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Physicochemical analysis of some natural sudanese juices (Roselle, Adansonia digitata and Tamairndus indica)

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Abstract
Sudanese use Roselle, Adansonia digitata, and Tamairndus indica as juices almost daily at home, especially, during fasting month "Ramadan". The juices are popular even in some restaurants and hotels. Roselle is used as a hot drink after boiling. The aim of this study was to determine some essential physicochemical properties of the three fruits by studying their water extract. The study also aimed to check if there is any component which may have a health negative effect for the consumers. The measured parameters include; Moisture content, Ash content, pH value of 10% solution and Total acidity. Total acidity was determined by potentiometric titrations. Inductively Coupled Plasma emission spectrometry has been used for determination of macro, trace, and toxic minerals. The results showed significant concentrations of some nutrient elements such as Potassium, Calcium and Iron. Roselle showed very high potassium concentration. The three fruits show high aluminum content and noticeable concentrations of Lead. The highest concentration of lead was found in Adansonia.

Keywords: Roselle, Tamairndus indica, Adansonis digitata, ICP, Acidity

1. Introduction

Roselle

Roselle locally known as "karkade" Belong to the family *Malvaceae*, it was believed to be domesticated in western Sudan before 4000 B.C., it was first recorded in Europe in A. D. 1576, it seems to have been carried from Africa to the new world for use as a food plant. The use of plant as (greens) was known in java as early 1658. It also has some medicinal properties (N.B A.P. 1999).the seeds contain (17.8- 21%) non-edible oil (Ahmed AK. 1980) [2] and 20% protein and are sometimes used for animal feed (Ahmed, Nour, 1981) [1]. Roselle is a flexible plant with a number of uses, its leaves seeds; capsules and stems are used in traditional medicines. In china Roselle used to treat hypertension, pyrexia and liver damage (Odigie and Addigun, 2003) [4]. Recently the sepal extract has been used as an effective treatment against leukemia due to its high content in poly phenols, particularly proto catechuic acid (Tseng *et al.* 2000). The Roselle extract has a unique red colour, good flavour, low sugar and high acidic content. The acidity makes the juice sour hence the need for addition of sweetening products (Mgaya Kilima *et al.*, 2014) [10]. There has been a global increase in consumption of fruit juice as consumers became aware of nutritional and health benefits of fruit juices (Wong PK *et al.*, 2003) [7]. Anthocyanins present in roselle are dephinidin 3-sambubioside, cyanidin 3- sambubioside, delphinidin 3-glucoside and cyanidin 3-glucoside (Wong PK et al, 2003; Tsai PJ, 2004) [7]. They contribute benefit for health as a good source of antioxidants as well as a natural food colorant (Duangmal K, *et al.*, 2008) [9]. 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 (CTA, 2001) [11]. Present research studied the proximate mineral composition and ascorbic acid content of drinks produced from blends of extract of Roselle calyces and different fruits (Fasoyiro SB. *et al.*, 2005) [5]. Roselle Antioxidants act as free radical scavengers, inhibit lipid peroxidation and other free radical mediated process, therefore consumption of roselle-fruit juices with high anthocyanin (493.5-118.2) mg/L will protect human body from several diseases attributed to the reactions of free radicals (Mgaya Kilima *et al.*, 2014) [10].

Adansonia digitata

Adansonia digitata L. (Bombacaceae family) is a native deciduous tree from the African savannas, Known in Sudan as (Tabaldi or Gongolase). It is widely spread over the African savanna through natural re-production. Wild animals open the fruits to eat the pulp. The seeds pass through the digestive tract of the animals, which breaks the dormancy (Joerg Gruenwald, 2005) [6]. The English common name is baobab, probably derived from the Arabic bu hibab, which means (fruit with several seeds) (Joerg Gruenwald, 2005) [6] or from name (Arber apolabre) meaning the place in the village where the elders meet to resolve problems. In the past decade, it was attracted the interest of several pharmaceutical companies and researchers due to its various traditional uses; Medicinal, nutritional, and Cosmetics (Buchmann *et al.*, 2010). The plant parts are used to treat various aliment such as diarrhea, malaria and microbial infections, it's an excellent antioxidant due to vitamin C content. Baobab has numerous biological properties including antimicrobial, Antiviral, and anti-inflammatory activities amongst others (Saab, 2011). Throughout Africa Baobab is regarded with awe by most indigenous people. Some even consider it bewitched (Wicknes, lowe, 2008). Almost all parts of the tree are used in traditional medicine in Africa although this varies from one country to another. The adansonia is extremely important to humans and animals in the dry areas of Africa because it offer shelter a source of nutrition, clothing as well as raw material for many useful items. In some villages in West Africa and Western Sudan, people store water in the tree trunk and it is estimated that more than 120,000L (Royal Botanic, 1999). The major interest in baobab product it is as a result of its ascorbic acid and dietary fiber content

(Vertuani *et al.*, 2002). Also consist several vitamins include vitamin A, F, and E (Nyam *et al.*, 2009) and D_3 which increase calcium absorption and decreases blood pressure in the elderly (Wasserman, 2004).

Tamirandus indica

Tamirandus fruit contains a high amount of ascorbic acid and β-carotene which are proved to be potent antioxidant and hepatic protective the aqueous extract of leaves contain ascorbic acid β-carotene and are proved to be antilipoperoxidant, stops the peroxidation of tissue lipid and antihepatotoxic (caltagirone s. *et al.,* 2000; Miyagi Y. *et al.,* 2000). Tamirandus contain flavonoid compounds plays as anticarcinogenesis, antioxidant as well as other medicinal uses. Adansonia digitata and Tamairndus indica are wild crops**.**

2. Materials and methods

Samples were collected from many local markets in Khartoum state. All chemicals used were of analytical grade. Moisture content determined using a hot air oven for 24 hours. pH values measured using 10% samples solutions. Inductively Coupled Plasma technique (Varian- 725-ES) – (microwave close digestion system) - was used for macro, trace, and toxic minerals determination. Total acidity calculated using potentiometer titrations (pH meter 3505- JENWAY).

3. Results and discussion

The moisture content in Roselle and adansonia is relatively was found to be high and showed equal values 8.7, but in Tamairndus indica the value was high (50%) compared to that of adansonia (8.7%) and Tamirandus (8.7%), this may be due to other volatile components in the sample. The Ash content of Roselle is high 10.50% and Tamairndus indica is low and this may enhance the high value of volatile matter content, pH measurements showed high acidic properties in all samples (Table .1).

Table 1: pH values, moisture content, ash content and total acidity

Parameter \ Samples	Roselle	Adansonia	Tamairndus indica
pH values (30.2°C)	2.27	3.15	2.57
Moisture contents (%)	8.70	8.70	50.0
Ash contents (%)	10.50	6.50	3.49
Total acidity (mg NaOH/g)	34.51	24.80	31.26

Mineral content analysis showed high potassium concentration in the three crops with significantly higher value in Roselle (Table 2). Calcium concentration is higher in Adansonia compared to the other two. Roselle showed high concentration of magnesium and sodium (Table 2). Toxic minerals showed high concentration in the three samples. Arsenic and Silver were of low concentrations in the three fruits. Barium and beryllium concentration are considerable in *Roselle*, which is dangerous. Aluminum content is high in the three samples.

Trace elements Samples showed relatively high Iron concentration, Silicon also shows High concentration in all samples. Boron, Molybdenum, Chromium, Manganese, Titanium, and Vanadium shows considerable concentrations. Many of these trace elements are required by human body as nutrients. Some of them are undesired such as strontium (Sr) and Boron. Total acidity The total acidity equivalent values showed relatively low acidity in Adansonia 24.8mg NaOH/g compared to the total acidity values in roselle and *Tamairndus indica* which were found tobe 34.51mg NaOH/g and 31.26 mg NaOH/g respectively (table.1; Fig 1, 2, and3).

Table 2: Results of Minerals Concentrations

Elements	Roselle (ppm)	Tamarindus indica (ppm)	Adansonia (ppm)
P	1238	913.2	583.1
Si	341.4	101.3	222.1
Se	<5.320	3.678	<5.320
Ag	<0.7000	<0.7000	<0.777
Al	369.0	566.8	422.9
As	<5.620	<5.620	<5.620
B	56.17	9.617	13.38
Ba	63.53	16.14	9.056
Be	0.0243	0.0086	0.0194
Ca	1311	1659	2820.0
Cd	<0.1800	0.2385	<0.1800
Co	<0.0018	1.230	0.4609
Cr	<0.2600	<0.2600	<0.2600
Cu	3.983	3.609	5.390
Fe	334.8	418.6	486.2
K	24138	9512	20221
Li	0.3824	0.0988	0.0594
Mg	3790	965.8	1432
Mn	53.76	12.51	12.04
Mo	<1.020	<1.020	<1.020
Na	93.92	52.95	51.04
Ni	<1.060	<1.060	<1.060

Pb	1.162	2.878	3.000
Sr	99.82	24.16	21.61
Ti	29.21	14.80	30.17
V	1.128	0.9143	1.181
Zn	35.97	6.210	8.122

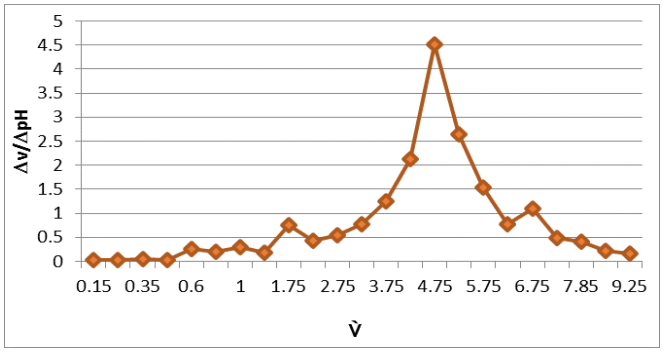

Fig 1: Total acidity in Roselle (34.51mg NaOH/g)

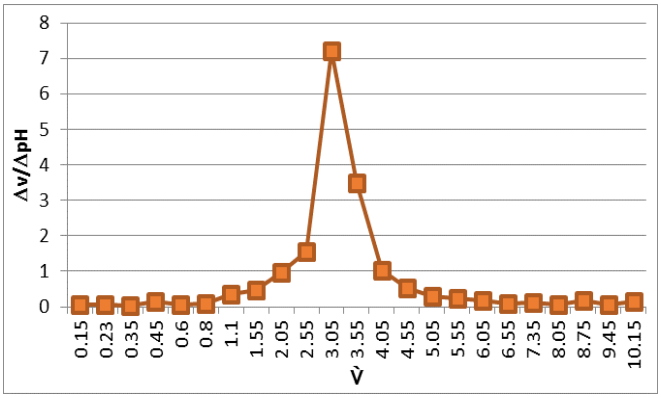

Fig 2: Total acidity in Adonsonia (31.26mg NaOH/g)

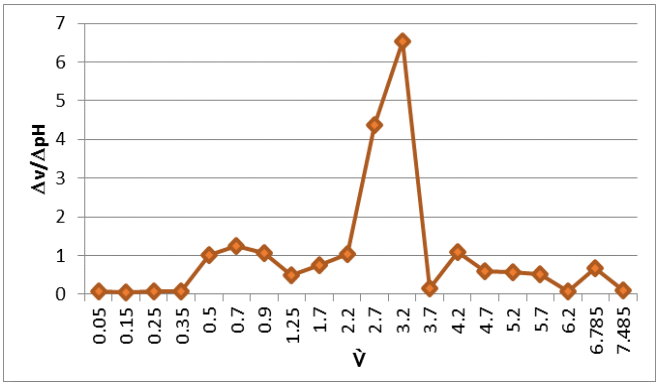

Fig 3: Total acidity in Tamairndus indica (31.26mg NaOH/g)

4. Conclusion and Recommendations

- These fruits can be a good source of Iron and can alleviate iron deficiencies.
- The three fruits are very rich with certain nutrients e. g (Calcium, Iron, Magnesium, Sodium, Phosphorous and potassium).
- More studies are necessary for macrological uses and medicinally importance for these trees.
- Some future studies may be needed to determine that if these fruits may have side effect to human health or not, taking in consideration the availability of many minerals with different detectable concentration.

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