QUALITY EVALUATION OF SOME COMMERCIALLY MANUFACTURED FRUIT BEVERAGES

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Samples of three batches of three popular fruit-based beverages offered in brick pack, collected from the market were analyzed for acidity, pH, total soluble solids, total sugars, ascorbic acid, ash, organic acid, trace metals and sensory characteristics for quality evaluation. The complete absence of malic acid in apple type beverages of brand C suggested the presence of something other than apple juice. Iron, zinc and copper, though within the permissible limits, indicated contamination from pesticide residues, water, ingredients or processing equipment. The results revealed that the brands and the bacthcs differed significantly in chemical composition and sensory characteristics showing lack of quality control.

INTRODUCTION

Fast drinks have gained increasing importance in the food industry. In Pakistan, there has been a spectacular growth in the commercial beverage industry during the past two decades (Anonymous, 1989). A large number of new brands of fruit juice based beverages have appeared in the market in glass, plastic, tetrapack and brick pack containers (Hussain *et al.,* 1993). Although, food laws exist for the production of quality food products (Awan, 1985), yet most manufacturers do not strictly comply with them.

Fruit beverages are commonly prepared from fresh or reconstituted concentrates. Fruit juice concentrates are valuable semifinished products for use in the production of fruit juice beverages (Ramteke *et al.,* 1993). Some manufacturers produce fruit based beverages from raw materials other than the fruit, or use concentrates in quantities far below the legal requirements. Ash content and/or organic acid profile may be used as an authenticity to check for the wholesomeness of such drinks. Presence of certain organic acids in amounts above traces in fruit juices is a clear indication of adulteration (Evans *et al., 1983).*

Metal contamination is common in raw and processed foods (Whitrnan, 1977; Siddiquc *et al.,* 1987). This may arise from industrial pollution, use of agricultural chemicals and from food processing (Anonymous, 1988). FAO/WHO have recommended tolerance limits for some metals such as iron, copper, lead, mercury, tin and zin in foods and beverages (Pearson, 1976) since excess amounts are responsible for toxicity in man (Awan, 1983). Kim *et al.* (1981) reported the presence of lead, copper, cadmium, mercury and aresenic in various samples of vegetables and fruits. Similarly, copper, lead and zinc were detected in some Philippine legumes (Dumadaug *et al.,* 1982). Downing *et al.* (1985) analyzed apple juice concentrate for pesticide residues and detected traces of lead. Fruit beverages get contaminated with these toxic metals from various sources during processing. This study was, therefore, undertaken to determine the wholesomeness of some selected popular fruit-based beverages produced in Pakistan.

MATERIALS AND METHODS

Fruit beverages of three popular brands* A, Band C offered in brick type packaging were purchased from the market. In each brand, sample of 3-5 batches of three beverage types namely mango, orange and apple were analyzed for physicochemical and sensory characteristics. Acidity was determined by titrating diluted sample against 0.1 N NaOH according to AOAC (1984). The pH was recorded on pH meter (HANNA Model HI 8520). The total soluble solids were directly recorded by Abbe's stage refractometer (Model RL Nr. 1373) and the results expressed as per cent soluble solids (Brix) as described in AOAC (1984). sugars were determined using Lane and Eynon's method as given by Ruck (1%9). Ascorbic acid content of the samples was estimated by indophenol titrimetric method (AOAC, 1984). Ash was determined by incinerating the samples at 525 ° C to white ash (AOAC, 1984).

Organic acids present in the beverages were identified on high performance liquid chromatographer (Gilson with Pump Model No. 302 using Aminex Ion Exchange HP X 87 H X 7.8 mm column) according to the method of Gancedo and Luh (1986). Atomic absorption spectrophotometer (Pye Unicam Model SP-9) was used for determining the presence of metal contaminants (AOAC, 1984). Sensory evaluation of the samples was done by panel of 7 trained judges from among the staff and students of the Department of Food technology, University of Agriculture, Faisalabad using 9 point Hedonic scale according to Larmond (1977).

Statistical analysis of the data was carried out by employing Completely Randomized Design (three factor factorial) and comparison of means was done by duncan's Multiple Range test (Steel and Torric, 1980).

*Brand names withheld.

RESULTS AND DISCUSSION

Chemical analysis: Chemical constituents were found to differ significantly in brands, drink types as well as in batches (Table 1). In all the three types, samples of brand A had the highest average acidity. Orange beverage had the highest average acidity of 0.32, 0.31 and 0.30 per cent, respectively in brands A, Band C. The highest average pH of 4.22 was observed in mango beverage of brand B while the lowest average (3.&) was in orange beverage of brand A. All the three beverage types in brand A contained significantly higher average total soluble solids and sugars. Orange beverages were found to contain highest average ascorbic acid content of 4.40, 2.H5 and 3.07 per cent in brand A, Band C, respectively. Samples of brand A contained significantly higher averag~ilsh content of 0.13, 0.19 and 0.12 per.(:Cnt in mango, orange and apple beverage, respectively. The variations in ash content of the samples may be attributed to the formulations of each manufacturer. The lower ash content indicted low fruit content in the drinks. The variations in brands might be due to the raw material, recipes or the ingredients used. Length of storage andtemperature also affects the quality parameters of these beverages (Hussain *et at.,* 1993). The differences among the batches might be attributed to poor quality control.

Organic acids: Organic acids are sometimes employed as indicators of the quality of the product. Some organic acids (e.g. citric, malic) are often added during processing to adjust the sugar /acid ratio. However, absence of certain specific organic acids in fruit based products is a clear indication of lower level of fruit juice incorporation. Three important organic acids were identi-

Table 1. Average chemical constituents in varlous , cOD1me~chdlymanufactured fruit beverages

Beverage type/brand	Acidity (%)			pH		
	A	B	C	A	B	C
Mango	0.25 a	0.12c	0.22b	3,45 c	4.22 a	3.65b
Orange	0.32 a	0.31 b	0.30 a	3.06 c	3.08 b	3.16 a
Apple	0.25 a	0.20 b	0,16 c	3,49 c	3.76 b	3.99 a

Beverage type/brand	Total soluble solids (%)			Total sugars (%)		
	A	B	C	A	B	C
Mango	15.35 a	15.17 b	14.92 c	15.19 a	15.03 b	14.72 c
Orange	14.68 a	14.17 c	14.51 b	14.50 a	13.91 c	14.31 b
Apple	14.81 a	~4.64b	14.17 c	14.66 a	14.46 b	14.01 c

Beverage type/brand	Ascorbic acid (%)			Ash (%)		
	A	B	C	A	B	C
Mango	4.27 a	2.71 c	3.20b	0.13 a	0.09 c	0.12 b
Orange	4.40 a	2.85 c	3.07b	0.19 a	0.11 b	0.11 b
Apple	3,33 a	2.74 c	3.17b	0.12 a	0.09 c	0.12b

Results are expressed as means ± **SO** for three observations.
Means followed by different letters are significantly different (OMR = P$O.OS).

fled in the samples (Table 2). The analysis revealed the presence of citric acid in all samples. Mango beverages of the three brands were also found to contain succinic acid. Malic acid was found in all the samples of apple beverage of brand A, while in brand B it could be detected in only one batch. It was absent in brand C indicating the absence of fruit juice from this brand of beverages. Two of the mango beverage samples in brand A and one orange drink in brand B also contained malic acid. This might have been due to increase in malic acid content of the fruit pulp during storage (Giacomo and Leo, 1973).

Trace metals: Some *metals* such as copper, iron and zinc are nutritionally important while lead is a non-nutritive toxic element. Their presence above certain limits is normally an indication of contamination, In ready-to-drink beverages permissible limits are zinc 5.0 ppm, copper 2.0 ppm and lead

Table 2. Identification of organic acids present in commercially manufactured fruit beverages

Flavour	Brand	Acid	Batch I	Batch 11	Batch III
		Citric	+	+	+
	A	Malic	+	+	+
		Succinic	+	+	+
		Citric	+	+	+
Mango	B	Malic	-	-	-
		Succinic	+	+	+
		Citric	+	+	+
	C	Malic	-	-	-
		Succinic	+	+	+
		Citric	+	+	+
	A	Malic	-	-	-
		Succinic	-	-	-
		Citric	+	+	+
Orange	B	Malic	-	+	-
		Succinic	-	-	-
		Citric	+	+	+
	C	Malic	-	-	-
		Succinic	-	-	-
		Citric	+	+	+
	A	Malic	+	+	+
		Succinic	-	-	-
		Citric	+	+	+
Apple.	B	Malic	+	-	-
		Succinic	-	-	-
		Citric	+	+	+
	C	Malic	-	-	-
		Succinic	-	-	-

+ = Present.

- = Absent.

2.0 ppm (Pcarson, 1976; FAO, 1980). In the present investigation, the highest average iron content 'If 1.26 ppm and lowest of 0.40 ppm were observed in mango beverages of brand A and orange beverage of brand C, respectively (Table 3). The highest average zinc content of 1.26 ppm was detected in mango beverage of brand A, while lowest of 0.38 ppm was found in apple beverage of brand B. The average zinc content in the samples were found within the permissible limits. Copper was only detected in mango beverage of brand Band C with an average content of 0.9 and 1.3 ppm, and also in orange beverage of brand B with an average content 0.6 ppm. wherever present, copper content was found below the FAO/WHO permissible limits (FAO, 1980). Average lead content varied between 0.08 and 1.6 ppm which appeared respectively in apple and orange bp,verages of brand B.

Since trace metals in the drinks were below the permissible limits, therefore]: the possibility of toxicity by these drinks is very low. However, the appearance of lead in the drinks indicates contamination with this metal from .water, improper washing of fruits or from processing equipment containing lead alloys (Koning *et ai., 1980).*

Sensory evaluation: Significant differences were observed among the brands and batches for sensory characteristics. Drinks of brand A were awarded significantly higher average scores for colour, taste and flavour (Table 4) probably due to proper sugar/acid ratio. The variation in brands for colour, taste and flavour might be attributed to ingredients, recipes and processing. Organoleptic attributes decrease with increase in storage period (Awan and Riaz, 19(3). Marketing conditions also play a significant role in quality deterioration of drinks (Siddique *et al., 1987).*

Table 3. Average contents of some metals in various commercially manufactured fruit beverages

Beverage type/brand	Average iron (ppm)			Average zinc (ppm)		
	A	B	C	A	B	C
Mango	1.26* a	1.27 a	1.09 c	1.26 a	1.08 b	O.64c
Orange	0.76 a	0.56 b	O.40c	1.04 a	0.82 b	O.60c
Apple	1.16 a	0.88 b	0.88 b	0.86 a	0.38 c	0.46 b

Beverage type/brand	Average copper (ppm)			Average lead (ppm)		
	A	B	C	A	B	C
Mango	0.00* c	O.90b	1.30 a	0.76 a	0.90 a	0.50b
Orange	0.00 b	0.60 a	0.00 b	0.26 c	1.60 a	0.50b
Apple	0.00 a	0.00 a	0.00 a	0.34 a	0.08b	0.34 a

Results are expressed as means:!:SD for three observation..•

Means followed by different letters are significantly different (DMR = P50.05).

Table 4. Sensory characteristics of various commercially manufactured fruit beverages

Beverage type/brand	Average colour scores			Average taste scores			Average flavour scores		
	A	D	C	A	D	C	A	D	C
Mango	7.03* a	5.69b	5.83b	6.66 a	6.29b	5.71 c	6.94 a	6.06 b	5.89b
Orange	651 a	6.71 b	6,11 b	6,51 a	6.11 b	5.66 c	6,40 a	6.11 a	5.71 b
Apple	6.23 a	5.83 b	5.63b	6.74 a	6.11 b	5.86b	6.60 a	5.85 b	5.66b

Results are expressed as means ± SD for three values.

"Means followed by different letters are significantly different (DMR = P≤0.05).

The differences in the chemical composition and sensory characteristics of fruit based beverages available in the market indicate a wide variation in their quality. The low ash content of these drinks clearly reveals that all were low in juice content. The amount of lead in the drinks, though within the safe limits, indicate contamination from equipment or ingredients.

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