INTERNATIONAL JOURNAL OF AGRICULTURE & BIOLOGY
1560–8530/2000/02–1-2–80–82

Effect of Artificial Sweetners on the Quality of Mango Drink

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ABSTRACT

Mango drink was prepared by replacing sucrose with artificial sweeteners aspartame and cyclamate. The treatments were analyzed for physico-chemical and sensory evaluation fortnightly for two months. Acidity and reducing sugar increased, while TSS, pH and ascorbic acid decreased with storage intervals. Maximum increase in acidity (0.25%) and reducing sugars (3.41%) was observed in samples with 100% sucrose, followed by samples with 75% sucrose and 25% aspartame having acidity and reducing sugar content 0.24% and 3.27%, respectively. In samples having 50% sucrose and 50%, aspartame the acidity and reducing sugars were recorded 0.23 and 3% respectively. TSS, pH and ascorbic acid decreased from 8.84° to 7.88°, 3.80 to 3.62 and 4.33 to 2.22 mg/100 gm, respectively. Treatments and storage periods significantly affected the color, flavor and taste of mango drink. For color, flavor and taste there was a declining trend in scores during storage. Sample having 75% sucrose and 25% cyclamate got maximum score for color (7.23), flavor (7.52) and taste (7.52). It was observed from this research that the samples with 75% sucrose and 25% cyclamate showed best results followed by that having 75% sucrose and 25% aspartame regarding sensory characteristics. Mango drink with these combinations is recommended further for commercial purpose.

Key Words: Artificial sweeteners; Quality; Mango drink

INTRODUCTION

Mango is one of the most important fruits of Pakistan. It is liked by all classes of people because of its excellent flavor, taste and therapeutic value. In Pakistan, total area under mango cultivation is 84800 hectares, with annual production of 839300 tonnes; Punjab province contributes more than 50% towards total production (Khan *et al*., 1995).

Nutritionally, mango is a rich source of vitamin A and C. It contains on an average 3000 IU of vitamin A and 40 mg vitamin C per 100 g of edible portion (Malik *et al*., 1994).

Due to its appealing taste and flavor mango juice based drink is liked by most of the people. Sugar is the major ingredient used in mango drink and it provides 394 Cal per 100 g (Gamman & Sharington , 1981).

Increased awareness about diets having calorific value have led to the proposal of searching non-nutritive sweeteners without sacrificing the sweet taste. This Paper describes the evaluation of aspartame and cyclamate for replacement of sugar in mango drinks.

MATERIALS AND METHODS

Fully matured, fresh mangoes were passed through coarse pulper. Water was added in ratio (4:1 w/v). The pulp was screened through fine pulper and uniform textured pulp was obtained.

Drinks were prepared by the use of water in 20% pulp to which 0.15% citric acid and 0.05% potassium metabisulphite was added. The amount of sweeteners was added according to the formulation given in Table I.

Table I. Detail of treatments

Treatments	Sweeteners ratio		
	Sucrose	Aspartame	Cyclamate
T_1	100	-	-
T_2	75	25	-
T_3	50	50	-
T_4	25	75	-
T_5	0	100	-
T_6	75	-	25
T_7	50	-	50
T_8	25	-	75
T_9	0	-	100

TSS and acidity were determined by the procedure described by A.O.A.C (1984) while pH and reducing sugars were determined following the procedure describd by Ruck (1963). Sensory evaluation was made on a 9 point hedonic scale as described by Larmond (1977). Statistical analysis was carried out by using two factors factorial completely randomized design as described by Steel and Torrie (1980).

RESULTS AND DISCUSSION

Acidity. There was highly significant effect ($P \leq 0.01$) of treatments and storage time on the acidity of the drinks. There was a gradual increase in the acidity of all samples throughout the storage period (Table II). After 60 days, the increase in acidity of T_1 (0.25%) was maximum, while minimum increase was observed in T_4 (0.21%). This increase in acidity as a function of storage might be due to the degradation of sugars into carbonyl groups (Goldbrith *et al*., 1961) or it could also be due to the fermentation of the drinks which might have occurred as reported by Jacobs (1959).

Table II. Effect of storage on acidity (%) of mango drink

Treatments	Storage Period (days)				
	0	15	30	45	60
T_1	0.17b	0.21a	0.24a	0.25a	0.25a
T_2	0.15b	0.18b	0.21a	0.24a	0.24a
T_3	0.15b	0.17b	0.22a	0.23a	0.23a
T_4	0.14b	0.19b	0.21a	.0.21a	0.21a
T_5	0.14b	0.15b	0.19b	0.22a	0.22a
T_6	0.15b	0.19b	0.21a	0.22a	0.22a
T_7	0.15b	0.22a	0.23a	0.23a	0.23a
T_8	0.14b	0.20a	0.21a	0.22a	0.22a
T_9	0.14b	0.21a	0.22a	0.22a	0.22a

Total soluble solids (TSS). Analysis of variance revealed that a highly significant effect ($P \leq 0.01$) of variations in sweeteners proportions and storage periods. It is evident from Table III that TSS of all treatments showed a decreasing trend during the storage period of 60 days. It is clear from Table IV that T_1 (12.44°) contained maximum TSS, while minimum TSS was recorded in T_5 (5.16°). Fermentation of sucrose at high temperature partly explains this change. The results are in agreement with the findings of Kalra and Tandon (1984).

pH. There was a decreasing trend on pH with storage intervals (Table III). The maximum value of pH was for T_3 (3.87) and the minimum for T_1 (3.45) as mentioned in Table IV. It is quite obvious that with the decrease in acidity pH increases. Saleem (1980) reported that the decrease in pH might be due to the increase in acidity of the drinks.

Reducing sugar. It is obvious from Table III that the reducing sugars increased with storage intervals. Maximum value of reducing sugars was recorded for T_1 (3.41) containing 100% sucrose, and minimum for T_9 (1.40) containing 100% cyclamate (Table IV). Bawa and Saini (1987), and Ewaidah (1988) observed that increase in reducing sugars might be due to the prolonged storage time, high storage temperature, increased catalytic oxidation and hydrolysis of sugars with increase in acidity and decrease in pH.

Ascorbic acid. Significant effect of treatments as well as storage ($P \leq 0.01$) on ascorbic acid content of the drink was observed in this study. There was a decline in ascorbic acid with the passage of time (Table III). Highest ascorbic acid contents were recorded at 0 day (4.33 mg/100 g) and lowest (2.22 mg/100 g) were recorded at 60 Days interval. It was evident from Table IV that maximum ascorbic acid contents were recorded in T_9 (3.75 mg/100 g) while minimum value was recorded in T_6 (2.91 mg/100 g). Similar trend of loss in ascorbic acid at room temperature was observed by Kaanane *et al.* (1988) and Muhammad *et al*. (1987).

Sensory evaluation. A panel of five judges evaluated the mango drink for color, flavor and taste. Statistical analysis revealed that treatments and storage periods have a highly significant effect on the color, flavor and taste of mango drink. There was a declining trend towards color in all the treatments during storage (Table III). Maximum score for color was obtained by T_6 (7.23) while minimum by T_5 (6.74). Muhammad *et al.,* (1987) and Ewaidah (1988) explained that the change in color might be due to the effect of light and temperature.

The results of flavor (Table IV) showed an excellent consumer acceptance for T_6 (7.52) containing sucrose 75% and cyclamate 25% as compared to other combinations. The decrease in flavor was also observed by Riaz *et al*. (1988) and Barrows *et al*. (1984) in comminuted kinnow juice and grapefruit juice, they

Table III. Effect of storage on various characteristics of mango drink

Days	TSS (Brix)	pH	Reducing sugar (%)	Ascorbic acid (mg/100gm)	Color	Flavor	Taste
0	8.84a	3.80a	1.57c	4.33a	7.4a	7.5a	7.8a
15	8.60a	3.69b	1.92c	3.81b	7.3a	7.5a	7.6a
30	8.41b	3.62b	2.37b	3.07b	7.0a	7.5a	7.5a
45	8.06b	3.62b	2.70b	2.64c	6.6b	7.4a	7.1b
60	7.88c	3.62b	3.21a	2.22c	6.3b	7.2b	6.9b

Table IV. Effect of sweeteners of various characteristics of mango drink

Treatments	TSS (Brix)	pH	Reducing sugars (%)	Ascorbic acid (mg/100gm)	Color	Flavor	Taste
T_1	12.44a	3.45e	3.41a	3.33c	6.94b	7.40b	7.40b
T_2	9.60b	3.59d	3.27a	2.94e	7.10a	7.44b	7.42b
T_3	8.40c	3.87a	3.00a	3.27c	6.84c	6.88e	7.18d
T_4	7.44d	3.71b	1.53d	3.11d	6.78d	7.34c	7.30c
T_5	5.16e	3.72b	1.45d	3.60b	6.74d	7.34c	7.34c
T_6	10.60b	3.67c	2.49b	2.91e	7.23a	7.52a	7.52a
T_7	8.90c	3.68c	2.51b	3.06d	7.02b	7.30c	7.32c
T_8	7.42d	3.74b	1.82c	3.02d	7.00b	7.32c	7.30c
T_9	5.32e	3.76b	1.40d	3.75a	6.88c	7.22d	7.18d

attributed this loss in flavor to the production of furan derivatives and ethyl esters of fatty acids.

There was deterioration in taste of all samples with the passage of time (Table III). At 0 days it was 7.8 and going down to 6.9 at 60 days. The results of taste (Table IV) showed an excellent consumer acceptance for T_6 (7.52) containing sucrose 75% and cyclamate 25% as compared to other combinations. Jacobs (1959) reported that taste differences might be on account of time and the temperature of storage.

CONCLUSION

It is concluded from this research that mango drink having 75% sucrose and 25% cyclamate showed better performance followed by a sample having 75% sucrose and 25% aspartame with regard to sensory characteristics. It is further recommended that above mentioned samples are suitable for commercial purpose.

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(Received 2 February 2000; Accepted 28 February 2000)