



## EFFECT OF DIFFERENT CONCENTRATIONS OF CUSTARD APPLE PULP ON THE PROPERTIES OF ICE CREAM

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**ABSTRACT** : An experiment was conducted at P.G. laboratory, Department of Horticulture, Junagadh Agricultural University, Junagadh (Gujarat) during the year 2014 to study the physical, chemical and sensory properties of custard apple pulp ice cream. Treatments comprised with 5, 10, 15, 20, 25 and 30% custard apple pulp were used to prepare ice cream. The experiment was designed in Completely Randomized Design (CRD) with three replications. Ice cream with custard apple pulp was kept at -35-38°C in deep freezer. Ice cream was analyzed for physico-chemical, bio-chemical and sensory characteristics at 0, 10, 15, 30, 45 and 60 days of storage. Lowest acidity, highest pH, time taken for melting and protein content were recorded in treatment with 5% custard apple pulp ( $T_1$ ) followed by 10% custard apple pulp ( $T_2$ ). Similarly, better response in ascorbic acid and lower fat content was noted in 30% custard apple pulp ( $T_6$ ), but was found at par with 25% custard apple pulp ( $T_5$ ), whereas highest carbohydrates was noted in treatment with 25% custard apple pulp ( $T_5$ ). In organoleptic evaluation, the highest score of colour, texture, flavor, taste, overall acceptability and palatability were recorded in the ice cream with 15% custard apple pulp. There was a progressive deterioration in all sensory parameters during storage.

**Keywords** : Custard apple; Ice cream; pulp.

Ice cream is a delicious, wholesome, nutritive frozen dairy product. It provides about 4.9% protein, 13% fat, and 20.3% carbohydrates. One hundred grams of ice cream give about 214 calories to our body. The earlier use of fruit purees in sorbet has been diversified into ice cream (Friedrich, 4). The development of new varieties of ice creams is based on flavouring with fruit and vegetables extracts (Olenev, 9). Frozen and sugared preserved fruit purees have been regularly used in ice cream (Anon., 2). Besides developing innovative flavours, value-added dairy products are also being developed for appealing modern consumer life styles. Hence, there is a need to develop new functional dairy products to reflect consumer interest in health (e.g., utilizing fruit source with phytochemicals) and naturalness (Anon., 3).

Custard apple is much relished by people due to its edible, soft, juicy, sugary, granular and mildly flavoured pulp. It is rich in carbohydrate and provides good amount of proteins and minerals like calcium, phosphorus and iron. Its caloric value ranges 822 to 1050 kcal per kg as compared with 741 kcal per kg of custard apple. Ascorbic acid range in custard apple

from 14.9 mg to 18.2 mg/100 g. Ether extract, pectin was practically negligible in all varieties. The custard apple pulp is easy to digest and it can be consumed easily by children and people of all ages.

Ice cream has good nutritive value, produced by intelligent manufacturers in various style and forms at an affordable price and easily available. The development of new varieties of ice-cream is based on either milk, cream and whey concentrates and flavored with fruit extract. Frozen and sugar preserved purees have also been used in ice-cream manufacture.

Moreover ice-cream can be stored for longer periods. So, ice-cream industry has the potentiality to generate employment on large scale in India. Very limited research work has been carried out in the study of using various concentrations of custard apple fruit pulp on properties of ice-cream. Considering these facts, the present experiment was carried out.

### MATERIALS AND METHODS

#### Recipe for preparation of ice cream

Required materials like milk, cream, sugar, CMC, GMS, milkmaid, corn flour etc. were collected. Fresh custard apple fruits were collected from Sakkarbaug farm of Junagadh Agricultural University, Junagadh.

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The fresh ripe custard apples were washed with water and peeled and the pulp was extracted. All the ingredients were weighed using electric balance according to the formulation. Milk was concentrated in an open pan over a fire, and heated up to 60°C. A mixture of sugar, CMC, GMS powder was added manually at this stage and mixed thoroughly by stirring until a uniform mixture resulted. Then milkmaid was added at this stage and after thorough mixing and heating corn flour mixed with some amount of cold milk was added to this mixture and stirred constantly and fire was put off. This mixture was then allowed to cool at room temperature for half an hour. Then pulp of custard apple fruit was added as per treatments and blended with a hand mixer until air bubbles were found. The mix was frozen for 4-6 hours in a freezer and after getting settled it was again churned for getting desired consistency. As per desired consistency was attained, the ice cream was filled in disposable 100 ml plastic cups. The cups were immediately placed in deep freezer at -20°C. The temperature was maintained at -35°C to -38°C. Organoleptic evaluation of custard apple ice cream of different treatments was done periodically at initial to 60 days interval by a panel of judges on hedonic scale.

## RESULTS AND DISCUSSION

### Physical parameters

Significant variation was observed and lowest acidity (0.12, 0.12, 0.14, 0.14 & 0.15 % and highest pH (6.49, 6.21, 6.19, 6.17 & 5.97) were noted in 5% fruit pulp (T<sub>1</sub>) followed by T<sub>2</sub> and 30% fruit pulp (T<sub>6</sub>) during all days of storage, respectively. Increased fruit pulp resulted to increase the acidity and decrease the pH. Lower acidity with lower pulp might be due to poor concentration of fruit pulp. Acidity was found to increase with the increase in storage time. The increase in acidity might be due to inherited acidity present in the pulp and results in the formation of organic acids by degradation of ascorbic acid and utilization of sugars to yield organic acid. The results of this study are similar to those reported by Siddique *et al.* (11) who found that there was a gradual increase in acidity on storage of ice cream. It was observed that pH also reduced as pulp concentration increased. It is true that lower pulp concentration tends to poor acidity which resulted to higher pH value. However, pH was found to reduce as storage time period increased which might be due to increase in titrable acidity. Acidity causes changes during storage which affects

**Table 1: Effect of different treatments on titrable acidity (%) in custard apple ice cream during storage.**

Treatment	Storage at the interval of 15 days				
	Initial	15 days	30 days	45 days	60 days
T <sub>1</sub>	0.12	0.12	0.14	0.14	0.15
T <sub>2</sub>	0.13	0.13	0.15	0.15	0.16
T <sub>3</sub>	0.13	0.14	0.16	0.16	0.17
T <sub>4</sub>	0.15	0.15	0.17	0.18	0.18
T <sub>5</sub>	0.18	0.18	0.19	0.20	0.20
T <sub>6</sub>	0.20	0.20	0.21	0.21	0.21
C.D. (P=0.05)	0.01	0.01	0.01	0.01	0.02
C.V. %	2.18	3.71	4.34	4.57	5.08

**Table 2 : Effect of different treatments on pH in custard apple ice cream during storage.**

Treatment	Storage at the interval of 15 days				
	Initial	15 days	30 days	45 days	60 days
T <sub>1</sub>	6.49	6.21	6.19	6.17	5.97
T <sub>2</sub>	6.24	5.87	5.80	5.73	5.64
T <sub>3</sub>	6.18	5.66	5.69	5.67	5.47
T <sub>4</sub>	6.13	5.52	5.45	5.43	5.09
T <sub>5</sub>	5.87	5.30	5.27	5.25	5.05
T <sub>6</sub>	5.57	5.17	5.16	5.15	4.96
C.D. (P=0.05)	0.22	0.20	0.17	0.14	0.12
C.V. %	2.07	1.98	1.71	1.44	1.28

**Table 3: Effect of different treatments on time taken for melting time (minute) in custard apple ice cream during storage.**

Treatment	Storage at the interval of 15 days				
	Initial	15 days	30 days	45 days	60 days
T <sub>1</sub>	52.33	52.00	52.17	52.33	52.40
T <sub>2</sub>	48.00	47.83	47.93	48.00	48.00
T <sub>3</sub>	49.33	49.83	49.90	50.07	50.17
T <sub>4</sub>	48.77	48.50	48.67	49.00	49.33
T <sub>5</sub>	49.33	49.33	49.50	49.83	50.20
T <sub>6</sub>	48.33	48.17	48.23	48.23	48.23
C.D. (P=0.05)	NS	2.65	2.56	2.66	2.71
C.V. %	3.18	3.03	2.92	3.01	3.06

**Table 4 : Effect of different treatments on ascorbic acid (mg/100g) in custard apple ice cream during storage.**

Treatment	Storage at the interval of 15 days				
	Initial	15 days	30 days	45 days	60 days
T <sub>1</sub>	14.82	14.79	14.73	14.60	14.50
T <sub>2</sub>	17.12	17.10	17.07	17.00	16.93
T <sub>3</sub>	17.67	17.57	17.50	17.40	17.33
T <sub>4</sub>	21.33	21.17	21.00	20.93	20.83
T <sub>5</sub>	22.43	22.31	22.24	22.14	22.07
T <sub>6</sub>	24.73	24.66	24.58	24.45	24.35
C.D. (P=0.05)	2.28	2.21	2.13	2.10	2.05
C.V. %	6.52	6.33	6.14	6.09	5.96

**Table 5 : Effect of different treatments on proteins (%) in custard apple ice cream during storage.**

Treatment	Storage at the interval of 15 days				
	Initial	15 days	30 days	45 days	60 days
T <sub>1</sub>	3.58	3.58	3.57	3.57	3.57
T <sub>2</sub>	3.42	3.42	3.41	3.41	3.41
T <sub>3</sub>	3.10	3.10	3.10	3.11	3.11
T <sub>4</sub>	2.71	2.68	2.68	2.67	2.67
T <sub>5</sub>	2.40	2.42	2.42	2.42	2.42
T <sub>6</sub>	2.22	2.22	2.22	2.22	2.21
C.D. (P=0.05)	0.21	0.21	0.21	0.21	0.21
C.V. %	4.05	4.02	4.00	4.03	3.98

**Table 6 : Effect of different treatments on pH in custard apple ice cream during storage.**

Treatment	Storage at the interval of 15 days				
	Initial	15 days	30 days	45 days	60 days
T <sub>1</sub>	3.85	3.83	3.82	3.78	3.75
T <sub>2</sub>	3.48	3.46	3.43	3.43	3.40
T <sub>3</sub>	3.11	3.10	3.08	3.02	3.00
T <sub>4</sub>	2.67	2.67	2.64	2.63	2.62
T <sub>5</sub>	2.42	2.37	2.36	2.34	2.30
T <sub>6</sub>	2.22	2.19	2.16	2.12	2.11
C.D. (P=0.05)	0.21	0.21	0.20	0.20	0.19
C.V. %	4.06	3.94	3.85	3.81	3.79

**Table 7: Effect of different treatments on carbohydrates (%) in custard apple ice cream during storage.**

Treatment	Storage at the interval of 15 days				
	Initial	15 days	30 days	45 days	60 days
T <sub>1</sub>	16.33	16.30	16.29	16.28	16.26
T <sub>2</sub>	22.50	22.50	22.49	22.48	22.48
T <sub>3</sub>	22.39	22.19	22.18	22.18	22.48
T <sub>4</sub>	22.72	22.70	22.69	22.69	22.68
T <sub>5</sub>	26.98	26.95	26.94	26.94	26.93
T <sub>6</sub>	26.87	26.86	26.85	26.84	26.82
C.D. (P=0.05)	2.47	2.41	2.40	2.39	2.21
C.V. %	6.05	5.90	5.90	5.88	5.41

**Table 8 : Effect of different treatments on colour (score\*) in custard apple ice cream during storage.**

Treatment	Storage at the interval of 15 days				
	Initial	15 days	30 days	45 days	60 days
T <sub>1</sub>	7.00	6.93	6.83	6.83	6.77
T <sub>2</sub>	6.67	6.60	6.53	6.53	6.43
T <sub>3</sub>	9.00	8.90	8.87	8.83	8.77
T <sub>4</sub>	6.50	6.43	6.40	6.37	6.33
T <sub>5</sub>	6.67	6.63	6.60	6.55	6.43
T <sub>6</sub>	6.33	6.30	6.23	6.20	6.13
C.D. (P=0.05)	0.81	0.74	0.66	0.63	0.53
C.V. %	6.49	5.98	5.33	5.12	4.40

\* score out of ten (10)

**Table 9 : Effect of different treatments on texture (score\*) in custard apple ice cream during storage.**

Treatment	Storage at the interval of 15 days				
	Initial	15 days	30 days	45 days	60 days
T <sub>1</sub>	6.93	6.83	6.80	6.60	6.50
T <sub>2</sub>	5.30	5.27	5.10	5.00	4.93
T <sub>3</sub>	8.00	7.97	7.53	7.43	7.37
T <sub>4</sub>	7.67	7.60	7.50	7.37	7.23
T <sub>5</sub>	5.00	4.84	4.73	4.67	4.57
T <sub>6</sub>	4.97	4.77	4.53	4.50	4.40
C.D. (P=0.05)	0.77	0.74	0.69	0.63	0.57
C.V. %	6.82	6.69	6.45	5.96	5.53

\* score out of ten (10)

the pH as well as acceptance of ice cream. The decrease in pH is due to chemical reaction taking place during storage. Mustufa *et al.* (8) reported the same result in peach ice cream and Ahmed (1) in sapota jam.

The statistical analysis of data revealed that differences among various treatments for melting time were found non-significant at initial but observed significant during storage period 15 to 60 days. Maximum time taken for melting (52.00, 52.17, 52.33 and 52.40 minute) was recorded in treatment having

**Table 10 : Effect of different treatments on flavour (marks\*) in custard apple ice cream during storage.**

Treatment	Storage at the interval of 15 days				
	Initial	15 days	30 days	45 days	60 days
T <sub>1</sub>	7.33	7.27	7.23	7.20	7.17
T <sub>2</sub>	5.00	4.93	4.83	4.77	4.73
T <sub>3</sub>	9.00	8.93	8.77	8.73	8.70
T <sub>4</sub>	7.00	6.93	6.93	6.87	6.83
T <sub>5</sub>	4.33	4.27	4.23	4.20	4.17
T <sub>6</sub>	5.67	5.60	5.57	5.53	5.53
C.D. (P=0.05)	0.73	0.63	0.60	0.59	0.52
C.V. %	6.39	5.58	5.35	5.32	4.70

\* marks out of ten (10)

**Table 11 : Effect of different treatments on taste (score\*) in custard apple ice cream during storage.**

Treatment	Storage at the interval of 15 days				
	Initial	15 days	30 days	45 days	60 days
T <sub>1</sub>	6.67	6.63	6.27	6.60	6.53
T <sub>2</sub>	5.33	5.30	5.27	5.27	5.23
T <sub>3</sub>	8.33	8.30	8.27	8.23	8.20
T <sub>4</sub>	6.67	6.63	6.60	6.63	6.57
T <sub>5</sub>	4.33	4.30	4.30	4.27	4.23
T <sub>6</sub>	5.33	5.30	5.20	5.27	5.23
C.D. (P=0.05)	0.81	0.76	0.23	0.64	0.20
C.V. %	7.47	7.00	6.79	5.91	5.76

\* score out of ten (10)

**Table 12 : Effect of different treatments on overall acceptability (score\*) in custard apple ice cream during storage.**

Treatment	Storage at the interval of 15 days				
	Initial	15 days	30 days	45 days	60 days
T <sub>1</sub>	3.85	3.83	3.82	3.78	3.75
T <sub>2</sub>	3.48	3.46	3.43	3.43	3.40
T <sub>3</sub>	3.11	3.10	3.08	3.02	3.00
T <sub>4</sub>	2.67	2.67	2.64	2.63	2.62
T <sub>5</sub>	2.42	2.37	2.36	2.34	2.30
T <sub>6</sub>	2.22	2.19	2.16	2.12	2.11
C.D. (P=0.05)	0.21	0.21	0.20	0.20	0.19
C.V. %	4.06	3.94	3.85	3.81	3.79

\*score out of ten (10)

5% pulp (T<sub>1</sub>) followed by treatment T<sub>3</sub> during all days of storage, respectively. The time taken for melting in custard apple ice cream recorded at various intervals of time varied. As the concentrations of pulp increased from treatment to treatment the time recorded for melting decreased. This might be due to the increase in pulp in different treatments. As time period advanced for storage, the melting time also increased, which

might be due to the continuous storage of ice cream samples in the deep freezer at low temperatures.

The differences among various treatments were found significant and maximum ascorbic acid (24.73, 24.66, 24.58, 24.45 and 24.35 mg/100g) was found in treatment having 30% fruit pulp (T<sub>6</sub>) and was followed by treatment having 25% fruit pulp (T<sub>5</sub>) during all days of storage, respectively. Ascorbic acid was slightly

**Table 13 : Effect of different treatments on palatability (score\*) in custard apple ice cream during Storage.**

Treatment	Storage at the interval of 15 days				
	Initial	15 days	30 days	45 days	60 days
T <sub>1</sub>	7.67	7.63	7.60	7.57	7.53
T <sub>2</sub>	5.00	4.97	4.93	4.90	4.87
T <sub>3</sub>	8.33	8.30	8.27	7.97	7.93
T <sub>4</sub>	6.33	6.30	6.27	6.20	6.17
T <sub>5</sub>	4.33	4.30	4.23	4.20	4.17
T <sub>6</sub>	6.00	5.98	5.98	5.90	5.87
C.D. (P=0.05)	0.84	0.77	0.71	0.61	0.56
C.V. %	7.51	6.91	6.38	5.61	5.15

**\*score out of ten (10)**

reduced as storage period increased and increased as concentration of pulp was increased. This may be due to the ascorbic acid present in the custard apple pulp. It decreased in the ice cream with increase in time period of about 60 days. A decrease in ascorbic acid content during storage may be due to oxidation of ascorbic acid to dehydro-ascorbic acid, as the ascorbic acid is highly sensitive to the presence of oxygen in its environment. Similar observations have been reported by Sikder *et al.* (12) and Gowda *et al.* (5) in custard apple beverages.

The variation in different treatments on protein was also found significant and highest protein content (3.58, 3.58, 3.57, 3.57, 3.57 %) was registered in treatment having 5% fruit pulp (T<sub>1</sub>) but, it was at par with treatment T<sub>2</sub> during all days of storage, respectively. Protein was found highest in lower pulp concentration, but it reduced as pulp concentration increased. Protein was found highest in lower pulp concentration, but it reduced as pulp concentration increased. This might be due to more protein present in milk. Protein also decreased with the increase in storage period. The results of this study are supported by the findings of Gwiszczyńska and Kaluziak (6). Similarly, lowest fat content (2.22, 2.19, 2.16, 2.12 and 2.11 g) was found in treatment having 30% fruit pulp (T<sub>6</sub>), but was observed at par with T<sub>5</sub> during initial and 15 to 60 days of storage, respectively. Whereas, the highest fat content (3.85, 3.83, 3.82, 3.78 and 3.75 g) was noted in treatment having 30% fruit pulp (T<sub>6</sub>) during all days of storage, respectively. The fat was found to decrease as pulp concentration increased. This might be due to the fat present in the milk at lower concentrations of pulp in the ice cream. The fat in the custard apple ice cream also decreased with the advancement of storage period.

The differences among various treatments on carbohydrate content were found significant and the maximum carbohydrate content (26.98, 36.95, 26.94, 26.94 & 26.93 %) was found in treatment having 25% fruit pulp (T<sub>5</sub>) but, it was at par with treatment T<sub>6</sub> during all days of storage, respectively. It was also observed that the carbohydrate was increased as fruit pulp concentration is increased. But, it decreased slightly with the advancement of time during storage period of 60 days. This might be due to the amount of more carbohydrates present in custard apple pulp.

**Organoleptic evaluation**

Variation due to different treatments was found significant and better performance for organoleptic parameters like colour, texture, flavor, taste, overall acceptability and palatability were observed in 15% custard apple pulp (T<sub>3</sub>).

During storage a slight degradation in sensory quality was observed. According to Palich (10), with the passage of time, sensory quality of ice cream deteriorated. Organoleptic properties of ice cream decreased with increase in storage time (Mahran *et al.*, 7).

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