Short Communication

Pak. j. sci. ind. res., vol. 36, no. 8, August 1993

Studies on the Preparation and Quality Evaluation of Kinnow (*Citrus reticulata* L.) Comminuted Squashes

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(Received July 11, 1991; revised August 5, 1993)

The present study was designed to develop a comminuted drink from Kinnow mandarins.

Kinnow mandarins were purchased from the local market, washed and sorted for damage, spoilage and maturity. Fruite were divided into 6 lots and treated as under:

T_1: Standard squash: Fruits were cut into two pieces and juice was extracted with manually operated presssure type juice extractor. Following formulation was used for the preparation of squash [1].

Juice	=	100 parts (50%)
Cane sugar	=	100 parts
Citric acid	=	1 percent

Blanched skin (3 min. in boiling water) of kinnow fruit was added to juice in following ratios and the suqash prepared as in T_1.

T_2: 90 Parts of juice were homogenized with 10 parts of blanched skin.

T_3: 80 Parts of juice were homogenized with 20 parts of blanched skin.

T_4: 70 Parts of juice were homogenized with 30 parts of blanched skin.

T_5: The whole fruit was cut into pieces and passed through a pulper (sieve size 1.3 mm) to prepare a base. The squash was then prepared by mixing the following ingredients:

Base	=	100 parts (25%)
Water	=	100 parts
Cane sugar	=	200 parts
Citric acid	=	1 percent

T_6: The whole fruit was autoclaved for 1 min. at 1.02 atm before preparing the base. The squash was prepared by mixing the base and other ingredients as in T_5.

The ingredients of different squashes were cold mixed thoroughly and passed through a muslin cloth. Potassium metabisulphite (0.061%) was used as a preservative (350 ppm SO_2). Squash was filled in sterilized glass bottles which were corked, waxed and stored away from light at room temperature (10 - 40°). Samples of different preparations were analysed periodically during storage. Ascrobic acid, total acidity and total soluble solids (TSS) were determined by standard A.O.A.C. methods [2] TSS and acid ratio was calculated. Sensory characteristics (appearance, flavour, overall acceptability) of different squashes (after dilution with water in the ratio of 1:4) were evaluated by a panel of judges by the numerical scoring method of Krum [3]. All the data were subjected to statistical anlysis and Duncan's Multiple Range Test was employed for comparison of means [4].

Results on physicochemical characteristics of comminuted citrus drinks prepared by different methods are presented in Table 1. Ascorbic acid content increased gradually with the increasing levels of peel added. However, the increase was significant ($P<0.05$) at 20 and 30% levels only. Use of less fruit (25%) in the formulation of whole fruit drinks than in standard and those containing different peel elvels (50%) was the most probable reason for lower asorbic acid content in the former than in the latter. Contrary to previous findings [5], asocorbic acid content of squashes prepared from blanched and unblanched fruits were comparable. Blanching softens the skin and other parts of the fruit. This softening might have enhanced the efficiency of comminution process and reduced the particle size to finer level. Loss of ascorbic acid due to blanching treatment might have been compensated by the inclusion of high quantities of fine particle peel in the squash. The peel of kinnows contain more than twice the amount of asorbic acid than does the juice of this fruit [6]. The inclusion of peel in the squashes by comminution process, therefore, enhanced its asorbic acid content. There was a graudal and significant ($P<0.05$) decrease in the ascorbic acid content of different squash samples during storage for 4 months at room conditions (10-40°) (Table 1). Average retention of this vitamin was 89.99, 80.76, 74.48 and 69.82% respectively after 1,2,3 and 4 months of stoarage of different drinks. Variation in the retention of ascorbic acid reported by various workers [7,8,9] is probably due to type and quantity of preservative used [10, 11], container type [12,13,14], exposure to light [14,15] and storage temperature [7]. Decrease in ascorbic acid in present study may be attributed to native enzymes [16] and rise in temperature during storage [17]. Different comminution processes and storage intervals decreased ($P<0.05$) total acid content, increased ($P< 0.05$) TSS/

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TABLE 1. PHYSICOCHEMICAL CHARACTERISTICS OF COMMINUTED KINNOW DRINKS PREPARED BY DIFFERENT METHODS.

Characteristics		Storage periods (months)					
Preparatory treatments		0	1	2	3	4	Mean
Ascorbic acid	T_1	13.48	13.01	10.88	10.53	9.59	11.50c
(mg/100 ml)	T_2	14.12	12.83	11.09	10.70	10.23	11.79bc
	T_3	15.48	14.84	12.99	11.45	10.87	12.73b
	T_4	18.22	15.90	13.63	12.02	11.12	14.18a
	T_5	7.92	7.69	6.70	5.90	5.58	6.76d
	T_6	8.12	7.34	7.17	7.00	6.61	7.25d
Mean		12.89a	11.60b	10.41c	9.60cd	9.00d	–
(TSS%)	T_1	55.6	55.4	55.4	55.2	55.2	55.36a
	T_2	52.2	55.2	54.8	54.8	55.6	54.52a
	T_3	55.5	55.4	55.2	55.2	55.0	55.26a
	T_4	55.2	55.4	55.05	55.0	55.0	55.12a
	T_5	52.4	52.5	52.07	55.3	42.2	53.02a
	T_6	54.6	55.0	54.08	54.5	54.8	54.74a
Mean		54.25a	54.82a	54.65a	55.00a	54.63a	–
Acidity	T_1	1.53	1.54	1.44	1.38	1.18	1.41a
(g citric acid/	T_2	1.47	1.41	1.41	1.35	1.09	1.35b
100ml)	T_3	1.38	1.41	1.34	1.29	1.25	1.33b
	T_4	1.34	1.41	1.31	1.32	1.07	1.29b
	T_5	1.15	1.15	1.15	1.00	0.96	1.08c
	T_6	1.22	1.15	1.15	1.12	0.96	1.12c
Mean		1.35a	1.35a	1.30a	1.24b	1.09c	–
TSS/acid	T_1	36.3	36.0	38.5	40.0	46.6	38.28a
ratio	T_2	35.5	39.2	38.9	40.6	51.1	41.06ab
	T_3	40.4	39.3	41.1	42.8	44.1	41.52ab
	T_4	41.2	39.2	42.5	41.7	51.3	43.18b
	T_5	45.6	45.7	45.7	55.5	54.4	49.30c
	T_6	44.7	47.8	47.5	48.6	57.1	49.14c
Mean		40.62c	41.18c	42.37bc	44.87b	49.77a	–

T_1 = Standard squash (control); T_2 = Standard squash + 10% peel; T_3 = Standard squash + 20% peel; T_4 = Standard squash + 30% peel; T_5 = Whole fruit drink; T_6 = Blanched whole fruit drink; Storage temperature = 10-40°; Figures fallowed by different letters are significantly different at 5% level.

acid ratio, but had no significant effect on TSS. Lower total acid content of other parts of citrus fruit than juice would have decreased the acid level and increased the TSS/acid ratio in comminuted beverages.

Judges gave maximum appearance scores to squash samples containing 10% peel (7.39) which were comparable to that of standard squash (7.17) (Table 2). Appearance scores of all the other samples were lower and ranged from 6.00 to 6.53. Presence of peel flavour was detectable beyond 10% level addition. Acceptability scores of standard squash (7.19) and squash + 10% peel (7.28) were significantly ($P<0.05$) higher than that of squash samples containing 20 and 30% peel (6.29 - 6.31) and whole fruits drinks (6.14 - 6.30). Although these drinks were not comparable to standard squash sensorily, they were within acceptable limits as they got more than

TABLE 2. SENSORY CHARACTERISTICS OF COMMINUTED KINNOW DRINKS AFTER 4 MONTHS STORAGE AT ROOM CONDITIONS.

Preparatory treatments	Sensory characteristics (0-10)		
	Appearance	Flavour (odour+taste)	Overall acceptability
Standard squash (control)	7.17ab	7.22a	7.19a
Squash + 10% peel	7.39a	7.17a	7.28a
Squash + 20% peel	6.33bc	6.22b	6.29b
Squash + 30% peel	6.56abc	6.06b	6.31b
Whole fruit drink	6.00c	6.28b	6.14b
Blanched whole fruit drink	6.39bc	6.22b	6.30b

0 = Disliked extremely; 10 = liked extremely. Figures followed by different letters are significantly different at 5% level. Storage temperature = 10-40°

60% of total scores (61.4 - 63.1%). Good quality whole fruit beverages from citrus fruits have been made in India [17,18] and Texas, USA [19-22].

Citrus peel is an agricultural waste in our country. Results reported in this paper clearly indicate that this nutritious materials can be successfully converted into comminuted citrus drinks. More research work on the quality improvement of comminuted citrus drinks is recommended. Citrus peel should be pretreated/modified in such a way so that it may be used in larger proportions in comminuted drinks.

Key words: Citrus comminuted beverage, Ascorbic acid, Sensory attributes.

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