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RESEARCH ARTICLE

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Studies on effects of total soluble solids, acidity and carbonation levels on quality of sweet orange beverage

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ABSTRACT

The sweet orange ready-to-serve (RTS) carbonated beverage was prepared by extracting and clarifying the juice and adjusting the total soluble solids (TSS) to 56, 60, 64 and 68°Brix with sugar and acidity to 0.5, 1.0 and 1.5 % with citric acid. It was observed that the beverage with 60° Brix TSS and 1.0 % acidity was found superior in sensory characteristics with respect to colour, aroma, taste, mouthfeel and overall acceptability followed by beverage with 60°Brix TSS and 0.5 % acidity over the beverage prepared by using other levels. The beverage carbonated at 120 psi pressure scored highest for sensory quality than those at 75 and 120 psi.

Key words : Sweet orange, Total soluble solids, Ready-to-serve beverage, Carbonation, Sensory characteristics

INTRODUCTION

The sweet orange (*Citrus sinensis* Osbeck) is non-climacteric citrus fruit grown in sub-tropical climates. It has three types such as normal oranges, blood oranges and low-acid oranges with varying capacity of juice yield. The fruit juice has low shelf-life and need preservation. Of the many methods of preservation of juice, carbonation is the best one with little changes in quality parameters. Carbonation is the process of adding sufficient CO_2 in beverage so that on serving, product gives off the gas in fine bubbles and has the characteristic pungent taste suitable to the beverage carbonated. Carbonation also prolongs the shelf-life of the beverage and contributes in some measure to its tang (Ranganna, 2000). It is also reported to enhance the appearance, flavour, taste and overall liking partly due to increased acidity and unique test, sparkle and taste of CO_2 gas itself (Baranowski and Park, 1984).

The degree of carbonation is expressed in terms of volume. One volume of gas means 200 ml CO_2 present in 200 ml beverage when measured at 15^0C and atmospheric pressure. Carbonation may vary from less than 1 volume in fruit drinks to 4 in cola drinks and more than 5 in soda (Natarajan, 1983). Carbonated beverages are the development of attempts to produce artificial effervescent waters similar to those of natural springs. After a time, flavours are added to increase the palatability. Carbonated beverages most familiarly known as soft drinks are mainly water, impregnated with CO_2 gas and contain colour, flavour, sugar and acid. An airtight pressure, seal is used to retain the CO_2.

It is estimated that soft drinks worth nearly 2 crores of rupees are marketed annually in India. In addition to a number of large units, manufacturing RTS of standard quality, small units both in rural and semi-urban are also manufacturing the soft drinks. However, very little data are available regarding the exact nature of such drinks (Phillips, 1992).

Fruits are important nutritional protective foods, which improve the quality of diet and maintain health. It is, therefore, necessary to ensure their availability throughout the year in fresh, processed or preserved forms. Only 1.3 % of total fruits and vegetables produced in the country are processed against 40 % in some of the developing and 70% in developed countries (Mehta *et al*., 2002). Therefore, attempts were made in the present investigation

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to increase the shelf-life of sweet orange juice by converting into RTS carbonated beverage.

MATERIALS AND METHODS

Extraction of juice and preparation of RTS beverages:

Fresh sweet oranges harvested at proper maturity were obtained from local market, washed and cut into halves and juice was extracted by using wooden basket press and then clarified by filtration. The TSS of juice was adjusted to 56, 60, 64 and 68 ^{0}Brix with cane sugar and acidity to 0.5, 1.0 and 1.5% with citric acid. Thus, there were 4 TSS levels and 3 acidity levels comprising of total 12 treatments as T_1, T_2, T_3 and T_4 with 56, 60, 64 and 68 ^{o}Brix TSS each with 0.5 % acidity respectively, T_5, T_6, T_7 and T_8 with TSS as above each with 1.0% acidity respectively, and T_9, T_{10}, T_{11} and T_{12} with TSS as above each with 1.5 % acidity, respectively.

Physico-chemical and sensory evaluation of RTS beverages:

The RTS beverages were evaluated for TSS, acidity, brix: acid ratio, total sugars and ascorbic acid as per standard procedures of Ranganna (2000). The RTS beverages were also evaluated for sensory quality by a semi-trained panel of 20 judges on a 9-point Hedonic scale (1- extremely dislike and 9- extremely like) in accordance with method suggested by Amerine *et al.* (1965). On the basis of overall acceptability score, the beverages in each TSS and acidity levels were carbonated with three levels of CO_2 at 75, 100 and 120 psi pressure by using chilled water (6^{0}C) and sealed immediately by crown corking as per the procedure of Khurdiya (1989) and further evaluated for pH and sensory quality as above.

RESULTS AND DISCUSSION

The data presented in Table 1 on physico- chemical analysis of sweet orange RTS beverage indicate an increase in the TSS, acidity and total sugars with increase in the levels of addition of sugars and as expected, a decrease in ascorbic acid content was observed in all the treatments. The brix-acid ratio was also dropped in all the treatments. It is universally true that addition of sugar to raise TSS content of any juice will have definite effect on sugars and acidity. The increase in TSS contents was highest in treatment T_4, T_8 and T_{12} where these treatments contained highest total sugars and lowest ascorbic acid. The results are similar to those reported by Khurdiya (1989).

The data pertaining to the sensory evaluation of carbonated sweet orange beverages presented in Table 2 indicate that the treatments T_2, T_6 and T_{10} were highest with respect to overall acceptability and other quality characters. This has shown that increase in TSS content beyond 60^{0}Brix did not offer improvement in sensory quality. The increased acidity level beyond 0.5% was also not much beneficial as shown by the scores obtained with 1.0 and 1.5% acidity which indicated that TSS of 60^{0}Brix and acidity of 1.0% were better than other levels.

The data on effect of CO_2 on the quality of sweet orange beverages presented in Table 3 indicate that at each acidity level, the quality score was found increased with increase in the CO_2 gas pressure and it was highest at 120 psi. While keeping the CO_2 gas pressure constant and acidity at variable levels, there was a tendency of increasing scores with decreasing acidity levels with the change in pH values at various levels of carbonation.

Table 1 : Physico- chemical analysis of sweet orange RTS beverages*

Treatments	TSS (^{0}Brix)	Acidity (%)	Brix: Acid ratio	Total sugars (%)	Ascorbic acid (mg/100g)
T_1	8.6	0.20	42.57	9.12	1.42
T_2	9.2	0.22	42.40	9.77	1.29
T_3	10.0	0.24	42.20	10.44	1.02
T_4	10.8	0.24	44.63	11.10	0.94
T_5	8.8	0.21	41.91	9.68	1.53
T_6	9.4	0.23	41.78	10.38	1.37
T_7	10.0	0.25	40.82	11.07	1.06
T_8	10.6	0.25	42.40	11.76	0.92
T_9	8.4	0.23	38.36	8.56	1.31
T_{10}	9.0	0.24	38.46	9.17	1.21
T_{11}	10.0	0.25	39.37	9.82	0.99
T_{12}	11.1	0.26	42.86	10.43	0.97

*Each value is average of three determinations

Table 2 : Sensory evaluation of sweet orange RTS beverages

Treatments	Color	Aroma	Taste	Mouth feel	Overall acceptability
T_1	5.0	5.0	6.0	6.0	6.0
T_2	5.5	5.3	6.5	6.5	7.0
T_3	5.5	5.2	6.8	6.7	6.8
T_4	5.0	5.0	6.0	6.0	6.0
T_5	5.0	5.0	5.0	5.0	5.0
T_6	5.7	6.0	6.7	6.8	7.2
T_7	6.0	5.7	5.5	5.8	5.8
T_8	5.7	5.5	5.5	5.3	5.2
T_9	5.0	4.0	4.0	4.0	5.0
T_{10}	6.2	5.8	4.8	5.6	5.6
T_{11}	6.2	5.2	4.4	4.8	5.2
T_{12}	5.8	5.0	4.2	4.6	5.4

*Each value is the average of ten determinations

Table 3 : Effect of CO_2 on the quality of sweet orange RTS beverages*

Treatments	CO_2 (psi)	pH	Overall sensory quality score
T_2	75	3.30	6.0
	100	3.30	6.6
	120	3.21	7.0
T_6	75	3.15	5.6
	100	3.20	5.7
	120	3.20	7.2
T_{10}	75	3.12	5.8
	100	3.12	6.1
	120	3.17	5.6

*Each value is average of three determinations

Conclusion:

The study revealed that the beverage prepared by using the syrup of 60°Brix, 1.0 % acidity and carbonation with 120 psi pressure was found better in almost all organoleptic characteristics as compared to the rest of the treatments.

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