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NUTRIENT COMPOSITION AND SENSORY PROPERTIES OF JUICE MADE FROM PITANGA CHERRY (*Eugenia uniflora* L.) FRUITS

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ABSTRACT

This study examined the nutrient composition and sensory properties of fruit juice produced from fruits of Pitanga cherry (*Eugenia uniflora L.*). Ripe Pitanga cherry fruits were harvested from the premises of the National Root Crops Research Institute, Umudike, Nigeria and used for the study. The fruits were sorted and washed thoroughly. The seeds were removed manually and the pulp was blended in a high speed Kenwood kitchen blender with little water (pulp: water; 4:1) for 10 minutes. The mixture was screened through a clean double folded cheese cloth into a beaker. The fruit juice was boiled in hot water for 15 minutes and poured into sterilized bottles for nutrient composition and sensory evaluation. Standard assay methods were used to analyze the nutrient content of the Pitanga cherry juice (PCJ). Standard black currant fruit drink (BCD) was bought from the market and used as control. A 9-point hedonic scale was adopted to evaluate the sensory properties of the two samples. Both samples had low levels of some of the proximate components but PCJ had higher fat (0.54%), fibre (0.553%) and ash (1.003%) contents. Total sugar for PCJ was 8.76% and BCD (13.72%). Energy value was 54.83 kcal for PCJ and 48.80 kcal for BCD. There were significant differences ($P<0.05$) in all the proximate and total sugar composition of the PCJ and the BCD except for carbohydrate where there was no difference ($P>0.05$).The Pitanga cherry juice contained significant quantities of potassium (101.26 mg), magnesium (15.52 mg), phosphorus (11.26 mg), calcium (10.75 mg), sodium (10.35 mg) and zinc (3.74 mg). However, the iron content was low (0.27 mg). The mineral content of PCJ was higher ($p<0.05$) than that of BCD except for magnesium and sodium. The cherry juice was moderately liked for all the sensory attributes of colour, taste, flavour and general acceptability. Instead of allowing the fruit to waste during peak periods, it could be processed into juice with appreciable nutritive value and acceptable sensory properties.

Key words: Pitanga, cherry, juice, nutrient, sensory

INTRODUCTION

Micronutrient malnutrition or "hidden hunger" is a major public health problem. Thus there is a need for a long-term sustainable intervention programme that would combat micronutrient deficiencies. Food-based approach especially dietary diversification to increase consumption of micronutrient- rich locally available foods could be valuable in the fight against hidden hunger [1]. In this era of food-based interventions, lack of knowledge not only of available foods but their usage, nutritional and health implications poses a problem especially as it relates to micronutrient deficiencies. A significant proportion of indigenous fruits in West African sub region are seasonal forest products, harvested for consumption on site or for sale in urban centers [2]. The knowledge of the nutrient composition of some of these fruits will enhance their use and increase their consumption which will in turn help to improve the micronutrient profile of a good proportion of the population. The availability of fruits is short-lived due to their seasonal and highly perishable nature [3].

Most of the fruits grown in the tropics including Pitanga cherry (*Eugenia uniflora* L.) are underutilized as a result of climate (season, harvest time, pest and insect attack) and biological (perishability and respiration) factors [4]. The unfavourable conditions of these factors contribute to the wastage of fruits and fruit products. The wastage of surplus Pitanga cherry which usually litter the surroundings of the cherry tree can be minimized by processing them into alcoholic and non-alcoholic drinks, jams and jellies at peak seasons, to make them available even at off season periods.

A fruit juice is defined as the clear or uniformly cloudy unfermented liquid recovered from sound fruits by pressing and other mechanical means [5]. Fruit juice is a fruit product, which could be easily consumed by infants, children and adults to meet their nutrient needs particularly that of micronutrients [1]. The English names of this fruit include Pitanga, Surinam, Brazilian cayenne and Florida cherry. In Nigeria, it is commonly known as Pitanga cherry. There are two distinct types: the common bright red and the rarer dark crimson to nearly black which tends to be sweeter and less resinous. *Eugenia unifloria* L.is ecologically important in its endemic range as a pioneer specie in the restinga ecosystem [6]. It is widely planted in central south Florida especially for hedges [7]. It is an evergreen multi-branched shrub with slender, spreading branches and resinously aromatic foliage [7]. Seeds and also grafting are the usual means of propagation [8]. Fruiting is generally profuse with hundreds or thousands of fruit per cycle and trees sometimes fruiting 2-3 times a year [9]. Pitanga cherry fruits are fleshy, juicy, orange–red berries 4cm wide and are depressed–globose, conspicuously 8–ribbed and contain 1-3 seeds. The fruit turns from green to orange as it develops and when mature, bright red to deep scarlet or dark, and purplish maroon ('black') when fully ripe [Fig.s 1 & 2]. The skin is thin, the flesh orange-red, melting and very juicy [7, 10].

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Figure 1: Picture of Pitanga cherry (Brightly-coloured variety)

Figure 2: Picture of Pitanga cherry (Dark-coloured variety)

Pitanga cherry is a red aggregate fruit, the size of a plum, with an acid taste and somewhat sour. It is noted for its provitamin A, vitamin C and calcium content as well as a promising source of antioxidants [9, 11]. Natural juices more than the processed are diuretic as a result of their high potassium and flavonoid content. They alkalize, in spite of their acidity and as such reduce the acidity of the blood and tissues. They mineralize because of their high mineral content with invigorating effects due to the high levels of sugars and vitamins [11].

In Nigeria, little industrial value is attached to this fruit. It is only consumed locally in the fresh state and there are no known commercial products made from Pitanga cherry yet. Most often, it ripens and falls off the tree. In peak seasons, the fruits litter the surrounding environment of the shrub because ripe ones fall off easily after being shaken by the wind. Little or no commercial value is attached to this fruit because it is rarely displayed for sale in the market. Utilization of fruits in Nigeria and most developing countries is limited due to inadequate processing and preservation methods [12]. Fruiting of this cherry is generally profuse with hundreds or thousands of fruits per cycle and the trees sometimes fruit 2-3 times a year. To increase the demand and reduce the wastage of this fruit, juice could be produced. However, minimal work has been done on this fruit.
The desire to study the production of fruit juice from Pitanga cherry lies in the fact that in this southern part of Nigeria, the cherry shrub is used to make hedges and form flowers around most compounds. The quantity that can be consumed by eating the fruit is less compared with the quantity that can be consumed from the juice. To this end, the juice offers opportunity for most of the micronutrients present in the fruit to be consumed and the consumers can meet their micronutrient requirements.

MATERIALS AND METHODS

Source of materials

About 1.5 kg ripe fresh fruits of Pitanga cherry were plucked from the premises of National Root Crops Research Institute (NRCRI) Umudike, Abia State, Nigeria and used for the study.

Production of fruit juice

The sorted fruits were washed in tap water and seeds removed from the pulp manually using stainless kitchen knives. The pulp was blended with little water (pulp: water, 4: 1) in a Kenwood food blender operated at full speed for 10 minutes. The mixture was screened through a clean double folded cheese cloth into a beaker. The fruit juice was boiled in hot water for 15 minutes and poured into sterilized bottles for nutrient composition and sensory evaluation.

Chemical analysis

The nutrient composition of the cherry juice and a standard black currant drink bought from the market which served as a control was determined using standard assay methods of Association of Official Analytical Chemists [AOAC] [13]. All analysis was performed in triplicate. Crude protein was determined using 6.25 as a conversion factor. Fat and ash content were determined by soxhlet extraction and wet ashing method, respectively. Carbohydrate was calculated by difference (100 - % protein + % fat + % crude fibre + % ash + % moisture). Gross energy was calculated using Atwater conversion factors [14]. Vitamin C was determined using the 2, 6-dichlorophenol method of AOAC [9]. Provitamin A was determined using the method adopted from International Vitamin A Consultative Group [IVACG] [15]. Minerals (calcium, magnesium, potassium, sodium, phosphorus, iron and zinc) were determined by atomic absorption spectrophotometer [13].

Sensory evaluation

A nine-point hedonic scale [16] where nine is the highest score (like extremely) and one the lowest (dislike extremely) was used to evaluate the colour, taste, flavour and general acceptability of the two samples. Thirty consumer panelists randomly selected from staff and students of Michael Okpara University of Agriculture, Umudike, participated in the sensory evaluation. The tests were done in two sessions, morning and afternoon. The juices were appropriately coded and presented to each of the panelists in a glass cup for the evaluation.

Statistical analysis

Data obtained from the study were analyzed using means and standard deviations. Analysis of variance (ANOVA) and Duncan's New Multiple Range Test (DNMRT) were used to test significant difference between means [17].

RESULTS

Proximate Composition

The chemical composition of the Pitanga cherry juice (PCJ) and black currant drink bought from Umuahia main market (BCD) and used as control are presented in Table 1. The protein level of the cherry juice was 1.007% and black currant drink was 0.023%, fat was 0.547% and 0.027% for cherry and black currant drink, respectively. Though both had low values, cherry juice had higher fat (0.547%) than the black currant drink (0.027%).Cherry had higher fibre (0.553%) than black currant drink and higher ash (1.003%) than black currant drink (0.333%). The total sugar for PCJ was (8.763%) and (13.727%) for BCD. The two samples had high moisture content 85.43% for cherry juice and 87.48% for black currant drink. The energy value for PCJ was 54.827 kcal and BCD was 48.80 kcal. There were significant differences ($P<0.05$) in all the proximate and total sugar composition of the Pitanga cherry juice and the standard black currant drink except for carbohydrate content which was not significantly different ($P>0.05$).

Nutrient Levels

The mineral and vitamin composition of the samples is presented in Table 2. The Pitanga cherry juice contained significant quantities of potassium (101.26 mg), magnesium (15.52 mg), phosphorus (11.26 mg), calcium (10.75 mg), sodium (10.35 mg) and even zinc (3.74 mg). However, the iron content was low (0.27 mg). The mineral value of the Pitanga cherry juice was higher than the values for the black currant drink except for phosphorus and calcium. There was significant difference ($P<0.05$) in the mineral content of the two samples except for magnesium and sodium where there was no difference ($P>0.05$).

The vitamin C value of the cherry juice (27.59 mg) was higher than that of the black currant drink (24.05 mg). The same is applicable to beta-carotene (15. 85 mg/100ml) for cherry juice and (1.24 mg/100g) for black currant drink. Vitamin C and provitamin A recorded significant differences ($p<0.05$) in PCJ and BCD.

Sensory evaluation

The mean sensory scores of the pitanga cherry juice and standard black currant drink are presented in Table 3. The mean sensory scores of BCD differed significantly ($P<0.05$) in colour, taste, flavour and general acceptability from that of the PCJ. The BCD was very much liked for all the parameters and PCJ was moderately liked for all the parameters as well.

DISCUSSION

The low protein content of PCJ is not surprising as low protein level in fruit juices has been reported [18, 19]. Though low, the higher fat, fibre and ash found in PCJ than in BCD could be because the black currant drink was prepared from the concentrate of its fruit. The higher total sugar level of the black currant drink (13.727%) than that of cherry juice (8.763%) could be due to the addition of sugar to the black currant drink during processing as indicated on the packet. The two samples had high moisture content PCJ (85.43%) and BCD (87.48%) The high moisture content of most fruits had been reported [5]. The high moisture content could have also affected the value of some of the other nutrients present. The energy value for PCJ (54.827 kcal) was higher than that of BCD (48.80 kcal). This could be because the cherry fruit had less moisture, higher fat and protein content. The energy value of foods is much more related to fat than carbohydrate content [20]. The energy and carbohydrate values of the cherry juice 54.83 kcal and (11.5%) respectively were higher than that reported for sweet orange 45 kcal and 10.5%, respectively [1]. The low crude fibre content of the cherry juice could make it an easily digestible food especially for children. This is because low fibre content in foods can enhance nutrient availability [21]. However, high fibre foods are also desirable in the daily diet because of their numerous nutritional benefits. The significant difference

($P<0.05$) noted in almost all the proximate and total sugar composition of the PCJ and BCD could be due to different methods of preparation of both juices.

The Pitanga cherry juice contained significant quantities of some of the minerals. Natural fruits and vegetables are good sources of potassium and are low in sodium, an advantage reported to protect against arterial hypertension as opposed to meat derivatives [11]. Pitanga cherry juice from this study possesses this quality as it contains significant quantity of potassium and low sodium. Meat and fish contain a great deal of phosphorus but little calcium. This situation fosters osteoporosis because excess phosphorus, reduces calcium absorption [11]. On the other hand, grains, legumes, fruits and vegetables are close to the ideal 1:1 balance between these two minerals [11]. This study revealed that Pitanga cherry has this ideal balance with 11.26 mg phosphorus and 10.75 mg calcium. Meeting calcium needs has been associated with reduced risk of osteoporosis, hypertension, colon/ breast cancer, kidney stones, lead exposure, premenstrual syndromes and obesity/over weight [22]. However, the iron content of PCJ was low (0.27 mg). This is not surprising as fruits are generally not good sources of iron. Traces of iron in fruit juice produced from lime, lemon and grape was observed [1].

The mineral content of Pitanga cherry juice in this study compared favorably with some other fruit juices like orange, pineapple and sour-sop as shown in Table 4 [1, 19]. In as much as all the mineral values of the Pitanga cherry juice were low compared with the recommended daily allowance, it is certain that only one food group cannot supply all the needed minerals. To this end, by consumption of a combination of the cherry juice, other fruits and vegetables and any other food group that contains certain amounts of the different minerals, individuals may meet their recommended micronutrient daily allowance.

The vitamin C content of the Pitanga cherry juice is noteworthy (27.59 mg/100ml) and comparable to the values reported for orange (49 mg), pineapple (24 mg), sour sop (26 mg), bananna (18 mg), and mango (25 mg) [1, 19, 23 - 27]. Pitanga cherry is known for its provitamin A, vitamin C and calcium content [11]. When consumed alongside other vitamin C rich foods each day, it can help an individual to meet the recommended daily allowance of 30 – 95 mg distributed within different age, sex and physiological status [11]. The vitamin A (carotene) value of the cherry juice indicates that Pitanga cherry is a fairly good source of provitamin A. This may be responsible for the red colour of the cherry fruit and juice. When this amount (15.85 mg/100ml) of beta-carotene in the cherry fruit is combined with other foods that are not considered very good sources of beta-carotene, it could provide cumulative importance. Beta-carotene is the carotenoid with the most vitamin A activity and because of its chemical nature, it has been suggested that beta carotene may be an antioxidant within tissues protecting them from damage by free radicals [22].

Sensory evaluation

The mean sensory scores of the Pitanga cherry juice (PCJ) and standard black currant drink (BCD) are presented in Table 3. In all the attributes, colour, taste, flavour and general acceptability, the mean values revealed that the panelists preferred the standard blackcurrant drink. This could be due to:

i. Familiarity of the panelist to the black currant drink as most people are not used to the cherry fruit/ juice.
ii. Higher sugar level of the drink since it was sweetened [11].
iii. More refining and processing method of the black currant drink which produced a better coloured and more acceptable drink.

However, from the mean sensory scores, the cherry juice was liked moderately for all the attributes. This is an indication that the cherry juice was not out rightly rejected and could be improved upon by addition of sugar to cover the acid / sour taste as well as finer filtration procedure to produce a juice that is bright in appearance.

CONCLUSION

The study has shown that the Pitanga cherry (*Eugenia uniflora L.*), a fruit that is not given much attention as a source of nutrients can be a good source of some minerals including potassium, calcium, phosphorus, magnesium and sodium, as well as vitamin C and beta-carotene. Thus, it holds promise as components of diet in the dietary diversification programme to combating micronutrient deficiencies especially using locally available foods (fruits). The production of Pitanga cherry juice would increase the quantity of nutrients consumed as against the quantity consumed through the fruit. The consumption of the whole fruit that will supply the needed nutrients may also become burdensome to the consumer. The cherry fruit can also be harnessed during the peak periods of their fruiting to produce fruit juice, which could be used in off-seasons. The utilization of cherry fruit as an alternative material for producing juice should therefore be encouraged rather than allowing the fruits to waste.

However, more research work is needed to improve the flavour, taste and general acceptability of the cherry juice. There should be efforts to reduce wastage of the fruit during peak season, and furthermore to process the large quantities of the fruit into soft drinks, alcoholic and non alcoholic drinks, jams and jellies, syrups as well as concentrates to be used during off seasons. The juice can also be fermentd into vinegar or wine, and sometimes prepared into distilled liquor as the Brazilians do.

Table 1:Proximate composition and sugar values of the samples

Nutrient (100 ml)	Samples	
	001	002
Protein (%)	1.007± 0.085[a]	0.023 ± 0.006[b]
Moisture %	85.430 ± 0.507[b]	87.480 ± 0.122[a]
Fat %	0.547 ± 0.023[a]	0.027 ± 0.006[b]
Fibre %	0.553 ± 0.042[a]	0.020 ± 0.010[b]
Ash %	1.003 ± 0.126[a]	0.333 ± 0.029[b]
Total sugar %	8.763 ± 0.015[b]	13.727 ± 0.023[a]
Carbohydrate %	11.470 ± 0.471[a]	12.117 ± 0.142[a]
Energy (kcal)	54.827 ± 1.380[a]	48.800 ± 0.582[b]

Values with different superscript on the same row are significantly different (P<0.05)

Sample 001 – (*Eugenia uniflora*) Pitanga cherry juice (PCJ)

Sample 002 – standard black currant drink purchased from the market (BCD)

Table 2:Mineral and vitamin composition of the samples

Nutrients (100 ml)	Samples	
	001	002
Calcium (mg)	10.75 ± 1.300[b]	13.510 ± 0.052[a]
Magnesium (mg)	15.523 ± 2.186[a]	14.393 ± 0.722[a]
Potassium (mg)	101.260 ±0.610[a]	9.680 ± 0.711[b]
Sodium (mg)	10.350 ± 0926[a]	10.247 ± 0.012[a]
Phosphorus (mg)	11.260 ± 0.131[b]	14.443 ±0.482[a]
Iron (mg)	0.273 ±0.025[a]	0.077 ± 0.015[b]
Zinc (mg)	3.743 ± 0.006[a]	0.307 ± 0.384[b]
Ascorbic acid (mg)	27.593 ± 0.951[a]	24.050 ± 0.050[b]
Provitamin A (µg RE)	15.853 ± 0.127[a]	11.243 ± 0.015[b]

Values with different superscript on the same row are significantly different (P<0.05)

Sample 001 – (*Eugenia uniflora*) Pitanga cherry juice (PCJ)

Sample 002 – standard black currant drink purchased from the market (BCD)

Table 3:Mean sensory score of samples

Sensory Attributes	Samples	
	001	002
Colour	7.667 ± 0.884^{b}	8.267 ± 0.740^{a}
Taste	6.833 ± 1.367^{b}	8.067 ± 0.868^{a}
Flavour	7.100 ± 1.061^{b}	7.767 ± 0.935^{a}
General Acceptability	7.067 ± 0.785^{b}	8.267 ± 0.640^{a}

Values in the row with different superscripts are significantly different ($p < 0.05$).

Sample 001 Pitanga cherry fruit juice (PCJ).

Sample 002 standard-black current drink purchased from the market (BCD).

The scores are based on 9 point Hedonic scales
Where:

9 like extremely	6 like slightly	3 dislike moderately.
8 like very much	5 neither like nor dislike	2 dislike very much
like moderately	4 dislike slightly	1 dislike extremely

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Table 4:Mineral content of Pitanga cherry juice compared with other fruit juices

	Mineral content			
Fruit juices	**Mg (mg)**	**K (mg)**	**Na (mg)**	**P (mg)**
Pitanga cherry	15.5	101.26	10.35	11.26
Orange*	9.9	17.0	0.55	9.0
Pineapple*	1.3	3.1	0.6	0.7
Sour-sop*	0.7	1.1	0.6	0.7

***Source [1, 19]**

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