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Phytonutrients and antinutrients screening of *D.edulis* fruits at different maturation stages

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ABSTRACT

Phytonutrients and antinutrientscomposition of D.edulis fruits at different maturation stages was investigated. Samples used were at the fully matured but not darkened, half darkened and full darkened stages. Results obtained for phytochemicals showed that alkaloids were present in fully matured but not darkened, and half darkened stages of the samples in high concentrations. Oxalates were present in high concentrations in half darkened and full darkened stages of the investigated fruits while tannins were highly concentrated in full darkened stage of the fruits only. Screened vitamins revealed moderate concentrations of thiamine in half and full darkened stages whereas pyridoxine concentration was moderately high in fully matured but not darkened and half darkened stages of the samples. Mineral results showed that concentrations of sodium, calcium, and magnesium were highest in full darkened stage of the fruits, phosphorus and iron were highest in fully matured but not darkened stage while copper, zinc and potassium were highest in half darkened stage of the studied fruits. The present study has revealed the phytonutrients and antinutrients composition of D.edulis fruits at different maturation stages.

Keywords: Phytonutrients, antinutrients, *D.edulis*, Mineral elements.

INTRODUCTION

Nigeria is a country full of variety of trees with medicinal and nutritional potentials [1, 2].These trees bear fruits, which have been part of human diet and food supplement over the years. Besides the nutritional potentials of fruits, they also possess medicinal properties and are used especially in herbal medicine to remedy diseases conditions [7,11,13]. Such diseases include hypertension, diabetes, malaria, infertility, menstrual problems, eczema, ringworm, typhoid, etc. The inherent ability of fruits to remedy these diseases lies in biologically active compounds found virtually in all plants as phytochemicals [4, 7, 8, 9, 10]. Some nutrient compounds found in plants such as vitamins , minerals, etc., also play dual role of supplying the body with nutrients and good health[6].

Dacryodesedulis (*Burseracea*) is of such trees that bear fruits that play the dual role of supplying the body with nutrients and good health. The fruit of *D. edulis* tree popularly known as African pear is known as "Ube" among the Igbos of South eastern, Nigeria. *D. edulis* fruit is eaten raw, roasted or boiled in hot water [17]. It is either eaten with fresh roasted or boiled maize [17]. In herbal medicine, the leaves, bark, stem and roots of *D. edulis* trees are effective against diseases [21, 23].

As part of our continued effort to expand the scanty literature on *D. edulis* fruit, this study investigated the chemical composition of *D.edulis* at different maturation stages.

MATERIALS AND METHODS

Plant materials collection, identification, and preparation: The fruits of *D.edulis* used in this study were purchased from a local market in Umunchi autonomous community, IsialaMbano, Imo State, Nigeria. The fruits were identified and authenticated by a Botanist in Plant Science Department, Abia State University, Uturu, Abia State, Nigeria. The fruits were washed under running pipe-borne water, air dried and separated in the required maturation stages (Fully matured but not darkened stage, half darkened stage, and fully darkened stage). The separated fruits were cut open with a sharp knife to obtaintheir pulps, which got grinded into powder using a blender. The ground samples were used for analysis.

Phytochemical screening: The phytochemical screening for the presence of alkaloids, flavonoids, saponins, oxalates, phytates, cyanogenic glycosides, tannins, phenols,steroids, were determined using the methods described by Annabelle *et al.* [21] and Shahidi *et al*.[24].

Vitamin screening: All the investigated vitamins were carried out using the methods of Shahidi *et al*[24].

Mineral element analysis: Mineral elements present in the studied samples were analysed using the methods by Nahapetian and Bassir[25] and Rice-Evans *et al*., [26].

RESULTS AND DISCUSSION

Table 1: Phytochemical screening of *D. edulis* fruit at different maturation stages

Phytochemical	Fully matured but not darkened stage	Half darkened stage	Full darkened stage
Alkaloids	+ +	+ +	+
Flavonoids	+	+	+
Saponins	+	+	+
Tannins	+	+	+ +
Cyanogenic glycosides	+	+	+
Oxalates	+	+ +	+ +
Phytates	+ +	+	+

Key:+ = Present in low concentration; + + = Present in high concentration

Table1 above shows the presence of phytochemicals in the investigated samples.Okwu [9] and Okwu [10] noted that alkaloids are known to exhibit marked physiological activity when administered to animals. Pure isolated alkaloid forms have been used as analgesic and bactericidal agents [13, 19, and 28]. Flavonoids represent the most studied plant polyphenols. For years now, it has been known that plant polyphenols are antioxidants *in vitro* [27]. These antioxidants are compounds that reduce the formation of free radicals or react with and neutralize them thus, potentially protecting the cells from oxidative damage [28]. Tannins and saponins are known for their astringency and bitterness respectively [9, 10].Saponins also display foaming capacity property. This property distinguished it from other phytochemicals. The astringent property of tannins and the foaming capacity of saponins may make *D.edulis* fruits effective against wounds. Both tannins and saponins are sometimes employed as astringent in gastrointestinal tract, on skin abrasions, wounds, etc [29].Annabella *et al*.[21] noted that the knowledge of cyanogenic glycosides in foods is important due to the inherent hydrogen cyanic acid(HCN) from the compounds on hydrolysis. This hydrogen cyanic acid is poisons to the respiratory system [21]. Oxalates and phytates are known to complex with nutrients in the body. Oxalates complex mineral elements such as calcium, magnesium, etc, as oxalate compounds, and remove them from the blood. These compounds are corrosive and can damage the kidney [30]. Phytic acid intake of 4-9 mg/100g is said to decrease iron (Fe) absorption by 4-5 folds in human [32]. The concentrations of alkaloids, oxalates and phytates as observed in this study could have been affected by degree of maturation.There is need to quantify the levels of these phytochemicals observed in the investigated samples, especially oxalates and phytates due their effects in the body. Okaka Okaka [35] reported that niacin helps the body fight infections, heal woundsand build cells. The same authors reported that ascorbic acid is required for healthy bones and muscle as well as collagen formation. *D.edulis* fruit may not have any link with production of antioxidants in the body due to the absence of tocopherol in all the stages of the fruit investigated.

Table 2: Vitamin screening of *D. edulis* fruit at different maturation stages

Vitamin	Fully matured but not darkened stage	Half darkened stage	Full darkened stage
Retinol	+	+	+
Thiamine	+	+ +	+ +
Riboflavin	+ +	+ +	+ +
Niacin	+ + +	+ + +	+ + +
pyridoxine	+ +	+ +	+
Panthothenic acid	+	+	+
Folic acid	+	+	+
Ascorbic acid	++ +	+ + +	+ + +
Tocopherol	-	-	-

Key: + = Present in low concentration; + + = Present in moderate concentration ; + + + = Present in high concentration

Table 2 above depicts *D.edulis* fruit as having retinol, panthothenic acid and folic acid in low concentrations. The relative importance of these investigated vitamins in the body cannot be overemphasized for instance, retinol is particularly needed for good sight and healthy skin [34], pantothenic acid functions as part of coenzymes A, which aids in acetylation, transfer or acceptance of an acetyl group (-CH_3CO) [16], while lack of folic acid often results in either macrocytic or megaloblasticanaemia [16, 32, 34]. Thiamine was moderate in terms of concentration while ascorbic acid and niacin were the most concentrated vitamins in the present study. Olusanya [16] noted that fruits are good sources of ascorbic acids, niacin, and thiamine. Their increased concentrations in this study are in line with [16]. Thiamine and riboflavin are forms of B-complex vitamins needed for converting blood sugar to energy, keeping the nervous system healthy, etc,[16, 35].Pyridoxine helps in the production of cells, maintains the health of the neurones and immune system, and aids in growth and cell development particularly the erythrocytes [35, 36, 38]. Thiamine tends to have increased with increase in degree of darkening while pyridoxine may have been reduced by it.

Table 3: Mineral elements composition of *D.edulis* fruit at different maturation stages(mg/kg).

Mineral element	Fully matured but not darkened stage	Half darkened stage	Full darkened stage
Sodium	160.20±6.12	168.72±9.65	169.40±5.10
Calcium	340.08±4 .64	338.47±15.82	350.16±16.13
Phosphorus	593.61±13.57	589.11±2.10	511.23±8.19
Potassium	434.19±3.98	439.15±0.12	436.80±11.19
Magnesium	275.83±4.21	270.18±7.05	280.16±5.24
Zinc	31.61±1.14	36.01±4.17	30.14±3.66
Iron	42.78±0.19	41.88±1.46	41.96±4.20
Copper	0.38± 0.07	0.45±0.16	0.41±.05
Lead	ND	ND	ND
Chromium	ND	ND	ND

Values are means ± standard deviations of triplicate determinations.

Fruits absorb minerals from the parent plant at different rate[ ].The investigated samples of *D.edulis* fruits showed high levels of sodium, calcium, potassium, magnesium and appreciable quantity of zinc in the stages investigated.Sodium is one of the minerals whose intake is considered a factor in etiology of hypertension [37], but this may not be experienced on consumption of the investigated fruit due to higher levels of potassium and calcium. Sodium and potassium are known to play important roles in cellular fluid of the body[16]. Calcium is important for its roles in blood clotting, and iron noted for its role in haemoglobin formation. Sodium, calcium and magnesium levels were highest in full darkened stage of the investigated fruits. Together with calcium, phosphorus is essential in formation of bones and teeth. [37] noted that magnesium also aids in bone and teeth formation and in the maintenance of muscle functions. Trace elements are essential for the normal functioning of the body. Their exact roles are not yet fully known, though most of them form integral part of vitamins, enzymes and hormones [16, 34, 35, 36, and 27]. Zinc is essential for the production of insulin (a hormone) and carbonic anhydrase (an enzyme) while copper plays its roles through enzymes [14, 16, 21, and 30]. Sodium, calcium, and magnesium levels were highest at full darkened stage of the investigated fruits, phosphorus and iron at non-darkened stage whereas copper and potassium were highest at half darkened stage. This could be due to the different rate at which these fruits absorb minerals from parent plants as they mature.

CONCLUSION

The present study has shown the phytonutrients and anti-nutrients present in*D.edulis* fruits at different stages of maturation.

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