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EFFECT OF RECIPE TREATMENT AND STORAGE PERIOD ON BIOCHEMICAL COMPOSITION OF NECTAR PREPARED FROM CUSTARD APPLE GENOTYPES

KISHAN KUMAR*, S.N. DIKSHIT, NISHA CHANDEL AND APURWA KESHARWANI

Department of Horticulture, IGKV, Raipur (Chhattisgarh) 492012
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ABSTRACT

The present investigation was designed to determine the effect of storage period on nectar of custard apple genotypes and to find out the best recipe beverages having a maximum shelf life. The experimental material consists of well ripened fruits of some local genotypes of Chhattisgarh with six recipe treatments and three replications under completely randomized design. The nectar prepared from different recipe treatments were analyzed periodically at 30 days interval up to 90 days for their biochemical changes. The acidity, TSS, total sugar, reducing sugar showed an increasing trend while non-reducing sugar decreasing trend with increasing period of storage upto 90 days under ambient conditions. The nectar prepared with the 20% pulp, 0.3% acidity, 17% TSS from the genotype IGCA-38 contained highest acidity (.40%), T.S.S. (18.88%), total sugar (13.64%) and reducing sugar (4.58%) with moderate amount of non-reducing sugar, thus, found to be suitable for preparation of custard apple nectar at commercial scale.

Key words: Custard apple genotypes, recipe, nectar, biochemical changes, storage period

INTRODUCTION

Custard apple, botanically known as *Annona squamosa* L., belongs to family Annonaceae. Genus *Annona* contains more than fifty species, of which, five produce edible fruits of horticultural importance. Custard apple is a hardy crop that can be grown on marginal lands with minimum care and inputs. Custard apple is highly valued for its nutritive qualities. Various products such as jam, ice cream, milk cake are prepared from custard apple. However, little or no attention has been given for utilizing this fruit to beverage industry. Processing of custard apple into quality beverages such as nectar, RTS would be more nutritious than many of the synthetic drinks. Fruit beverages are easily digestible, highly refreshing, thirst quenching and nutritionally far superior than many synthetic and aerated drinks (Shrivastava *et al.,* 2013). Looking to the demand of natural beverages, there is a great scope for the preparation of fruit juice and other fruit-based beverages.Custard apple fruit is climacteric and highly perishable in nature and mostly utilized for fresh market. It is having shelf life of four or five days. The shorter shelf life makes the marketability difficult. Therefore, in the period of glut it has to be sold at unremunerative prices.Hence, there is an urgent necessity to develop some suitable technology for the preparation of custard apple beverages, which could be economical and made available to a large population. The palatable products of custard apple should have many of the dietary values of fresh fruits. Hence, the preservation of fruits partially solves this problem and also helps to control glut and very low prices in the market. Due to their nutritive values they are becoming more popular than synthetic drinks. They contain vitamins (A, B and C) and minerals (iron, calcium etc.) and provide more calories (Bal, 2006). Therefore, in order to explore the possibilities of utilizing the fruits for making different quality products with longer shelf life, the recipe used for the preparation of this beverage should be standardized which will be helpful in procuring the maximum benefit from same quantity of fruit as used in raw form.

MATERIALS AND METHODS

The experimental materials used in the investigation include well ripened custard apple fruits of local genotypes *viz.,* IGCA-18, IGCA-21, IGCA-37 and IGCA-38 which were procured from Kanker district and surrounding areas of Chhattisgarh state. The experiment was laid out in completely randomized design having 6 recipe treatments with 3 replications. The recipes (Treatments) of nectar were T_1: (20% pulp, 0.3% acidity, 15% TSS), T_2: (20% pulp, 0.3% acidity, 16% TSS), T_3: (20% pulp, 0.3% acidity, 17% TSS), T_4: (20% pulp, 0.3% acidity, 18% TSS), T_5: (20% pulp, 0.3% acidity, 19% TSS) and T_6: (20% pulp, 0.3% acidity, 20% TSS). Fully ripened fruits were selected for the preparation of custard apple nectar. The fruits were washed under tap water to remove dirt and dust particles and the pulp was extracted manually under hygienic conditions. The seeds and pulp were separated from each other by adding equal amount of warm water to the pulp and the pulp was passed through the pulper. The whole mass was then sieved to obtain a fine fruit pulp

*****Corresponding author Email: *kbanjara51@gmail.com*

devoid of skin and seeds. After the extraction of pulp, 20 per cent pulp was taken for preparation of nectar. The volume of the final product was maintained by adding water to each recipe. A calculated amount of sugar was added in the pulp to adjust the total soluble solids as 15 to 20 per cent in the recipes for nectar. The acidity was adjusted to 0.3 per cent in the final product by the addition of required amount of citric acid. Then after filtration, pulp juice extraction was obtained. This extraction was mixed with the syrup and then boiled, filtered, bottled, properly pasteurized and then stored at the ambient temperature to access the effect of various recipes treatment on various biochemical parameters of nectar beverage. Chemical analysis of custard apple nectar was done initially just after preparation upto 90 days at 30 days interval during storage under ambient condition. TSS of nectar was determined by Hand Refractometer at 20°C and expressed in per cent. The acidity of nectar was determined by the procedure given by Ranganna (1986). Sugars (Reducing, non-reducing and total sugars) were determined by the method of Lane and Eynon as described by Ranganna (1986). The analysis of variance of the data was done by using completely randomized design (CRD) for different treatments as per the methods given by Gomez and Gomez (1985).

RESULTS AND DISCUSSION

Total Soluble Solids

The TSS content in custard apple nectar showed an increasing trend with the genotypes at increasing period of storage (Table 1). A non-significant difference in TSS content was observed among genotypes at the time of preparation. While, at 30 days of storage, the TSS was found to be significantly higher in the genotype IGCA-21 (20.36%) under 20% pulp, 0.3% acidity, 20% TSS followed by IGCA-38 (19.37%) 20% pulp, 0.3% acidity, 19% TSS. At 90 days of storage, genotype IGCA-38 contained maximum TSS (20.87%) under 20% pulp, 0.3% acidity, 20% TSS). The increasing trend of TSS in nectar during storage was probably due to the conversion of left over polysaccharides into soluble sugars. Similar results were reported in date juice RTS (Godara and Pareek, 1985), in litchi by (Singh and Singh, 1994), in custard apple beverages (Choudhary and Dikshit, 2006 and Jain *et al.*, 2007).

Acidity

It is observed from Table 1 that acidity in custard apple nectar showed an increasing trend in all the genotypes and recipes with increasing period of storage. The acidity was not influenced significantly at the time of preparation in all the genotypes. Thereafter, at 30 days of storage, the acidity was found to be increased significantly in the genotype IGCA-38 (0.42%) under the treatment 20% pulp, 0.3% acidity, 20% TSS followed by 20% pulp, 0.3% acidity, 19% TSS. At the 90 days of storage, genotype IGCA-38 contained maximum acidity (0.44%) under the treatment 20% pulp, 0.3% acidity, 20% TSS followed by 20% pulp, 0.3% acidity, 19% TSS. The increase in acidity in nectar during the storage might be due to the formation of organic acids by ascorbic acid degradation as well as the degradation of pectin substances of pulp into soluble solids. Similar findings were also reported by Jain *et al.* (2007) in different fruit beverages and Choudhary and Dikshit (2006) in custard apple beverages.

Reducing sugar

There was significant increase in reducing sugar with the increase in storage period (Table 2). The reducing sugar content in nectar increased sharply in all the recipes during storage. A significantly higher content of reduce sugar was observed after 30 days of storage in the genotype IGCA-21 (3.99%) under 20% pulp, 0.3% acidity, 17% TSS followed by IGCA-38 (3.98%) under 20% pulp, 0.3% acidity, 15% TSS. At the 90 day of storage, the genotype IGCA-38 contained maximum reducing sugar content (4.73%) under 20% pulp, 0.3% acidity, 15% TSS, which was significantly higher than IGCA-18 (4.71%) under 20% pulp, 0.3% acidity, 15% TSS.The rate of increase in reducing sugar content was more rapid in most of the recipes between 30 to 60 days of storage than rest of the storage periods. The reason of rise in reducing sugar during storage might be ascribed to the conversion of non-reducing sugars to reducing sugar due to the process of hydrolysis. The similar results in respect of beverages prepared from other fruits have also been reported by Deka *et al.* (2004), Saravanan *et al.* (2004) and Jain *et al.* (2007).

Total Sugar

The total sugar content in custard apple nectar (Table 2) showed an increasing trend with all the genotypes and recipe treatments at increasing period of storage. A higher content of total sugar was observed in the genotype IGCA-37 (13.49%) under 20% pulp, 0.3% acidity, 15% TSS followed by (13.41%) 20% pulp, 0.3% acidity, 16% TSS at the time of preparation. At the 90 days of storage, genotype IGCA-18 contained maximum total sugar (13.89%) under 20% pulp, 0.3% acidity, 15% TSS, which was significantly higher than IGCA-21 (13.87%) under 20% pulp, 0.3% acidity, 15% TSS, IGCA-18 (13.8%) under 20% pulp, 0.3% acidity, 19% TSS. The increase in reducing sugar as well as

Table 1: Effect of recipe treatment and storage on TSS and acidity of nectar from custard apple genotypes

Genotypes Recipe	Storage periods (days)															
	0 days				30 days				60 days				90 days			
	IGCA-18	IGCA-21	IGCA-37	IGCA-38	IGCA-18	IGCA-21	IGCA-37	IGCA-38	IGCA-18	IGCA-21	IGCA-37	IGCA-38	IGCA-18	IGCA-21	IGCA-37	IGCA-38
	Total Soluble Solids (TSS) (%)															
T_1	15.2	15.3	15.1	15.1	15.2	15.4	15.2	15.2	15.3	15.4	15.3	15.3	15.6	15.7	15.6	15.7
T_2	16.2	16.1	16.1	16.1	16.2	16.2	16.2	16.2	16.3	16.4	16.3	16.3	16.6	16.7	16.6	16.7
T_3	17.1	17.1	17.2	17.2	17.2	17.2	17.2	17.2	17.3	17.5	17.3	17.2	17.6	17.8	17.7	17.8
T_4	18.1	18.1	18.2	18.3	18.2	18.2	18.2	18.3	18.3	18.3	18.3	18.4	18.7	18.7	18.7	18.8
T_5	19.1	19.1	19.1	19.3	19.2	19.2	19.1	19.3	19.3	19.4	19.3	19.4	19.7	19.7	19.8	19.8
T_6	20.1	20.2	20.0	20.1	20.1	20.3	20.2	20.1	20.2	20.4	20.3	20.2	20.7	20.7	20.8	20.8
CD (P=0.05)	0.06	0.04	0.04	0.06	0.05	0.04	0.06	0.08	0.06	0.05	0.06	0.09	0.05	0.05	0.08	0.05
	Acidity (%)															
T_1	0.30	0.34	0.31	0.36	0.31	0.34	0.32	0.37	0.33	0.35	0.33	0.38	0.34	0.36	0.35	0.39
T_2	0.30	0.35	0.32	0.366	0.32	0.35	0.33	0.37	0.33	0.36	0.34	0.38	0.33	0.37	0.36	0.39
T_3	0.30	0.33	0.33	0.37	0.32	0.34	0.34	0.38	0.33	0.35	0.35	0.39	0.36	0.36	0.37	0.40
T_4	0.30	0.33	0.31	0.37	0.33	0.34	0.32	0.38	0.38	0.35	0.33	0.39	0.41	0.35	0.35	0.40
T_5	0.30	0.34	0.32	0.38	0.31	0.35	0.33	0.39	0.33	0.36	0.34	0.40	0.34	0.37	0.36	0.41
T_6	0.30	0.36	0.33	0.41	0.33	0.36	0.34	0.42	0.34	0.37	0.35	0.43	0.37	0.38	0.37	0.44
CD (P=0.05)	NS	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	NS	0.010	0.011

Table 2: Effect of recipe treatment and storage on reducing, total and non-reducing sugar of nectar from custard apple genotypes

Genotypes	Storage periods (days)															
	0 days				30 days				60 days				90 days			
Recipe	IGCA-18	IGCA-21	IGCA-37	IGCA-38	IGCA-18	IGCA-21	IGCA-37	IGCA-38	IGCA-18	IGCA-21	IGCA-37	IGCA-38	IGCA-18	IGCA-21	IGCA-37	IGCA-38
Reducing Sugar (%)																
T_1	3.8	3.8	3.8	3.8	3.9	3.9	3.9	3.9	4.1	4.1	4.0	4.1	4.7	4.6	4.7	4.7
T_2	3.8	3.8	3.8	3.8	3.9	3.9	3.9	3.9	4.1	4.1	4.0	4.1	4.6	4.5	4.6	4.6
T_3	3.7	3.7	3.7	3.8	3.9	3.9	3.9	3.9	4.2	4.2	4.0	4.1	4.5	4.4	4.5	4.5
T_4	3.7	3.7	3.7	3.7	3.9	3.8	3.8	3.9	4.1	4.0	3.9	4.1	4.4	4.3	4.4	4.5
T_5	3.7	3.7	3.7	3.7	3.8	3.8	3.8	3.9	4.1	3.0	3.9	4.0	4.4	4.2	4.3	4.4
T_6	3.7	3.7	3.6	3.7	3.8	3.8	3.7	3.8	4.1	3.1	3.9	4.1	4.3	4.1	4.3	4.3
CD (P=0.05)	0.04	0.02	0.01	0.01	0.02	0.08	0.00	0.01	0.05	0.05	0.03	0.01	0.03	0.008	0.027	0.019
Total Sugar (%)																
T_1	13.1	13.1	13.4	13.1	13.3	13.3	13.6	13.3	13.6	13.6	13.8	13.6	13.8	13.8	14.3	13.8
T_2	13.1	13.0	13.4	13.0	13.3	13.3	13.6	13.3	13.5	13.5	13.8	13.5	13.8	13.8	14.2	13.8
T_3	13.0	13.0	13.2	13.0	13.2	13.2	13.4	13.2	13.3	13.3	13.6	13.3	13.6	13.6	13.9	13.6
T_4	13.0	13.0	13.0	13.0	13.1	13.1	13.2	13.1	13.4	13.3	13.4	13.3	13.7	13.6	13.7	13.6
T_5	13.2	13.1	13.2	13.1	13.3	13.3	13.1	13.3	13.5	13.2	13.3	13.2	13.8	13.6	13.6	13.6
T_6	13.4	13.2	13.1	13.2	13.4	13.2	12.9	13.2	13.5	13.3	13.6	13.3	13.7	13.5	12.9	13.5
CD (P=0.0at 5)	NS	0.03	0.02	0.03	0.03	0.02	0.02	0.03	0.01	0.05	0.16	0.03	0.01	0.03	0.03	0.03
Non-reducing Sugar (%)																
T_1	9.3	9.2	9.6	9.2	9.3	9.3	9.6	9.3	9.7	9.5	9.7	9.5	9.1	9.2	9.6	9.1
T_2	9.3	9.2	9.6	9.2	9.4	9.3	9.7	9.3	9.6	9.4	9.8	9.4	9.2	9.3	9.6	9.1
T_3	9.2	9.3	9.5	9.2	9.3	9.2	9.5	9.3	9.4	9.1	9.6	9.2	9.1	9.1	9.4	9.0
T_4	9.2	9.3	9.2	9.2	9.2	9.2	9.3	9.2	9.4	9.2	9.4	9.1	9.3	9.2	9.3	9.1
T_5	9.5	9.4	9.5	9.4	9.5	9.5	9.3	9.4	9.7	10.2	9.3	9.2	9.4	9.3	9.2	9.2
T_6	9.6	9.5	9.4	9.4	9.6	9.4	9.1	9.4	9.7	10.2	9.7	9.2	9.4	9.4	8.6	9.2
CD (P=0.0 5)	0.05	0.05	0.024	0.04	0.04	0.09	0.03	0.03	0.03	0.06	0.16	0.03	0.03	0.03	0.04	0.04

total sugar corresponded to the increase in total soluble solid and ultimate decrease in non-reducing hydrolysis of polysaccharides like starch, pectin and inversion of non-reducing sugar into reducing sugar, as increase in reducing sugar was correlated with the decrease in non-reducing sugar. The increased level of total sugar was probably due to conversion of starch and pectin into simple sugar. Similar findings were reported by Jain *et al. (*2007) and Choudhary and Dikshit (2006) in custard apple beverage.

Non-reducing sugar

Days of storage significantly affected the non-reducing sugar content of nectar (Table 2). The non-reducing sugar in custard apple nectar showed a decreasing trend under all the genotypes with increasing period of storage. The non-reducing sugar content was found to be higher in the genotype IGCA-18 (9.69%) under 20% pulp, 0.3% acidity, 20% TSS followed by ICGA-37 (9.65%) under 20% pulp, 0.3% acidity, 15% TSS at the time of preparation. At 90 day of storage, genotype IGCA-37 contained maximum non-reducing sugar (9.64%) sugar in the beverage during storage period. The variation in different fraction of sugar might be due to under 20% pulp, 0.3% acidity, 16% TSS followed by (9.61%) 20% pulp, 0.3% acidity, 15% TSS. Reduction in non-reducing sugar content might be due to conversion of non-reducing sugar into reducing sugar with the progress of storage period. The present findings are in agreement with those of Saravanan *et al.* (2004) in papaya nectar. The acidity, total sugar, reducing sugar and TSS increased with increase in the days of storage while there was a decreasing trend for non-reducing sugar. The nectar prepared from genotype IGCA-38 and IGCA-18 with recipe treatment T_3 (20% pulp, 17% TSS and 0.3% acidity) contains highest acidity, total sugar, reducing sugar with moderately good amount of total soluble solids during the storage period. Thus, the recipe of 20% pulp, 0.3% acidity, 17% TSS is best suitable for preparation of custard apple nectar at commercial scale.

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