RESEARCH ARTICLE
ISSN 2279 –0586

NUTRITIONAL, ANTINUTRITIONAL, MINERALS AND VITAMIN COMPOSITIONS OF FOURTEEN BRANDS OF FRUIT JUICE SOLD IN ONITSHA MAIN MARKET

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ABSTRACT

The nutritional composition, antinutritional factors and minerals of fourteen brands of processed fruit juices sold in Onitsha main market was chemically analyzed. The vitamin C contents and pH of the fruit juices were also determined by standard methods. The moisture content, density and sugar level is high across the samples and are required for energy and maintenance of body fluids and metabolic activities. Crude protein and ash is expectedly low as a result of treatment and maceration of the fruits. Crude fibre was not detected as the fruits were thoroughly crushed and filtered, whereas the mineral contents were adequate and may aid normal cell function and maintenance. The pH (4.66-5.65) of the fruit juice samples was generally acidic irrespective of the brand and may reduce contamination. Cyanide was present in trace amount while and tannins was detected in insignificant quantity (< 0.001mg/100ml) across the samples. Regular intake of fruit juices should be encouraged as it will provide nourishment and vitality to the body.

KEYWORDS: Fruit Juice, Nutrients, Minerals, Antinutritional Factors, Vitamin C.

INTRODUCTION

Hollis et al. defined fruit juice as the liquid that is naturally contained in fruit or vegetable tissue and prepared by mechanically squeezing or macerating fruit or vegetable flesh without the application of heat or solvents [1]. For example, orange juice is the liquid extract of the fruit of the orange tree [2]. Nigeria has the largest market in sub-Saharan Africa, with a population nearing 150 million people and growing at three percent annually. Despite a huge number of consumers, Nigeria's agricultural sector is under-developed and the country remains a major importer of food and agricultural products, including fruit juice concentrates and premix [3].Fruits are generally high in fiber, water, vitamin C and sugars, although the later varies widely from traces as in lime, to 61% of the fresh weight of the date fruit [4]. Fruits also contain various phytochemicals that do not yet have an RDA/RDI listing under most nutritional factsheets, and which research indicates are required for proper long-term cellular health and disease prevention. Regular consumption of fruit is associated with reduced risks of cancer, cardiovascular disease (especially coronary heart disease), stroke, Alzheimer disease, cataracts, and some of the functional declines associated with aging [5]. Experts around the globe recommend increased consumption of fruits and vegetables to promote health and prevent disease. Studies confirm that drinking 100% fruit juice can actually boost intake of whole fruit and is linked to other healthy behaviours [6].

Fruit juices processed under hygienic condition could play important role in enhancing consumers' health through inhibition of breast cancer, congestive heart failure (CHF), and urinary tract infection [7; 8]. Literature on the nutritional compositions of fruits juice processed in Nigeria is limited [9]. The antinutritional contents of fruit juices have not been determined, whereas data on the mineral and vitamin composition of the juices provided by the manufacturers is subject to be investigated to confirm the authenticity of their claims.This study reports on the nutritional, antinutritional and mineral compositions of fourteen brands of fruits juice processed in Nigeria and sold in Onitsha main market. A Vitamin C composition and hydrogen ion concentration (pH) of the juices was also determined.

MATERIALS AND METHODS

Collection of Samples

A total of fourteen processed made in Nigeria fruit juices, consisting of seven single and seven mixed fruit juices packaged in different materials were purchased in Onitsha main market. Samples were collected for a period of six months. The packaging materials were confirmed intact.

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Analysis of Samples

Determination of pH

Determination of pH was done with a Uniscope pH meter previously standardized. Fifty milliliter (50 ml) portion of juice samples were removed into a clean 100ml beaker. The pH probe was inserted into the beaker and swirl continuously. Samples were analysed in triplicates and the values recorded as the mean.

Estimation of nutrient composition of samples

Proximate Analysis

Moisture and ash contents of fruit juices were determined using standard methods [10; 11]. Crude protein was determined by the Kjedahl method [12; 13], in which Nitrogen content was determined by the furnace incineration gravimetric method. The Bligh Dyer method was used to determine the fat content of the fruit juice samples [14]. The crude fibre content of the fruit juice sample was determined by the Weenden gravimetric method [11; 14]. The carbohydrate (Nitrogen free extracts) content was obtained by difference which also represents the brix level of the fruit juices [14]. Ascorbic acid (Vitamin C) was estimated by 2, 6-Dichlorophenol-indophenol visual titration according to the method described by Osborne and Voogt [14].

Determination of Minerals

Minerals present in the fruit juice samples were determined. These include Sodium, Potassium, Phosphorus, Calcium and Magnesium. The Phosphorus content of the fruit juice samples was determined using Molybdate Method [14]. The calcium and magnesium content of the samples were determined using Ethylenediaminetetraacetic acid (disodium salt)-EDTA [14]. The Magnesium was then obtained by difference between Ca determined above and (Ca + Mg) determination. The Sodium and Potassium content of the fruit juice samples were determined by Flame Photometry [15].

Antinutritional factors

Determination of Cyanide

Cyanide was determined by Alkaline Picrate method (Wang and Filled Method) described by [14].

Determination of Tannins

Folin-Denis Spectrophotometric method was used for the determination of Tannins. The method was described by [16].

Table 1. Mean Values of Proximate the Composition of Fruit Juices

S/No	Sample Code	Density (g/cm^3)	Sugar or Brix (% of 100ml)	Moisture Content (% of 100ml)	Ash (% of 100ml)	Crude Protein (% of 100ml)	Fat (% of 100ml)	Fibre (% of 100ml)	Vitamin C (mg/100ml)
1	SOr	1.066	12.4	88.45	0.045	2.062	<0.001	N.D.	21.00
2.	SBa	0.983	16.25	82.14	0.188	1.75	<0.001	N.D.	8.00
3.	M1	1.051	13.20	86.42	0.095	1.64	<0.001	N.D.	6.50
4.	M4	1.050	12.20	88.34	0.117	1.57	<0.001	N.D.	12.50
5.	SBl	1.084	11.80	88.59	0.016	1.53	<0.001	N.D.	32.50
6.	M3	1.066	12.20	87.60	0.172	1.20	<0.001	N.D.	30.00
7.	SGu	1.063	12.60	87.90	0.019	1.43	<0.001	N.D.	6.00
8.	M2	1.064	15.40	83.77	0.178	1.77	<0.001	N.D.	8.50
9.	M6	1.042	12.80	87.64	0.047	1.65	<0.001	N.D.	2.50
10.	SPe	0.966	12.90	87.59	0.050	1.62	<0.001	N.D.	4.00
11.	M5	1.036	11.00	90.97	0.538	2.03	<0.001	N.D.	20.00
12.	M7	1.046	12.20	88.40	0.144	1.63	<0.001	N.D.	28.00
13.	Sap	1.051	10.00	90.46	0.219	1.91	<0.001	N.D.	2.50
14.	SPi	1.051	7.60	92.38	0.086	2.04	<0.001	N.D.	4.00

Key: N.D. = Not Detected.

RESULTS AND DISCUSSION

Results of nutritional analysis

Results of Proximate Analysis

The proximate analysis results of the fruit juice samples are shown in Table 1. The moisture content was very high while the fat present is quite negligible. The sample does not contain any fibre.

Results for Determination of Minerals

The minerals present in the fruit juice samples were determined and the results are shown in the Table 2.

Table 2. Mean Values for the Composition of Minerals in Fruit Juices

S/No	Sample Code	Sodium (%)	Potassium (%)	Phosphorus (ppm)	Calcium (%)	Magnesium (%)
1	SOr	0.0126	0.0113	0.903	0.0072	0.0036
2.	SBa	0.0221	0.0394	1.408	0.0237	0.0197
3.	M1	0.0156	0.0262	1.560	0.0219	0.0384
4.	M4	0.0175	0.0345	1.001	0.0351	0.0050
5.	SBl	0.0035	0.0093	0.520	0.0062	0.0021
6.	M3	0.0192	0.0211	0.391	0.0250	0.0078
7.	SGu	0.0028	0.0016	0.625	0.0113	0.0013
8.	M2	0.0115	0.0133	0.444	0.0102	0.0111
9.	M6	0.0149	0.0099	0.585	0.0088	0.0059
10.	SPe	0.0141	0.0080	0.526	0.0050	0.0028
11.	M5	0.0129	0.0258	0.927	0.0172	0.0037
12.	M7	0.0132	0.0080	0.292	0.0078	0.0012
13.	Sap	0.0219	0.0368	1.151	0.0184	0.0484
14.	SPi	0.0161	0.0096	0.506	0.0111	0.0010

Results for the determination of pH of the samples

The results of the pH of the fruit juice samples analysed are shown in Table 3. The results show that the pH of all the fruit juice samples is within acidic range.

Table 3. Mean Values of pH

S/No.	Sample Code	pH
1	Sor	5.24
2.	Sba	5.56
3.	M1	5.22
4.	M4	5.65
5.	SBl	4.82
6.	M3	5.44
7.	Sgu	4.66
8.	M2	4.98
9.	M6	4.83
10.	SPe	5.13
11.	M5	5.29
12.	M7	4.71
13.	Sap	5.54
14.	SPi	5.22

Results for the Determination of Antinutritional Factors

The result for the determination of Antinutritional factors of the fruit juice samples is shown in Table 4. Cyanide is present in trace quantity while tannin is negligible.

Table 4. Mean Value of the Composition of Antinutritional Factors

S/No.	Sample Code	Tannin (mg/100ml)	Cyanide, HCN (mg/100ml)
1	SOr	<0.001	Trace
2.	SBa	<0.001	Trace
3.	M1	<0.001	Trace
4.	M4	<0.001	Trace
5.	SBl	<0.001	Trace
6.	M3	<0.001	Trace
7.	SGu	<0.001	Trace
8.	M2	<0.001	Trace
9.	M6	<0.001	Trace
10.	SPe	<0.001	Trace
11.	M5	<0.001	Trace
12.	M7	<0.001	Trace
13.	SAp	<0.001	Trace
14.	SPi	<0.001	Trace

An estimate of the gross nutrient composition of the juices shows in slight variations. The carbohydrates content was analysed as soluble sugar or brix level, and the value ranges from 7.60 – 16.25 % of 100ml equivalent to mg per 100ml of the fruit juice samples with an average value of 12.325mg/100ml (Table 1). The fruit juice sample with the highest level of sugar is SBa (16.25 mg/100ml) followed by M2 (15.40 mg/100ml) while the least sample is SPi (7.60mg/100ml). Most of the common fruits are low in protein, as considerable proportion of the protein content of fruits is insoluble and consequently remains in the pomace. The crude protein of the fruit juice samples as shown in Table 1 ranges from 2.062mg/100ml to 1.20mg/100ml with SOr having the highest level of crude protein while M3 have the least crude protein with an average value of 1.7023mg/100ml. The fat content was <0.001mg per 100ml across the samples while fibre was not detected. The mineral compositions of the samples shows that sample SBa have the highest level of Sodium (0.0221% per 100ml), while SGu have the least Calcium (0.0028% per 100ml) with an average value of 0.0143mg/100ml. Potassium is high in SBa (0.0394%/100ml) while M7 and SPe have the least Potassium with 0.0080%/100ml. The average level of Potassium and phosphorus across the samples is 0.0182%/100ml and 0.7742 ppm respectively (Table 2). M1 have the highest level of Phosphorus with 1.560 ppm while M7 have the least Phosphorus with 0.292 ppm. Calcium has the average value of 0.0149%/100ml and was found to be highest in M3 (0.0250%/100ml). SAp has the highest level of Magnesium while SPi have the least Magnesium (0.0010%/100ml). The average value of Magnesium across the samples is 0.0109%/100ml. Results of the investigation showed that the pH of the fruit juice samples was generally acidic irrespective of the brand (Table 3). The high acidity of fruit juices is due to the presence of a mixture of organic acids, whose composition varies depending on fruit nature and maturity [17]. The overall range of

pH is 4.66-5.65 with most figures being between 4.80 and 5.50. The highest pH was shown by M1 (5.65), followed by SBa (5.56), while the lowest was SGu (5.65).The high acidity of the juices could account for the low numbers and few types of organisms associated with its deterioration and spoilage [18].Ascorbic acid not only restores nutritional value lost during processing, but also contributes to the product appearance and palatability. Ascorbic acid (vitamin C) content of different fruit juices is shown Fig. 4. The ascorbic acid content of commercial fruit juices is lost with respect to time and temperature during processing and storage [19]. Many processors add ascorbic acid to their products to make up for processing losses [20]. This could account for higher content of ascorbic acid in some of the juices analysed. The range of Ascorbic acid is 28.00mg/100ml to 2.50mg/100ml with M7 having the highest level of Vitamin C while SAp and M6 have the least level of Vitamin C. The average value of Vitamin C across the samples is 13.286mg/100ml.

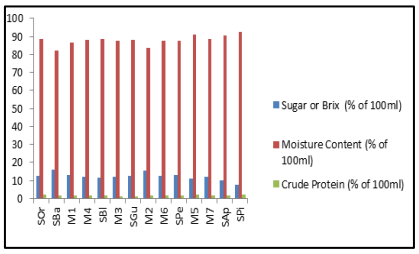

Figure 1. Showing the level of Sugar/Brix, Moisture Content and Crude Protein (in %/100ml equivalent ton g/100ml) across the 14 samples

Figure 1 shows the tripartite result of the brix level, moisture and crude protein contents of the fourteen fruit juice samples analysed and expressed in percentages per milliliter. Figures 2 and 3 shows the ash content and density (energy) level of the fourteen fruit juices. The vitamin C contents of all the juice is shown in Figure 4.

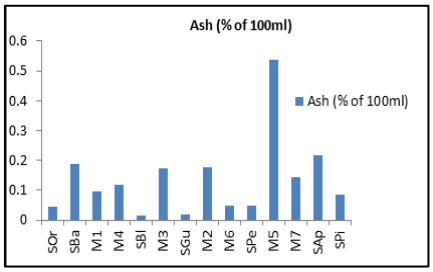

Figure 2. Showing the Ash Content across the 14 sample

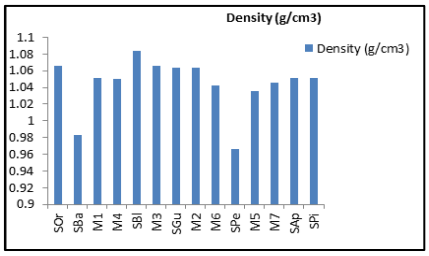

Figure 3. Showing the Density of the 14 fruit juice samples

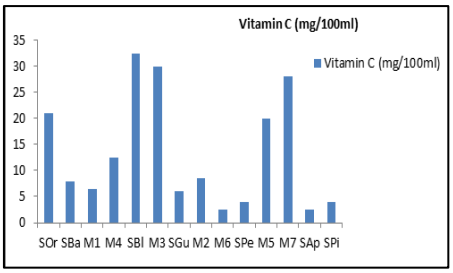

Figure 4. Showing the level of Ascorbic Acid across the 14 fruit juice samples

The Density, Moisture content and Ash content of the samples were also investigated with an average value of 1.044g/cm^3, 87.904 %/100ml and 0.1367 %/100ml respectively. The crude protein and moisture contents and sugar level is visibly shown in Figure 1. Figures 2 and 3 also show the ash contents and density level of the fruit juices. SBa is nutritionally richer than the rest of the samples, while M7 have the least value for most of the parameters investigated. The moisture content and sugar level is high across the samples and are required for energy and maintenance of body fluids and metabolic activities. Crude protein and ash was expectedly low as a result of treatment and maceration of the fruits. Crude fibre was not detected as the fruits are thoroughly crushed and filtered while the mineral contents were adequate [2]. Tannin and cyanide were the only antinutritional components analysed. Tannin was <0.001mg/100ml across all the samples while Cyanide was identified to be present in trace amount across all the samples (Table 4).Tannins are naturally occurring plant polyphenols that binds and precipitate proteins. They are fascinating but sometimes molecules when in solution. Cyanide is a rapidly acting, potentially deadly chemical that contains the cyano group [2].

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