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Studies on the biochemical and sensory qualities of enzymatic clarified carbonated sapota beverages

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ABSTRACT

Sapota fruits were pulped and treated with pectinase enzyme at 0.5 % concentration (w/v) incubated for 2-3 h at AT (32 - 37 ° C). The clarified juices were used to prepare carbonated beverages by adjusting the total soluble solids. (9, 12 and 15 ° B) keeping the acidity constant at 0.25 % and varying the carbonating pressure as 0 (non-carbonated), 80, 100 and 120 psi. The carbonated sapota beverage could be stored for 6 months at ambient (AT - 32-37°C) and low temperatures (LT - 3-5 DC) and was found acceptable with respect to colour, flavour, taste and overall acceptability. Heat processing and carbonation improved the colour, flavour and taste of the carbonated sapota beverage.

Key words : Sapota juice, Clarified juice, Chemical and sensory characteristics.

Beverages are consumed by all age groups to quench the thirst, as social drinks and for health conscious and medicinal values. Non-alcoholic beverages are of various types such as fruit based drinks, synthetic drinks, sweetened aerated water or carbonated drinks and some times non-alcoholic beer, wine etc. In India, cold drinks are in demand for the greater part of the year. Carbonated drinks like cola type, lemon, lime, orange flavour etc. have become popular. The production centres of these products are located mostly in cities catering largely to the urban as well as rural populations. Carbonated beverages are popular among people of all age groups and are consumed for varied reasons including taste, refreshment, relaxation, pressure, sociability and more commonly to quench the thirst (Phillips, 1992). Most of the carbonated drinks contain synthetic colouring and flavouring components, which are suspected to be allergenic (Taylor, 1982). Inclusion of concentrated fruit juices in the soft drinks not only imparts characteristic colour and flavour but also provides some nutrients (EI-Wakeli *et al.,* 1974). Since the demand for soft drinks is increasing every year, we can exploit this trend by developing nutrient enriched carbonated fruit juice beverages, as the consumers are becoming increasing conscious of the ways in which diet is linked to a healthy life style (Euromonitor Market Direction, 1999). The production of fruit based syrups, nectars and squashes have indicated a declining trend. Aseptically processed and packaged retail packs of ready-to-serve fruit beverages are emerging in the market. If the fruit juices are added to sweetened aerated waters, they provide nutrients and also some more diversification to the soft drinks. Coupled with increasing demand for soft drinks, there is considerable scope for developing naturally existing nutrient rich carbonated fruit juice beverage. Total soluble solids (TSS) and CO_2 gas pressure for carbonation are key parameters that affect the sensory quality of the carbonated beverages. Based on these facts, the present investigation was conducted to study the effect of TSS and CO_2 pressure on physico-chemical and sensory quality of carbonated sapota beverages.

METHODOLOGY

Fully ripened sapota (var. 'PKM 4') was procured from the College of Horticulture, Periyakulam, Tamil Nadu. The fruits were washed thoroughly with clean water and peeled fruits were crushed in a fruit mill with addition of 20 % water. The pulp was heated to 65° C for 10 min. The pulp was treated with 0.5 % pectinase enzyme at AT (32-37° C) for 2-3 h. with intermittent stirring. Juice was strained and filtered through three fold muslin cloth. The enzyme clarified juice was filled in clean pre-sterilized bottles (650 ml cap.) upto the brim and sealed with crown cork. The carbonated beverages were prepared by pre-mix method using clarified sapota juices by adjusting total soluble solids (TSS) at 9, 12, 15° B (with fixed acidity of 0.25 %). The desired amount of sugar and citric acid was dissolved in water by gentle heating, strained through muslin cloth and mixed thoroughly with concentrated fruit juices. The beverages were carbonated with carbonating machine at different CO_2 pressure (0,

80, 100 and 120 psi). The fruit beverage filled in pre-sterilized bottles (300 ml cap.) sealed with crown cork heated at 60° C for 20 min in water bath. For storage study, the carbonated beverages was stored at two different temperatures (ambient temperature - AT (32-37° C) and low temperature - LT (3-5° C).

Total soluble solids (TSS) as ° Brix were measured with a hand refractometer of 0 -32° B (UNICO make). The pH of the sapota beverages was measured using Analog model, 301 (Corian Research, USA). The titrable acidity was determined by titration against 0.01 N NaOH (Ranganna, 1986). The total and reducing sugar contents were determined using dinitrosalicylic acid (Miller, 1959). The relative viscosity was measured using Ostwald viscometer by comparing the time (in seconds) taken to flow out a definite volume of the sample to that taken by equal volume of distilled water. Ascorbic acid and tannin were determined as per the procedure given by Ranganna (1986). Carbonated sapota beverages were subjected to sensory evaluation by a panel of 10 panelists using composite scoring test for colour, flaovur, mouth feel, taste and overall acceptability (Amerine *et al.*, 1965). The data were subjected to statistical analysis by Factorial Completely Randomised Design (FCRD) as suggested by Rangaswamy (1995).

RESULTS AND DISCUSSION

Physico-chemical characteristics of carbonated sapota beverages:

A slight increase in TSS was noticed incase of juices after a storage period of 6 months (Table 1). The increase of TSS ranged from 15.75 ° B to 17.10 in A.T and 16.8° B in LT. A gradual increase in acidity was recorded throughout the storage period of 6 months. Similar observation had been reported by Islam *et al.* (1996) for mango based beverages. The initial acidity of carbonated sapota beverage stored at AT and LT were 0.27 % which had increased to 0.35 and 0.30 %, respectively. An increasing trend in the acidity of the carbonated sapota beverages had directly influenced by the change in pH. Gradual increase was in reducing sugar during storage at both temperatures (AT and L T) from 7.3 to 8.4 and 7.8 %, respectively. This might be due to the hydrolysis of non reducing sugars which continued to increase while non reducing sugar showed a decreasing trend in fruit beverage during storage, rise in level of reducing might be assigned to the conversion on non reducing sugar, owing to the process of hydrolysis. Similar findings were also reported by Khurdiya *et al.* (1996) in carbonated guava beverage. Total sugar of the carbonated beverage showed a gradual decrease during storage and the corresponding decrease for beverage from 14.4 to 13.9% and 14.04 % under AT and LT storage, respectively. The storage temperature gradually influenced the ascorbic acid content. It decreased at faster rate at AT than at LT. After 6 months of storage, the retention of ascorbic acid was 53.6 and 77.7 % at AT and LT, respectively. Thus, LT storage caused about a 22.1 % higher retention of ascorbic acid than beverage stored at AT.

Sensory qualities of carbonated sapota beverage:

The effect of TSS and CO_2 gas pressure on the sensory quality of carbonated beverage prepared from sapota has been shown in Table 2. The scores for colour ranged from 10.17 to 15.40 for different treatments. Sapota beverages with 15° B TSS carbonated at 80 psi CO_2 gas pressure scored the maximum followed by 120 psi (14.65) and 100 psi (14.28) while that with 12° B at 0 psi (non carboanted) scored the minimum followed by 100 psi (12.92). TSS of 15° B scored significantly higher (13.96) than 12° B (12.76) and 9°B (12.22). Carbonation pressure of 80 psi scored the highest (14.22) which was statistically at par with 100 psi (13.27) but significantly higher than 120 psi (13.48). Data presented in Table 3 for scores for flavour ranged from 10.30 to 16.37. Khurdiya *et al.* (1996) revealed that juice content and carbonation pressure had no significant effect on the flavour score of the carbonated guava beverage. Sapota

Table 1 : Changes in physico-chemical characteristics of carbonated sapota beverages

Storage period (in month)	Temperature	TSS (^{0}Brix)	Acidity (%)	pH	Reducing Sugar (%)	Total sugar (%)	Ascorbic acid (%)	BAR
Initial		15.75	0.27	3.60	7.31	14.35	16.41	58.33
1	AT	15.85	0.27	3.57	7.35	14.26	14.22	57.63
	LT	15.75	0.27	3.60	7.32	14.32	16.00	57.90
3	AT	16.35	0.29	3.45	8.21	14.15	11.68	55.80
	LT	16.00	0.28	3.53	7.65	14.26	14.05	57.14
6	AT	17.10	0.35	3.24	8.42	1.3.97	8.80	48.43
	LT	16.80	0.30	3.32	7.80	14.04	12.75	55.08

AT - Ambient Temperature L T - Low Temperature BAR - Brix Acid Ratio

Table 2 : Sensory qualities of carbonated sapota beverages

CO_2 pressure (psi.)	Colour				Flavour				Mouth feel			
	9^0B	12^0B	15^0B	Mean	9^0B	12^0B	15^0B	Mean	9^0B	12^0B	15^0B	Mean
0	10.17	11.17	11.50	10.95	10.30	12.10	12.50	11.63	-	-	-	0.00
80	13.30	13.95	15.40	14.22	13.56	14.43	16.37	14.79	11.50	14.30	14.26	13.35
100	12.60	12.92	14.28	13.27	13.20	14.20	16.10	14.50	12.67	12.60	15.05	13.44
120	12.80	12.98	14.65	13.48	12.87	13.60	14.90	13.79	12.10	12.15	14.90	13.05
Mean	12.22	12.76	13.96		12.48	13.58	14.97		9.67	9.76	11.05	
C.D. (P=0.05)												
TSS (T)				0.58861				0.66316				2.39124
CO_2 Pressure				0.50975				0.577432				2.07087
TXC				1.01950				1.14863				2.14174
	Taste				Overall acceptability							
0	10.60	9.20	11.66	10.49	10.30	11.10	12.00	11.13				
80	13.57	14.00	15.27	14.33	13.60	14.60	15.90	14.70				
100	13.10	14.16	14.36	13.82	12.10	13.20	15.00	13.43				
120	11.60	13.26	13.96	12.94	12.67	12.90	14.17	13.25				
Mean	12.22	12.66	13.81		12.17	12.95	14.27					
C.D. (P=0.05)												
TS S (T)				0.69250				0.63899				
CO_2 Pressure				0.59973				0.55338				
TXC				1.19945				1.1 0677				

Values are the average of 10 taste panelists and maximum score for each attribute is 20

beverage with 15° B TSS recorded the maximum at 80 psi (14.79) and 100 psi (14.50) while that with 12° B at 0 psi (non carbonated) recorded the minimum score followed by 120 psi (13.60). TSS of 15° B scored significantly higher (14.97) than 12 ° B (13.58) and 9° B (12.48).

Scores for mouth feel ranged from 0 to 15.05 for different treatments. Sapota beverage with 9, 12 and 15° B without carbonation obviously, scored the minimum while 15° B beverage carbonated at 100 psi (15.05) scored the maximum followed by 120 psi (14.90) and 80 psi (14.26). TSS of 15° B scored the maximum of 15.05, which was significantly higher than 120 psi (14.90) and 80 psi (14.26). Scores for taste ranged from 9.20 to 15.27 for different treatments. Beverage with TSS of 15° B carbonated at 80 psi scored the highest followed by 100 psi (14.36) and 120 psi (13.96) while 12° B beverage at 0 psi (non carbonated) scored the lowest followed by 80 psi (14.00). TSS of 15° B scored significantly higher (13.81) than 12° B (12.66) and 9° B (12.22). Thus, TSS of 15° B scored the highest for all the sensory attributes and carbonation pressure of 80 psi CO_2 gas scored the highest for all the attributes. Therefore, sapota juice beverage with 15° B TSS carbonated at 80 psi and 100 psi CO_2 gas pressure was adjudged to be the best from overall sensory quality. Saxena and Arora (1996) reported that carbonated RTS blends resulted in sparkling drinks of excellent sensory quality. Khurdiya (1989 and 1990) also reported similar results on different fruit juice beverages.

The CO_2 beverages prepared from sapota can be stored at both AT (32-37° C) and L T (3-5° C) retaining colour, flavour, taste and over all acceptability.

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