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Standardization of recipe and storage behaviour of date pulp (Khajur) fortified custard apple (*Annona squamosa* L.) Shake

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Abstract

The research work entitled with, "Standardization of recipe and storage behaviour of date pulp (Khajur) fortified custard apple (*Annona squamosa* L.) Shake," was conducted during year 2021–2022 at the Department of fruit science, College of Agriculture, IGKV, Raipur (C.G.). The goal of the current study was to improve custard apple shakes by adding date pulp at four different concentrations: 2.5%, 5%, 7.5%, and 10%. The five different ratio of custard apple pulp and date pulp used in the experiment are as follows: T₀ represents the control (12 percent custard apple pulp), T₁: 12% custard apple pulp + 2.5% date pulp, T₂: 12% custard apple pulp + 5% date pulp, T₃: 12% custard apple pulp + 7.5% date pulp, T₄: 12% custard apple pulp + 10% date pulp. According to the findings of the current investigation, treatment T₄, which consisted of 12% custard apple pulp + 10 percent date pulp recorded the maximum scores of TSS, pH, reducing sugar, total sugar, TSS: acid ratio, specific gravity, protein, ash and density in the custard apple shake. However, the levels of ascorbic acid, non-reducing sugar and titratable acidity were recorded maximum under treatment T₀ i.e. (control).

Keywords: Custard apple, date palm, TSS: Acid ratio, specific gravity, density and ascorbic acid

Introduction

Custard apple (*Annona squamosa* L.) is a member of the Annonaceae family. Custard apple is a delightful fruit with an excellent taste, mild scent with a smooth, sweet, juicy and granular pulp that is sometimes regarded as a poor man's rich food in the desert zones of South India (Bala *et al.* 2018) [7]. The fruit is rich in starch when firm but sugar increases marked by as it softens. The main sugars have been reported as glucose and fructose (80–90%) (Kumar *et al.* 2015) [15]. Custard apple fruit has TSS of 26.40° Brix, pH 5.5 and contains 0.5% tannins. The average percentage of pulp, peel and seeds in custard apple fruits was 40.38%, 48.62%, and 10.30%, respectively (Bakane *et al.* 2015) [5].

Fruit contains moisture (70.5%), carbohydrates (23.5%), protein (1.6%), fat (0.4%), mineral matter (0.9%), iron (1.0%), calcium (0.2%), phosphorous (0.04%) and energy value 104 Kcal/100g of edible portion (Gopalan *et al.*, 2004) [9]. Sugar content ranges from 12.4% to 18.5% and acidity ranges from 0.26 to 0.65%. It has great potential for value addition through processing (Kotecha *et al.* 2000) [14].

Date palm (*Phoenix dactylifera* L.) is one of the most valuable fruit tree cultivated in both tropical and subtropical climates and belongs to the family Palmae (Arecaceae) having chromosome number of 2n=36. It is a dioecious, perennial and monocotyledonous fruit tree. Date palm is a high energy fruit and have been used as a staple food for thousands of years in the desert regions of the world.

According to Al-Shahib *et al.*, (2003) [3] fruits of date palm hold a high proportion of carbohydrate (44–88%), fat (0.2–0.5%), proteins (2.3–5.6%), tannins (1.0–2.3%) and a good percentage of dietary fiber (6.4–11.5%). It enriches the human diet with high quality of a few compulsory amino acids (Shaba *et al.* 2015) [20]. There are 23 types of amino-acid are present in dates, some of which are not found in the very famous fruits such as oranges, apples and bananas.

Dates are chief source of Vitamin A. Higher amount of potassium and iron are and found in dates as regulation of heart rate and blood pressure by potassium and in red blood cells iron is the constituent of haemoglobin. Dates are sweet fruits that can be consumed either fresh or dried.

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Dates are frequently used in baked goods, desserts, butter, pork, date syrup, animal feed, date powder, multiple types of bread, marmalade, sweet candy, chocolate and date paste to flavour cakes. (Ahmed and Ramaswamy, 2005) [1].

Materials and method

The purpose of this study was to see, if it was possible to make a high-quality fortified custard apple shake by using date pulp in various level. The research is being conducted at IGKV's Horticulture fruit processing laboratory in Raipur (C.G).

Treatment combination

T ₀	Control (12% custard apple pulp)
T ₁	12% custard apple pulp + 2.5% date pulp
T ₂	12% custard apple pulp + 5% date pulp
T ₃	12% custard apple pulp + 7.5% date pulp
T ₄	12% custard apple pulp + 10% date pulp

Preparation of fortified custard apple shake

Cow's milk, sugar (10%), date pulp, custard apple pulp and almond were used as per the required ingredients. Initially, fresh, pure cow's milk was heated. The milk was then filtered through a clean, dry muslin cloth. The milk was heated to 71°C for 30 minutes. At this temperature, 10% sugar was added. The milk was cooled to a temperature of 30 degrees Celsius. Then, according to the treatments, custard apple pulp and date pulp were added. This mixture was blended, then chilled and stored at 5 °C in the refrigerator.

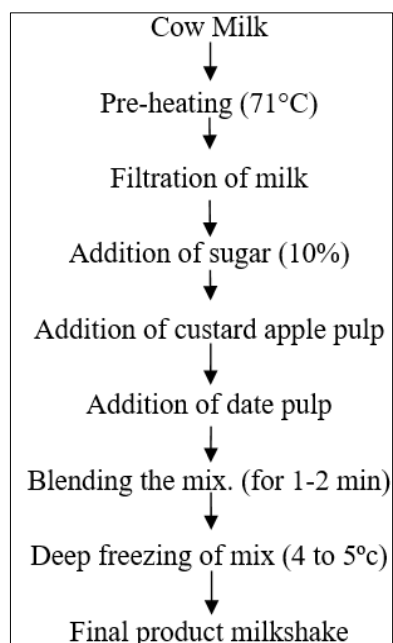


Fig 1: Flow chart for preparation of fortified custard apple shake

Result and Discussion

The result obtained from the present investigation as well as relevant discussion have been summarized under following given in table 1.

Total soluble solids (° Brix)

During 60 days of storage, the total soluble solids (TSS) of custard apple shake gradually increase. The treatment (12% custard apple pulp + 10% date pulp) T₄ recorded maximum TSS value of 19.71° Brix followed by T₃ (12% custard apple

pulp + 7.5% date pulp) was 18.64° Brix. Whereas, minimum TSS was recorded in T₀ (control) *i.e* 16.39° Brix. In the present experiment the TSS content was increased in the custard apple milkshake with the increase in date pulp quantity. A similar outcome was reported by Kashid *et al.* (2007) [12] in golden milkshake, Poul *et al.* (2009) [18] and Taware (2002) [21] in custard apple milkshake.

pH

During storage, the pH of the custard apple shake rises. The treatment T₄ (12% custard apple pulp + 10% date pulp) had the highest pH of 6.52 followed by treatment T₃ (12% custard apple pulp + 7.5% date pulp) was 6.44. Whereas, the treatment T₀ (control) had the lowest pH which was 6.12. The pH of the custard apple shake was increased as the amount of date pulp increased. Increased hydrogen ion concentration may be the reason for the pH values rising throughout the storage periods similar result were reported by Kashid *et al.* (2007) [12] in golden milkshake, Taware (2002) [21] and Poul *et al.* (2009) [18] in custard apple milkshake.

Ascorbic acid (mg/100ml)

During storage ascorbic acid of custard apple shake gradually decreases. The maximum ascorbic acid was observed in treatment T₀ (control) which was 10.91 mg/100 ml followed by T₁ (12% custard apple pulp + 2.5% date pulp) which was 9.24 mg/100ml and the minimum ascorbic acid was observed in treatment T₄ (12% custard apple pulp + 10% date pulp) which was 7.12 mg/100 ml. the ascorbic acid of custard apple shake declined with storage time. The oxidation of L-ascorbic acid into dehydro ascorbic acid in the presence of the enzyme ascorbic acid oxidase (Ascorbinase), which is trapped or residual oxygen left in the glass bottles, may be the reason for the decreased ascorbic acid concentration in custard apple shake during storage. Similar finding were observed by Jayathilakan *et al.* (2012) [10] in mango milkshake, Alizadeh *et al.* (2014) [2] in fruit flavoured milkshake,

Acidity (%)

The maximum titratable acidity was observed in treatment T₀ (control) which was 0.71% followed by T₁ (12% custard apple pulp + 2.5% date pulp) which was 0.14% and the minimum titratable acidity was observed in treatment T₄ (12% custard apple pulp + 10% date pulp) which was 0.12%. Data showed that as storage time increased, the acidity of custard apple shake gradually decreased. The breakdown of organic acid into sugars may also possibly be the reason for this. Similar result was reported by Kashid (2005) [13] in golden milkshake, Kadav (2001) [11] in fruit flavoured milkshake

TSS: acid ratio

TSS: acid ratio increases during 60 days of storage period. The highest TSS: acid ratio was observed in treatment T₄ (12% custard apple pulp + 10% date pulp) which was 58.57 followed by treatment T₃ (12% custard apple pulp + 7.5% date pulp) which was 55.20. The minimum TSS: acid ratio was observed in treatment T₀ (control) which was 49.13.

Total sugar (%)

The maximum total sugar of custard apple shake was observed in T₄ (12% custard apple pulp + 10% date pulp) which was 17.17% followed by treatment T₃ (12% custard apple pulp + 7.5% date pulp) which was 16.12%. Minimum

total sugar was observed in T₀ (control) which was 13.42%. During the storage period, the total sugar gradually increased. The breakdown of polysaccharides like pectin, starch, etc. into simple sugars during storage as well as moisture evaporation may be the causes of an increase in total sugars. Similar findings were reported by and Bakane *et al.* (2016) [6] in custard apple milk shake, Kashid (2005) [13] in golden milkshake,

Reducing sugar (%)

Reducing sugar of custard apple shake increase during storage. The maximum reducing sugar was observed in treatment T₄ (12% custard apple pulp + 10% date pulp) which was 13.85% followed by treatment T₃ (12% custard apple pulp + 7.5% date pulp) which was 12.56% and the minimum reducing sugar was observed in T₀ (control) which was 8.69%. The increase in reducing sugars might be due to hydrolysis of sugar by acid, which might have resulted in

degradation of disaccharides to monosaccharides. Similar results were reported by Kashid *et al.* (2007) [12] in golden milkshake and Ubale *et al.* (2014) [22] in sapota milkshake.

Non-reducing sugar (%)

The non-reducing sugar of custard apple shake decrease during storage. The maximum non reducing sugar was observed in treatment T₀ (control) which was 4.65% followed by treatment T₁ (12% custard apple pulp + 2.5% date pulp) which was 4.38% and the minimum non-reducing sugar was observed in treatment T₄ (12% custard apple pulp + 10% date pulp) which was 3.31%. During the storage period, the non-reducing sugar content ultimately decreased while both the reducing sugar and total sugar increased. Increase in reducing sugar was correlated with a decrease in non-reducing sugar. Similar result were found by Nidhi *et al.* (2007) [16], Pakalwad *et al.* (2010) [17] in papaya milkshake

Table 1: Chemical analysis of custard apple shake fortified with date pulp during storage

Treatment	TSS (° Brix)					pH				
	Storage period									
	0 DAS	15 DAS	30 DAS	45 DAS	60 DAS	0 DAS	15 DAS	30 DAS	45 DAS	60 DAS
T ₀	15.26	16.51	16.52	16.63	17.03	5.28	6.30	6.32	6.35	6.36
T ₁	15.27	17.45	18.15	18.84	19.13	5.35	6.38	6.41	6.45	6.48
T ₂	15.41	17.52	18.11	19.37	19.73	5.39	6.49	6.51	6.57	6.59
T ₃	15.55	19.24	18.51	19.85	20.05	5.45	6.66	6.68	6.71	6.75
T ₄	15.81	20.04	20.13	21.22	21.36	5.59	6.60	6.74	6.83	6.87

Treatment	Ascorbic acid (mg/100g)					Titratable acidity (%)				
	Storage period									
	0 DAS	15 DAS	30 DAS	45 DAS	60 DAS	0 DAS	15 DAS	30 DAS	45 DAS	60 DAS
T ₀	11.44	11.23	11.16	10.54	10.22	0.18	0.19	0.17	0.16	0.15
T ₁	9.87	9.82	8.88	8.85	8.80	0.17	0.17	0.14	0.13	0.13
T ₂	9.96	8.59	8.54	8.82	7.66	0.19	0.15	0.13	0.11	0.11
T ₃	8.95	8.79	7.64	7.55	7.49	0.18	0.15	0.11	0.12	0.10
T ₄	7.87	7.83	6.71	6.67	6.53 ^d	0.16	0.13	0.12	0.12	0.11

Treatment	TSS: acid ratio					Total sugar (%)				
	Storage period									
	0 DAS	15 DAS	30 DAS	45 DAS	60 DAS	0 DAS	15 DAS	30 DAS	45 DAS	60 DAS
T ₀	84.77	86.89	97.17	103.93	113.53	13.23	12.29	13.32	14.01	14.25
T ₁	89.82	102.64	129.64	144.92	147.15	13.85	13.99	14.78	14.95	15.39
T ₂	81.10	116.8	139.30	176.09	179.36	14.29	14.36	15.44	15.87	15.99
T ₃	86.38	128.26	168.27	165.41	200.50	15.29	16.26	16.31	16.38	16.40
T ₄	98.81	154.15	167.75	176.83	194.18	16.34	17.21	17.32	17.49	17.52

Treatment	Reducing sugar (%)					Non-reducing sugar (%)				
	Storage period									
	0 DAS	15 DAS	30 DAS	45 DAS	60 DAS	0 DAS	15 DAS	30 DAS	45 DAS	60 DAS
T ₀	7.88	7.92	8.55	9.45	9.66	5.35	4.37	4.77	4.56	4.23
T ₁	8.95	9.68	9.74	10.99	11.22	4.90	4.31	5.04	3.96	3.72
T ₂	9.24	9.89	11.22	11.76	12.11	5.05	4.47	4.22	4.11	3.85
T ₃	10.85	11.95	12.98	13.29	13.77	4.44	4.31	3.33	3.09	2.76
T ₄	11.78	13.62	13.62	14.95	15.16	4.56	3.59	3.56	2.54	2.33

Conclusion

Based on the above result the following conclusion have been drawn. Higher value of TSS, pH, reducing sugar, total sugar, TSS/acid ratio, specific gravity, protein, ash and density are obtained under custard apple shake prepared from 12% custard apple + 10% date pulp. However, maximum ascorbic acid, non-reducing sugar and titratable acidity was obtained when custard apple shake is prepared by using 12% custard apple pulp *i.e* (control).

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