Chemical Analysis of Wild Edible Fruits of *Azanza garckeana* in Sudan

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ABSTRACT

Azanza garckeana is a wild edible indigenous fruit tree species in western Sudan, locally named (Jakhjakh). The physicochemical and analytical study of *Azanza garckeana* fruit, physical parameters of fruits determined length ranges 2.52–3.52 cm, Width 2.07–2.68 cm, Thickness 2.00–2.72 cm, Weight 4.05–7.98 g, Edible part + peels 2.89–5.92 g, Seeds 1.15 – 2.06 g. The chemical contents Crude Protein 9.21%, Moisture 3.82%, Fat 1.19%, Crude Fiber 45.23%, Ash 22.2%, Carbohydrates 42.17%, Energy Value 219.28%, Total Sugar 31.36%, Reducing Sugars 17.72%, Total treatable acidity 0.13%, Vitamin C 41.92%, B-carotene(IU/100g) Vitamin A 18.50% and Pectin 0.26%. The elements determined using ICP-OES, the metal levels found are decreasing in order Sr > Mn > Ti > Ba > As > Zn > Cu > Cr > V > Co. And essential elements found in higher level order decrease as Ca > K > Mg > P > Na > Si > Fe > Al > Li = Be.

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Introduction

Azanza garckeana is a wild edible indigenous fruit tree species, the Sudanese local name (Jakhjakh). The local name of it depends on areas in East and South Africa are snot apple (Africans). muneko (Tongon), mkole (Nyanja), chinga and mukole (Bemba), morojwa (Tswana) [1]. In English is known as tree hibiscus, azanza, snot apple, in Nigeria named goron tula, Bostwana is morojwa, South Africa *Thespesia garckeana*. It is widespread in tropical eastern and southern Africa [2]. *Azanza garckeana* in Sudan it is wild tree grows in western Sudan at Jebel Mrra and Nuba Mountains forests, it uses in closes in this areas and not circulative in the country.

Azanza garckeana is a deciduous shrub growing to height from 3–15 m, with stem diameter at breast height of up to 25cm. Leaves alternate, simple and round with 3-5 lobes, up to 20 x 20 cm size [2] which are covered in brown star-shaped hairs, and have longitudinal fissures in the midrib.

The fruits are spherical shape and woody in nature and about 2.5 to 4cm in diameter with short hairs and are divided into 4 to 5 segments, yellowish to brownish green and hairy when mature [3]. The fruit containing a seeds, they are hemispherical, up to 10 mm long, 7 mm thick, with brownish and woolly floss [2]. The fruits can be eaten while slightly green or when ripe, they are persistent, therefore are picked on repining and some people dry them and reconstitute them later [4].

The *Azanza garckeana* species is an important source of essential minerals particularly P, Ca, Mg and Na [5]. The chemical compositions determined contained 49 – 56 % carbohydrate, 285.5 - 308.5 mg/50g ascorbic acid, 0.0541 - 0.0543% fat, starch, and selective metals Fe, Mg, Ca, and Mn [6]. The pulp and seed is an important source of phytochemical and mineral components such as ascorbic acid, Mg, Ca, Na, Fe, K, P, crude fiber, Carotenoids, Tannins, Saponins, Alkaloids, Flavonoids, Phenols, C. glucosides and Xanthone [7].

The ripe fruit of *Azanza garckeana* are edible and widely

consumes in many African countries [5], is also used a food additive with the jelly or syrup from the species added into soups or made into porridge and occasionally dried to be reconstituted later. Jakhjak juice (*Azanza garckeana* juice) contents pH value 5.48 ± 0.01 , total soluble solid (TSS) $4.5 \pm 0.5\%$ and ascorbic acid 21 ± 13 mg/100g, where the Jakhjak juice samples free from mould and yeast while they contained a range 1.20×10^7 to 1.7×10^{65} CFU ml⁻¹ total bacterial count. [8]

Azanza garckeana species used as herbal medicine for some diseases and has wide range pharmacological activates such as antibacterial, antifungal, antihyperglycemic, antimalarial, antioxidant and iron absorption [9]. The aim of this study is chemical analysis of *Azanza garckeana* fruit for determination the physicochemical characteristics and the elements.

Material and methods

The sample collection, the wild edible fruit samples of Jakhjakh *Azanza garckeana* were collected from local markets in western Sudan Dar Four states.

Instrument

Inductively coupled Plasma Optical Emission Spectrometers (ICP-OES) 725 ES was used for determination of analytes. The optimum operation conditions for ICP-OES are summarized in Table 1

Table 1. Operation condition parameters for ICP-OES

Power	1.2KW
Plasma Flow	15 L min ⁻¹
Aux Flow	1.5 L min ⁻¹
Neb. Flow	0.7 L min ⁻¹
Pump rate	15 rpm
Replicate read time (S)	10 sec
Sample uptake time	30 sec
Rinse time	25 sec
Instrumental stabilization delay	15 sec

The physical characteristics

Azanza garckeana fruits are spherical shape, edible part is brown to dark brown color, sweetly, has beige peels color

and bright yellow seeds. The samples classified according to size small, medium and large for physical properties studies, for determination the physical parameters for jakhjakh fruits, the results shown in table 2.

Table 2. Physical characteristics of different size of *Azanza garckeana* fruit

Parameter	Fruit size					
	Small		Medium		Large	
	Mean \bar{x}	SD	Mean \bar{x}	SD	Mean \bar{x}	SD
Length (cm)	2.52	0.03	3.05	0.04	3.52	0.02
Width	2.07	0.06	2.72	0.02	2.68	0.02
Thickness	2.00	0.00	2.58	0.02	2.72	0.02
Weight (g)	4.05	0.37	6.69	0.08	7.98	0.16
Edible part + peels (g)	2.89	0.34	4.27	0.07	5.92	0.21
Seeds (g)	1.15	0.08	2.42	0.11	2.06	0.05

Means \pm SD bearing different Superscript letters within rows are significantly different ($P \leq 0.05$).

Proximate Analysis

Proximate analysis was carried out by using analytical methods which described in (AOAC, 2000) [10]. The moisture content at 105 °C for 4h, protein was determined by kjeldahl catalyst method, ash content determined when 5 g heating at 550 °C/5h, crude fat was extracted by soxhlet apparatus using petroleum ether solvent and fiber determined. Available carbohydrates were calculated by subtracting the sum of fat, protein, fiber and ash as a percentage from 100 as described by West [11]. The caloric values were calculated by summing the values obtained through multiplying the contents of fats, protein, and carbohydrates by the coefficients recorded in IMNA [12], shown in table 3.

Table 3. physicochemical characteristics of *Azanza garckeana* fruit

Component	Quantity (%)
Moisture	3.82%
Crude Protein	9.21%
Fat	1.19%
Crude Fiber	45.23%
Ash	22.2%
Carbohydrates	42.17%
Energy Value (Kcal/100g)	219.28%
Total Sugar	31.36%
Reducing Sugars	17.72%
Total treatable acidity 3	0.13%
Vitamin C (mg/100g)	41.92%
B-carotene(IU/100g)Vitamin A	18.50%
Pectin	0.26%

Determination of elements:

The minerals and some important element were determined using inductively coupled plasma optical emission Spectrometers, ICP-OES. in which sample prepared for analysis under standard procedure, digested 1 g of sample in approximately 5 ml mixture of concentrated Nitric acid HNO₃ and perchloric HClO₄ acid by 3:1 ratio, they were heated for about hours, the mixtures were treated and the clear solution was used for metal quantification. shown in table 4.

Results and Discussion

According to fruit size the physical properties studies, the results had been shown in table (1), the lengths range between 2.52 ± 0.03 to 3.52 ± 0.02 cm and width range 2.07 ± 0.06 to 2.68 ± 0.02 cm, Palgrave, reported diameter range about 2.5 to 4 cm [3]. Thickness range is 2.00 to 2.72 ± 0.02 cm, weight range 4.05 ± 0.37 to 7.98 ± 0.16 g and edible part

and peels range 2.89 to 5.92 g, this is referring to the large fruit size has great amount of edible part and peels than medium and small size. Seeds amount about 1.15 ± 0.08 to 2.42 ± 0.11 in medium size. Figure 1, shown the results values of the physical parameters where depend on the size of the fruit, except for the amount of seeds that increase in medium-sized fruits compared to large and small sized fruits.

Table 4. The concentration of element in fruit of *Azanza garckeana*

Elements	Conc $\mu\text{g/g}$	Elements	Conc $\mu\text{g/g}$	Elements	Conc $\mu\text{g/g}$
Ti	7.410	Mg	1249	Ca	1777
Pb	ND	Mn	7.848	Co	0.203
V	0.354	Ni	ND	Cd	ND
Zn	2.043	Mo	ND	Be	0.005
Sb	ND	Na	54.290	Ba	5.668
P	1237	Fe	119.500	Al	115.6
Si	132.800	K	14345	As	3.039
Sr	12.020	Li	0.054	Ag	ND
Se	ND	Cu	1.968	Cr	0.355

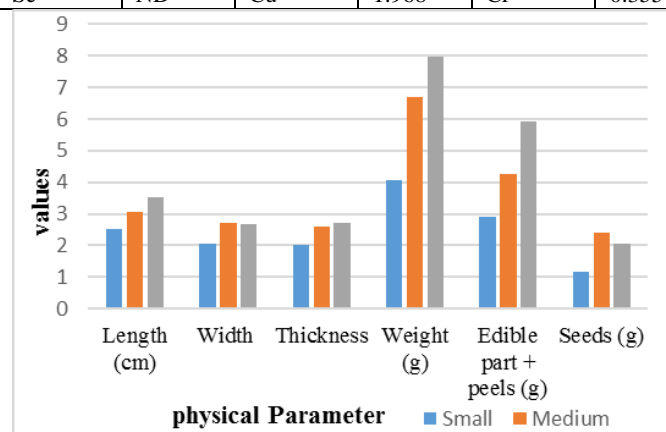


Figure 1. Physical Parameters of different size of *Azanza garckeana* fruit.

The physicochemical characteristics of *Azanza garckeana*, were studied for determination the chemical composition with proximate analysis results shown in table (2), the moisture content found 3.82% this value is less than value 6.50 % which reported by (Nkafamiya, I.I. et.al 2015) [13] and (Abdel Moneim E. Suliman. et.al 2012) value's 13.542 ± 2.5 [8]. The Crude Protein content found 9.21%. Fat content found 1.19%. The crude fiber content was 45.23%, the values of Crude Protein, Fat and crude fiber in range of reported value. The Ash content was 2.22% where (Abdel Moneim E. Suliman. et.al 2012) [8] reported ash value 7.3 ± 0.5 . The Carbohydrates Content fruit was found to be 42.17%. The energy value found at 219.28 kcal. The value of total reducing sugar was 31.36%. Treatable Acidity content found 0.13%. The values of vitamin C content found 41.92% mg/100g and Beta - Carotene (Vitamin A) content found 18.50%. The pectin content found 0.26%.

The elements in fruit of *Azanza garckeana* had been investigated and concentration reported in table (3), heavy metals determination Pb, Sb, Se, Ni, Mo, Cd and Ag are not detectable, this results refers to fruit of *Azanza garckeana* is devoid of them, and heavy metals detected Ti, V, Zn, Sr, Mn, Cu, Co, Ba, As and Cr, at concentration 7.410, 0.354, 2.043, 12.020, 7.848, 1.968, 0.203, 5.668, 3.039 and 0.355 $\mu\text{g/g}$ respectively. The observation heavy metals levels are decreasing in order $\text{Sr} > \text{Mn} > \text{Ti} > \text{Ba} > \text{As} > \text{Zn} > \text{Cu} > \text{Cr} > \text{V} > \text{Co}$. According to recommended limit as established by the FAO/WHO 1999 [14] the concentrations of heavy metals Pb, Cd, Zn, Cu, Co, and Ni in the fruit of *Azanza garckeana*

in range of permissible value of food. And essential elements P, Si, Mg, Na, Fe, K, Li, Ca, Be and Al at concentration 1237, 132.800, 1249, 54.290, 119.500, 14345, 0.0537, 1777, 0.005 and 115.600 $\mu\text{g/g}$ respectively. The essential elements found in higher level order decrease as $\text{Ca} > \text{K} > \text{Mg} > \text{P} > \text{Na} > \text{Si} > \text{Fe} > \text{Al} > \text{Li} = \text{Be}$. Figure 2 shows the concentrations of mineral and non-metallic elements that are contained in fruits in varying proportions, they contain high concentration elements calcium, then potassium, magnesium, and phosphorus, respectively.

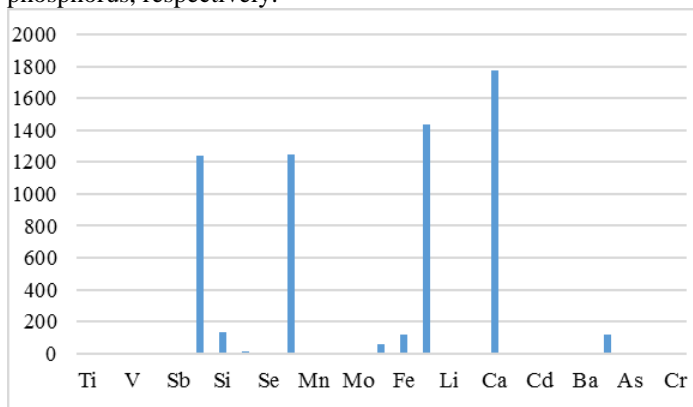


Figure 2. The elements concentration level content in fruit of *Azanza garckeana*.

Conclusion

From the results, the chemical analysis of fruits for the *Azanza garckeana* trees contain nutrient compounds, minerals, essential elements and non-essential elements, it is an edible fruit of nutritional value. *Azanza garckeana* trees can be planting in Sudan in orchards and farms.

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