparation of custard apple jam



2.6 Chemical Analysis

The present investigation was carried out in the Post-Harvest Laboratory, Department of Horticulture, JNKVV, Jabalpur (M.P.) The preparation of custard apple jam was evaluated for various chemical properties like TSS, acidity, pH, ascorbic acid, reducing sugar, non-reducing sugar, total sugar and moisture per sentage By (A.O.A.C. 1990) Ascorbic acid and acidity as per the standard method suggested by (Ranganna, 1997) [7].

3. Result and Discussion

The present investigation entitled "Standardization of recipe for development of value added products of custard apple (*Annona squamosa* L.)" was carried out to observe the effect of different blend ratio of custard apple and sugar along with citric acid etc. on preparation of custard apple jam and to find out acceptability of the products during storage.

3.1 Total soluble solids percentage

The result recording TSS of custard apple jam different stages of storage has been presented in Table 3.1. The results revealed that the higher concentration of sugar in custard apple jam increased the TSS percentage the custard apple jam found that the highest score (72.56%) for TSS was observed in G₄C₁(40% custard apple + 60% sugar with 0.75 g citric acid). As the period of storage increased, the TSS value of custard apple jam increased significantly up to 100 days of storage. The increase in TSS during storage might be due to the conversion of polysaccharides like starch and pectin into simple sugar. Similar inference was drawn by findings of Sreemathi *et al.* (2008) [12] who reported the increase in TSS of fruit bar (sapota 50: papaya 50) throughout during 3 months. The reasons assigned for the increased TSS content in nectar during storage might be due to conversion of left over polysaccharides into soluble sugar. These findings have been well supported by Baramanray *et al.* (1995) with guava nectar, Singh *et al.* (2013) [11] in the storage of jam from three different mango cultivar and Nidhi *et al.* (2008) with bael and guava blends beverage.

3.2 Acidity Percentage

The result recording acidity of custard apple jam different stages of storage has been presented in Table 3.2. In custard apple jam the higher value of acidity (1.84) was recorded in G₁C₃ (40% custard apple + 60% sugar with 1.25g citric acid). Results noted for the acidity percentage, clearly indicated that the acidity of custard apple jam was increased with the increasing storage period continuously up to 100 days of storage. A slight increase in titrable acidity during storage was also reported by Sandhu *et al.* (2008) [8] in papaya leather and Shakin *et al.* (2008) [10] in apple pear mixed fruit jam and Falchand *et al.* (2015) in papaya and apple fruit leather.

3.3 pH

The result recording pH of custard apple jam different stages of storage has been presented in Table 3.3. The pH value of a product plays an important role in preservation of pulp. Lowering of pH value is the result of increased acidity. The low pH inhibits the activity of microorganism specially the bacteria. An overall pH was observed to be less than 7.0 i.e; acidic. The pH values, however observed to be high at initial day of storage (0 day) in all ratio of recipes. In the custard apple jam highest value of pH (3.85) of custard apple jam was

observed in G₄C₁ (40% custard apple + 60% sugar with 0.75g citric acid). With regard to sugar content, it was noticed that the pH value increased with increasing sugar content and decreased significantly during storage period. Jindal (1997) reported that the acidity increased with corresponding decrease in pH. This might be due to formation of organic acid by ascorbic acid degradation. Nataliya *et al.* (2012) also observed a decrease in pH values during study of apple leather from 3.50 to 3.30 and Sreemathi *et al.* (2012) [12] also noticed that the pH decreased significantly during storage.

3.4 Ascorbic Acid (mg/100g)

The result recording ascorbic acid of custard apple jam different stages of storage has been presented in Table 3.4. Data revealed that the ascorbic acid custard apple jam, recorded at 0 days decreased significantly with increase in ratio of sugar and custard apple pulp. The treatment combination G₁C₁ (70% custard apple + 30% sugar with 0.75g citric acid). The highest ascorbic acid (32mg/100g) custard apple jam. In support to these result, Dhawan (1998) analysed the decrease content of ascorbic acid during storage of guava bar. Perhaps it might be due to decrease in quantity of acid (citric acid) and increase in enzymatic oxidation particularly when the custard apple pulp was mixed with papaya pulp. Similar results was also obtained by Thakre and Jain (2013) on blended nectar of papaya cv. Taiwan and banana cv. Dwarf Cavendish.

3.5 Moisture Percentage

The result recording moisture of custard apple jam different stages of storage has been presented in Table 3.5. The results recorded with moisture at 0 days in all the treatments. It was observed that in custard apple jam moisture values were increased as the proportion of custard apple pulp. It is also clear that the moisture content of custard apple jam decreased continuously during storage period. The moisture of custard apple jam, recorded at 0 days increased significantly with increase in ratio of citric acid and custard apple pulp. The treatment combination G₁C₃ (70% custard apple + 30% sugar with 1.25g citric acid). In recorded highest (30.24) moisture of custard apple jam. Moisture contents of custard apple jam decreased significantly possibly due to evaporation of water from the products, as a result of increased temperature during summer season. Similarly results obtained by Ahmad *et al.* (2007) with mango leather storage studies.

3.6 Reducing Sugar Percentage

The result recording reducing sugar of custard apple jam different stages of storage has been presented in Table 3.6. It is obvious that the reducing sugar per cent of custard apple jam was influenced by the storage period. The reducing sugar per cent increases continuously with the increase in storage period up to 100 days. In custard apple jam found that the highest score (23.11) for reducing sugar was observed in G₁C₃(70% custard apple + 30% sugar with 1.25g citric acid). The increase in reducing sugar during storage might be due to the conversion of polysaccharides like starch and pectin into simple sugar. Similar supported results were concluded by Sreemathi *et al.* (2008) [12] who reported the increase in reducing sugar of fruit bar (sapota 50: papaya 50) throughout the storage of 3 months and Nidhi *et al.* (2008) with bael and guava blends beverage.

Table 3.1: Effect of different recipes on TSS (° Brix) of custard apple jam during storage

Ratio of fruit pulp+sugar (Factor A)	0 days				20 days				40 days				60 days				80 days				100 days			
	Citric acid (Factor B)			Mean	Citric acid (Factor B)			Mean	Citric acid (Factor B)			Mean	Citric acid (Factor B)			Mean	Citric acid (Factor B)			Mean	Citric acid (Factor B)			Mean
	C1	C2	C3		C1	C2	C3		C1	C2	C3		C1	C2	C3		C1	C2	C3		C1	C2	C3	
G1	69.80	69.23	68.90	69.31	69.90	69.33	69.00	69.41	69.96	69.43	69.16	69.52	70.00	69.73	69.36	69.70	70.40	69.80	69.600	69.93	70.60	70.16	69.83	70.20
G2	70.53	70.30	70.10	70.31	70.63	70.40	70.26	70.43	70.86	70.46	70.30	70.54	70.96	70.63	70.40	70.66	71.13	70.96	70.633	70.91	71.23	71.03	70.96	71.07
G3	71.16	71.03	70.96	71.05	71.23	71.10	70.96	71.10	71.36	71.13	71.10	71.20	71.46	71.36	71.23	71.35	71.56	71.47	71.367	71.46	71.63	71.56	71.46	71.55
G4	72.56	72.40	72.20	72.38	72.70	72.53	72.30	72.51	72.73	72.50	72.40	72.54	72.76	72.53	72.46	72.58	72.83	72.70	72.500	72.67	72.93	72.76	72.53	72.74
MEAN	71.01	70.74	70.54		71.11	70.84	70.63		71.23	70.88	70.74		71.30	71.06	70.86		71.48	71.23	71.025		71.60	71.38	71.20	
Factor	A	B	AB		A	B	AB		A	B	AB		A	B	AB		A	B	AB		A	B	AB	
SEm±	0.111	0.097	0.193		0.088	0.076	0.152		0.122	0.106	0.211		0.114	0.099	0.198		0.124	0.107	0.215		0.117	0.102	0.203	
CD at 5% level	0.327	0.283	NS		0.258	0.223	NS		0.358	0.310	NS		0.335	0.290	NS		0.364	0.316	NS		0.344	0.298	NS	

Table 3.2: Effect of different recipes on acidity (%) of custard apple jam during storage

Ratio of fruit pulp+sugar (Factor A)	0 days				20 days				40 days				60 days				80 days				100 days			
	Citric acid (Factor B)			Mean	Citric acid(Factor B)			Mean	Citric acid (Factor B)			Mean	Citric acid (Factor B)			Mean	Citric acid (Factor B)			Mean	Citric acid (Factor B)			Mean
	C1	C2	C3		C1	C2	C3		C1	C2	C3		C1	C2	C3		C1	C2	C3		C1	C2	C3	
G1	1.52	1.72	1.84	1.69	1.54	1.74	1.85	1.71	1.56	1.78	1.90	1.74	1.58	1.84	1.94	1.78	1.59	1.88	1.98	1.81	1.68	1.92	2.20	1.93
G2	1.48	1.64	1.76	1.62	1.52	1.66	1.77	1.65	1.54	1.68	1.84	1.68	1.56	1.74	1.880	1.72	1.58	1.78	1.94	1.76	1.62	1.84	1.98	1.81
G3	1.42	1.56	1.62	1.53	1.45	1.57	1.66	1.56	1.48	1.62	1.76	1.62	1.52	1.68	1.82	1.67	1.56	1.74	1.86	1.72	1.58	1.78	1.90	1.75
G4	1.32	1.36	1.42	1.36	1.34	1.36	1.47	1.39	1.38	1.42	1.54	1.44	1.42	1.60	1.62	1.54	1.47	1.64	1.66	1.59	1.58	1.68	1.72	1.66
MEAN	1.43	1.57	1.66		1.466	1.58	1.69		1.49	1.62	1.76		1.52	1.71	1.81		1.55	1.76	1.86		1.61	1.80	1.95	
Factor	A	B	AB		A	B	AB		A	B	AB		A	B	AB		A	B	AB		A	B	AB	
SEm±	0.007	0.006	0.012		0.010	0.009	0.017		0.007	0.006	0.012		0.007	0.006	0.012		0.007	0.006	0.012		0.020	0.018	0.035	
CD at 5% level	0.020	0.017	0.034		0.029	0.025	0.050		0.020	0.017	0.034		0.021	0.018	0.036		0.020	0.017	0.034		0.060	0.052	0.103	

Table 3.3: Effect of different recipes on pH of custard apple jam during storage

Ratio of fruit pulp+sugar (Factor A)	0 days				20 days				40 days				60 days				80 days				100 days			
	Citric acid (Factor B)			Mean	Citric acid (Factor B)			Mean	Citric acid (Factor B)			Mean	Citric acid (Factor B)			Mean	Citric acid (Factor B)			Mean	Citric acid (Factor B)			Mean
	C1	C2	C3		C1	C2	C3		C1	C2	C3		C1	C2	C3		C1	C2	C3		C1	C2	C3	
G1	3.39	3.38	3.37	3.38	3.37	3.36	3.35	3.36	3.36	3.35	3.34	3.35	3.35	3.30	3.25	3.30	3.25	3.20	3.15	3.20	3.24	3.18	3.12	3.18
G2	3.69	3.68	3.67	3.68	3.68	3.67	3.62	3.65	3.46	3.40	3.30	3.38	3.43	3.36	3.26	3.35	3.40	3.33	3.23	3.32	3.26	3.20	3.20	3.22
G3	3.73	3.640	3.600	3.65	3.60	3.55	3.52	3.55	3.54	3.50	3.45	3.49	3.50	3.46	3.40	3.46	3.50	3.43	3.36	3.43	3.48	3.45	3.35	3.42
G4	3.85	3.78	3.73	3.78	3.74	3.71	3.66	3.70	3.72	3.70	3.57	3.66	3.70	3.65	3.53	3.62	3.68	3.60	3.50	3.60	3.67	3.49	3.46	3.54
MEAN	3.66	3.62	3.59		3.59	3.57	3.53		3.52	3.48	3.41		3.50	3.44	3.36		3.46	3.39	3.31		3.41	3.33	3.28	
Factor	A	B	AB		A	B	AB		A	B	AB		A	B	AB		A	B	AB		A	B	AB	
SEm±	0.008	0.007	0.014		0.008	0.007	0.014		0.026	0.023	0.045		0.025	0.022	0.044		0.025	0.022	0.044		0.007	0.006	0.012	
CD at 5% level	0.023	0.020	0.040		0.024	0.021	0.042		0.077	0.066	NS		0.074	0.064	NS		0.074	0.065	NS		0.020	0.017	0.034	

Table 3.4: Effect of different recipes on ascorbic acid (mg/100 g) of custard apple jam during storage

Ratio of fruit pulp+sugar (Factor A)	0 days			Mean	20 days			Mean	40 days			Mean	60 days			Mean	80 days			Mean	100 days			Mean
	Citric acid (Factor B)				Citric acid (Factor B)				Citric acid (Factor B)				Citric acid (Factor B)				Citric acid (Factor B)				Citric acid (Factor B)			
	C1	C2	C3		C1	C2	C3		C1	C2	C3		C1	C2	C3		C1	C2	C3		C1	C2	C3	
G1	32.00	30.00	28.00	30.00	28.00	26.00	24.00	26.00	26.00	24.00	22.50	24.16	24.00	22.00	20.50	22.16	23.00	21.00	19.50	21.16	21.00	19.00	17.50	19.16
G2	30.00	28.00	26.00	28.00	27.00	24.00	23.00	24.66	25.50	22.50	21.50	23.16	23.50	21.40	20.50	21.80	22.50	20.40	19.50	20.80	21.00	19.00	18.00	19.33
G3	27.00	25.00	23.00	25.00	24.00	22.00	20.00	22.00	22.16	20.50	18.50	20.38	20.50	18.50	17.40	18.80	19.30	17.50	16.50	17.76	18.00	16.00	15.00	16.33
G4	26.00	24.00	22.00	24.00	24.00	22.00	20.00	22.00	22.50	20.00	18.00	20.16	20.40	19.00	17.20	18.86	18.60	17.90	16.70	17.73	17.50	16.80	16.00	16.76
MEAN	28.75	26.75	24.75		25.75	23.50	21.75		24.04	21.75	20.12		22.10	20.22	18.90		20.85	19.20	18.05		19.37	17.70	16.62	
Factor	A	B	AB		A	B	AB		A	B	AB		A	B	AB		A	B	AB		A	B	AB	
SEm±	0.106	0.092	0.183		0.100	0.086	0.172		0.155	0.134	0.268		0.129	0.111	0.223		0.108	0.093	0.186		0.071	0.061	0.122	
CD at 5% level	0.311	0.269	NS		0.292	0.253	NS		0.454	0.393	NS		0.378	0.327	NS		0.316	0.274	0.547		0.208	0.180	0.360	

Table 3.5: Effect of different recipes on moisture (%) of custard apple jam during storage

Ratio of fruit pulp+sugar (Factor A)	0 days			Mean	20 days			Mean	40 days			Mean	60 days			Mean	80 days			Mean	100 days			Mean
	Citric acid (Factor B)				Citric acid (Factor B)				Citric acid (Factor B)				Citric acid (Factor B)				Citric acid (Factor B)				Citric acid (Factor B)			
	C1	C2	C3		C1	C2	C3		C1	C2	C3		C1	C2	C3		C1	C2	C3		C1	C2	C3	
G1	30.15	30.21	30.24	30.20	30.05	30.27	30.16	30.16	29.86	29.94	30.01	29.93	29.40	29.45	29.61	29.48	28.16	29.24	29.32	28.90	29.07	29.11	29.18	29.12
G2	29.96	30.04	30.11	30.03	29.75	29.80	30.01	29.85	29.30	29.37	29.45	29.37	28.96	29.04	29.11	29.03	28.63	28.70	28.74	28.69	28.61	28.66	28.70	28.65
G3	29.61	29.64	29.70	29.65	29.39	29.44	29.51	29.44	29.02	29.05	29.13	29.06	28.65	28.66	28.62	28.64	28.57	28.59	28.60	28.58	28.27	28.35	28.44	28.35
G4	29.37	29.41	29.46	29.41	29.19	29.24	29.32	29.25	28.67	28.74	28.84	28.75	28.35	28.38	28.39	28.37	28.27	28.28	28.30	28.28	28.03	28.08	28.14	28.08
MEAN	29.77	29.82	29.87		29.59	29.68	29.75		29.21	29.27	29.35		28.84	28.88	28.93		28.40	28.70	28.74		28.49	28.55	28.61	
Factor	A	B	AB		A	B	AB		A	B	AB		A	B	AB		A	B	AB		A	B	AB	
SEm±	0.015	0.013	0.027		0.012	0.011	0.021		0.011	0.010	0.019		0.012	0.011	0.021		0.018	0.015	0.030		0.010	0.009	0.018	
CD at 5% level	0.045	0.039	NS		0.036	0.031	0.062		0.033	0.028	NS		0.036	0.031	0.062		0.052	0.045	0.089		0.031	0.026	NS	

Table 3.6: Effect of different recipes on reducing sugar (%) of custard apple jam during storage

Ratio of fruit pulp+sugar (Factor A)	0 days			Mean	20 days			Mean	40 days			Mean	60 days			Mean	80 days			Mean	100 days			Mean
	Citric acid (Factor B)				Citric acid (Factor B)				Citric acid (Factor B)				Citric acid (Factor B)				Citric acid (Factor B)				Citric acid (Factor B)			
	C1	C2	C3		C1	C2	C3		C1	C2	C3		C1	C2	C3		C1	C2	C3		C1	C2	C3	
G1	23.00	23.02	23.11	23.04	23.740	23.78	23.90	23.80	24.15	24.20	24.33	24.22	24.50	24.54	24.62	24.55	24.74	24.78	24.90	24.80	25.00	25.07	25.14	25.07
G2	21.54	21.58	21.62	21.58	22.00	24.72	22.14	22.95	22.32	22.38	22.46	22.38	22.58	22.54	22.72	22.61	22.78	22.90	22.96	22.88	23.00	23.08	23.14	23.07
G3	20.20	20.26	20.36	20.27	20.72	20.76	20.90	20.79	21.12	21.18	21.26	21.18	21.42	21.48	21.52	21.47	21.62	21.68	21.76	21.68	21.72	21.78	21.84	21.78
G4	19.56	19.62	19.68	19.62	20.00	20.04	20.12	20.05	20.60	20.66	20.76	20.67	20.76	20.90	20.98	20.88	21.00	21.06	21.14	21.06	21.30	21.36	21.44	21.36
MEAN	21.07	21.12	21.19		21.61	22.32	21.76		22.04	22.10	22.20		22.31	22.36	22.46		22.53	22.60	22.69		22.75	22.82	22.89	
Factor	A	B	AB		A	B	AB		A	B	AB		A	B	AB		A	B	AB		A	B	AB	
SEm±	0.013	0.011	0.022		0.223	0.193	0.385		0.015	0.013	0.026		0.008	0.007	0.014		0.004	0.003	0.006		0.005	0.004	0.009	
CD at 5% level	0.038	0.033	NS		0.653	0.566	1.132		0.044	0.038	NS		0.023	0.020	0.040		0.011	0.009	0.018		0.015	0.013	0.025	

Table 3.7: Effect of different recipes on total sugar (%) of custard apple jam during storage

Ratio of fruit pulp+sugar (Factor A)	0 days			20 days			40 days			60 days			80 days			100 days								
	Citric acid (Factor B)			Mean	Citric acid (Factor B)			Mean	Citric acid (Factor B)			Mean	Citric acid (Factor B)			Mean	Citric acid (Factor B)			Mean				
	C1	C2	C3		C1	C2	C3		C1	C2	C3		C1	C2	C3		C1	C2	C3		C1	C2	C3	
G1	48.20	48.22	48.31	48.24	48.94	48.98	49.10	49.00	49.35	49.40	49.53	49.42	49.70	49.74	49.82	49.75	49.94	49.98	50.10	50.00	50.20	50.27	50.34	50.27
G2	46.74	46.78	46.82	46.78	47.20	47.26	47.34	47.26	47.52	47.58	47.66	47.58	47.78	47.84	47.92	47.84	47.98	48.10	48.16	48.08	48.20	48.28	48.34	48.27
G3	45.40	45.46	45.56	45.47	45.92	45.96	46.10	45.99	46.32	46.30	46.46	46.38	46.62	46.68	46.72	46.67	46.82	46.88	46.96	46.88	46.92	46.98	47.04	46.98
G4	44.76	44.82	44.88	44.82	45.20	45.24	45.32	45.25	45.80	45.86	45.96	45.87	45.96	46.10	46.18	46.08	46.20	46.26	46.34	46.26	46.50	46.56	46.64	46.56
MEAN	46.27	46.32	46.39		46.81	46.86	46.96		47.24	47.30	47.40		47.51	47.59	47.66		47.73	47.80	47.89		47.95	48.02	48.09	
Factor	A	B	AB		A	B	AB		A	B	AB		A	B	AB		A	B	AB		A	B	AB	
SEm±	0.016	0.014	0.027		0.013	0.011	0.022		0.010	0.008	0.017		0.009	0.008	0.016		0.011	0.009	0.019		0.011	0.009	0.019	
CD at 5% level	0.046	0.040	NS		0.037	0.032	NS		0.029	0.025	NS		0.027	0.024	NS		0.031	0.027	NS		0.032	0.028	NS	

3.7 Total Sugar Percentage

The result recording total sugar of custard apple jam different stages of storage has been presented in Table 3.7. It is obvious that the total sugar per cent of custard apple jam was influenced by the storage period. The total sugar per cent increases continuously with the increase in storage period up to 100 days. Custard apple jam found that the highest (48.31) score for total sugar was observed in G₁C₃ (70% custard apple + 30% papaya with 1.25g citric acid). The increase in total sugar during storage might be due to the conversion of polysaccharides like starch and pectin into simple sugar. Similar inference was drawn by findings of Sreemathi *et al.* (2008) [12] who reported the increase in total sugar of fruit bar (sapota 50: 50papaya) throughout the storage of 3 months and Kohinkar (2014) in mixed fruit toffee from fig and guava fruits.

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