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Chemical Composition and Sensory Quality of Fruit-Flavoured Roselle (*Hibiscus sabdariffa*) Drinks

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Abstract: Roselle extract was flavoured with different fruits: Orange, pineapple and apple. pH, titratable acidity, total solid, proximate, minerals and vitamin C contents of the roselle-fruit drinks were determined. Roselle-fruit drinks increased in vitamin C and mineral quality. Roselle-fruits drinks had higher acceptability than the traditional roselle (zobo) drink especially the roselle-pineapple drink in term of its taste, flavour and overall acceptability.

Key words: Chemical · sensory · roselle · fruits · drinks

INTRODUCTION

The edible roselle *Hibiscus sabdariffa* is a member of the family Malvaceae to which belongs okro, cotton and kenaf. It is much like the kenaf but it can be distinguished by the size of the flower and shape of the seed. The flower of roselle are generally smaller and are kidney-shaped while those of kenaf are bigger and triangular-shaped [1].

Roselle is a tropical shrub with red or green inflated edible calyces [2, 3]. The calyces group are red, dark red and green types [4]. The crop is native to India but it has been introduced to other parts of the world such as Central America, West Indies and even African [5]. It is an annual crop and it is easily adapted to varieties of climatic and soil conditions. It is well-grown the in the tropics and sub-tropical regions.

The different parts of roselle are the seeds, leaves and calyces and these have been used for different uses as vegetables, source of oils, refreshing drinks and food preserves [6]. The calyces have been found to be rich in vitamin C and other antioxidants such as flavonoids [7] and also minerals [8].

Fruits are also rich sources of vitamins and antioxidants which are essential as health foods in the building up of body immune system and in preventing diseases [9]. Present research studies the proximate, mineral composition and ascorbic acid content of drinks produced from blends of extract of roselle calyces and different fruits. The acceptability of the different roselle-fruit drinks were also determined.

MATERIALS AND METHODS

Dried red roselle calyces and fruits: Pineapple, orange and apples were obtained from a local market, Bodija in Ibadan, Nigeria.

Preparation of roselle-fruit drink: Roselle calyces were washed and soaked overnight in distilled water (1:10 w/v). This was boiled for 15 min and filtered while still hot. Different fruits: apples, oranges and pineapples (about 400 g, respectively) were also separately washed, peeled and cut (seeds were removed from the apples and oranges). The fruits were blended in a warring blended and filtered. The extract from the roselle calyces was mixed with the filtrate of each fruit at three different ratios (1:1 w/v), (1:2 w/v) and (1:3 w/v), respectively and sugar was added to each drink (1:20 w/v). The Roselle-apple drink was coded RAP, while roselle-orange drink was ROP and roselle-pineapple drink was RPD. The drinks were pasteurized at 95°C for 5 min, cooled and packaged in clean uniform plastic bottles (Fig. 2).

Chemical analysis: pH was determined using glass electrode pH meter (Methron 620) standardized with buffer solutions of 4.0 and 7.0. Total soluble solid was determined using Abbe refractometer. Titratable acidity, proximate composition and vitamin C content were determined according to AOAC [10]. Mineral composition was determined using atomic absorption spectrophotometer (Buck 200).

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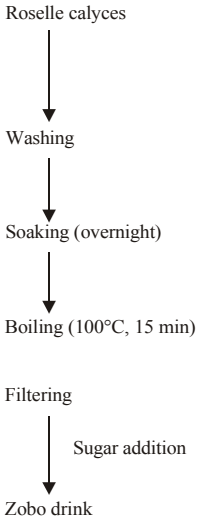

Fig. 1: Traditional processing of zobo drink

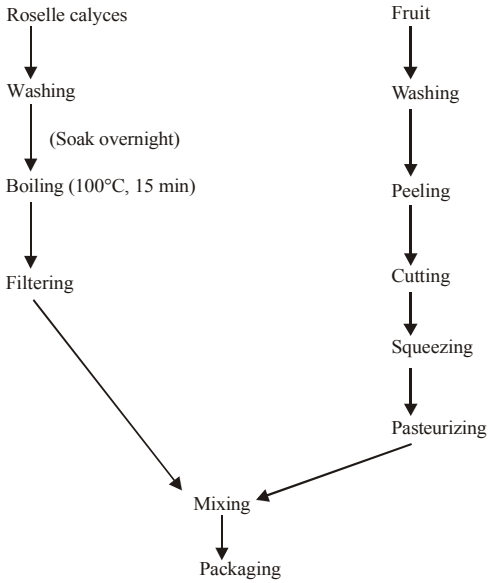

Fig. 2: Processing of fruit-flavoured roselle drink

Sensory analysis: The samples of roselle-fruit drink were presented as coded samples to a ten member panel. The traditionally processed roselle (zobo) drink was used for comparison (Fig. 2). The panelists were provided with a mouth-rinse after each tasting. They were requested to assess the drinks for the following attributes: colour, taste, flavour and overall acceptability. Scores were based on the nine- point hedonic scale where one equals extremely dislike and nine equals extremely like.

Statistical analysis: Data obtained from chemical and sensory analyses were subjected to analysis of variance (ANOVA) and means were separated by Duncan's multiple range test [11].

RESULTS AND DISCUSSION

Table 1 shows the pH, titratable acidity, total solids of fruits, roselle extract and roselle-fruit drinks. pH of the fruits and roselle extract were within the range of 3.12-3.62 while titratable acidity were within 1.90-2.30% and soluble solids of fruits were within 9.33-10-43°Brix. The roselle calyces had the lowest soluble solid of 3.20°Brix.

Table 2 shows the chemical composition of the fruits and roselle extract. Moisture content of the fruits was within the range of 78.24-84.41%. The apple had the highest carbohydrate content of 15.21%. The roselle extract had the lowest protein, crude fibre and vitamin C contents but it had the highest ash, phosphorus and sodium contents. Kirk and Sawyer [12] reported higher amount of ascorbic acid for roselles than orange and mango. Vitamin C content of roselle calyces is related to the state of freshness or dryness. Lower value of vitamin C content of roselle reported in present research could be associated with nutritional losses during drying process of the dried calyces used and during processing. Williams [13] reported that vitamin C is water-soluble and that it can be easily lost through boiling, heating and cooking water.

Table 3 shows the chemical composition of roselle-fruit drinks. Moisture content of the drinks was within the range of 80.13-87.63%. Higher carbohydrate content was recorded for the different ratios of RAD drink in comparison with RPD and ROD. Protein, crude fibre, ash and fat contents of the drinks were minimal which correlated with their initial contents in the fruits or roselle extract.

Table 1: pH, titratable acidity, total solid of fruits, roselle extract and roselle - fruit drinks

Samples	pH	Titratable acidity (%)	Soluble solid (°Brix)
Apple	3.32±0.11	2.21±0.54	9.33±1.00
Pineapple	3.62±0.02	2.10±0.23	8.72±0.10
Orange	3.54±0.10	1.90±0.45	10.43±0.45
Roselle extract	3.10±0.14	2.40±0.38	3.20±0.63
Roselle-apple drink (RAD)	3.38±0.14	2.00±0.33	8.20±0.14
Roselle-pineapple drink (RPD)	3.14±0.05	2.11±0.10	9.22±0.55
Roselle-orange drink (ROD)	3.52±0.10	2.30±0.05	11.21±0.73

Means of three readings ± standard deviation

Table 2: Chemical composition of fruits and roselle extract

	(%)					(g/100 g)				
Samples	Moisture	Carbohydrate	Protein	Crude fibre	Ash	Fat	Vitamin C	Calcium	Phosphorus	Sodium
Apple	78.24^{c}	15.21^{a}	0.76^{b}	3.62^{a}	0.57^{b}	0.05^{b}	44.14^{b}	2.80^{a}	0.95^{c}	0.39^{c}
Pineapple	82.79^{b}	12.30^{b}	1.12^{a}	0.94^{b}	0.33^{bc}	1.18^{a}	41.82^{b}	1.10^{d}	2.07^{b}	0.82^{b}
Orange	84.81^{b}	9.82^{c}	0.84^{ab}	0.55^{c}	0.39^{c}	0.03^{b}	51.62^{a}	2.61^{b}	0.71^{c}	0.03^{c}
Roselle extract	89.63^{a}	6.31^{d}	0.36^{c}	0.24^{d}	2.31^{a}	1.14^{a}	31.33^{c}	2.30^{c}	2.78^{a}	2.25^{a}

Table 3: Chemical composition of roselle-fruit drinks

		(%)						(g/100 g)			
Fruit-flavoured Roselle drinks		Moisture	Carbohydrate	Protein	Crude fibre	Ash	Fat	Vitamin C	Calcium	Phosphorus	Sodium
Roselle-apple drink (RAD) ratio:	1:1	84.23^{b}	11.70^{a}	0.51^{c}	1.44^{ab}	0.44^{a}	0.04^{c}	35.63^{b}	2.51^{b}	1.60^{d}	0.61^{cd}
	1:2	80.13^{c}	12.30^{b}	0.47^{cd}	1.93^{a}	0.41^{a}	0.04^{c}	36.33^{b}	2.62^{a}	1.80^{c}	0.53^{b}
	1:3	88.21^{a}	14.60^{a}	0.63^{b}	2.02^{a}	0.43^{a}	0.04^{c}	36.11^{b}	2.63^{a}	1.87^{c}	0.71^{c}
Roselle-pineapple drink (RAD) ratio:	1:1	88.62^{a}	8.7^{d}	0.93^{a}	0.64^{c}	0.32^{c}	0.67^{b}	35.21^{b}	1.54^{e}	2.40	1.10^{a}
	1:2	87.13^{a}	8.3^{d}	0.92^{a}	0.66^{c}	0.33^{c}	0.93^{a}	34.63^{b}	1.66^{e}	2.62	1.38^{a}
	1:3	83.11^{b}	10.4^{c}	0.94^{a}	0.72^{c}	0.31^{c}	0.98^{a}	35.1^{b}	1.71^{e}	2.63	1.41^{a}
Roselle-orange drink (RAD) ratio:	1:1	87.63^{a}	6.3^{e}	0.53^{c}	0.52^{d}	0.36^{b}	0.02^{c}	46.21^{a}	2.11^{cd}	1.71^{d}	0.75^{c}
	1:2	83.22^{b}	6.7^{e}	0.56^{c}	0.55^{d}	0.37^{b}	0.02^{c}	47.14^{a}	2.42^{c}	1.80^{c}	0.93^{b}
	1:3	80.23^{c}	7.2^{de}	0.54^{c}	0.57^{d}	0.38^{b}	0.03^{c}	48.25^{a}	2.34^{c}	1.82^{c}	0.94^{b}

Table 4: Sensory quality of roselle-fruit drinks

Sample		Colour	Taste	Flavour	Overall acceptability
Roselle-apple drink (RAD) ratio:	1:1	6.99^{c}	6.00^{ab}	6.1^{b}	6.5^{b}
	1:2	6.60^{c}	7.00^{a}	6.3^{b}	6.7^{b}
	1:3	7.20^{bc}	6.20^{b}	6.2^{b}	6.7^{b}
Roselle-apple drink (RAD) ratio:	1:1	8.10^{a}	8.00^{a}	7.6^{a}	7.9^{a}
	1:2	7.80^{ab}	8.00^{a}	7.8^{a}	7.2^{a}
	1:3	7.90^{ab}	7.70^{a}	7.8^{a}	7.7^{a}
Roselle-apple drink (RAD) ratio:	1:1	6.70^{c}	6.10^{b}	6.3^{b}	6.5^{b}
	1:2	7.70^{ab}	5.80^{bc}	6.1^{b}	6.0^{bc}
	1:3	7.40^{bc}	6.10^{b}	6.2^{b}	6.3^{b}
Roselle (zobo) drink	7.0^{a}	5.70^{bc}	5.3^{c}	5.4^{c}	

Means in the same column not followed by the same letter are different at 5% level of significance

Vitamin C contents of all the drinks were higher than the value recorded for roselle extract alone without fruit addition with the highest vitamin C content recorded in the roselle-orange drinks. This shows that addition of fruits to the roselle extract increased the vitamin C content in the drinks. The mineral contents of all the drinks were also higher than values recorded for the individual fruits.

Table 4 shows the sensory quality of the roselle-fruit drinks when compared to the traditionally processed roselle (zobo) drink. The samples of RAD at ratio 1:2 and 1:3 and all the samples of RPD drinks at the different ratios were not significantly different in overall acceptability in terms of taste. The samples of RPD also had the highest acceptability for flavour and overall acceptability. The samples of RAD and ROD were not significantly different but were more acceptable than roselle (zobo) drink.

Present research shows that combination of roselle extract with fruits tends to improve the nutritional quality of both the extract and juices in terms of the vitamins C and the mineral contents. Also, the roselle-fruit drinks had a higher acceptability in terms of its taste, flavour and overall acceptability.

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