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Phytochemical, vitamin and proximate composition of *Dacryodes edulis* fruit at different stages of maturation

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ABSTRACT

The phytochemical, vitamins and proximate composition of D. edulis at different stages of maturation were investigated. Fully matured but not darkened, half darkened, and fully darkened D. edulis samples were used. The results obtained for phytochemical composition showed that flavonoids (0.67 ± 0.27 – 2.42 ± 0.32 mg/10 0g), alkaloids (0.42 ± 0.13 – 1.50 ± 0.25 mg/100g), sap onins (0.21 ±0.04 – 1.29 ± 0.41 mg/100g), tannins (3.10 ± 0.11 – 5.78 ± 0.67 mg/100g), cyanogenic glycosides (0.03 ± 0.02 – 0.05 ± 0.00 mg/100g) ,and oxalate (1.34 ± 0 .91 – 4.97 ± 0.24 mg/100mg).Those for vitamins revealed that thiamine (0.95 ± 0.53 – 0.26 ± 0.06mg/100g), riboflavi n (0.23 ± 0.11 – 1.69 ± 0.21 mg/100g), niacin (0.17 ± 0.02 – 0.93 ± 0.19mg/100g), ascorbic (0.07 ± 0.81-002 ± 0. 00mg/100g), and tocopherol (0.29 ± 0.16-0.90 ± 0.46 mg/100g) wh ile proximate content showed the presence of moisture (26.12 ± 0.16 – 32.10 ± 2.10 %), crude protein (5.13 ± 2. 39 – 8.25 ±1.12 %), lipid (31.52 ± 10.75 – 37. 31 ± 1.07 %), ash (2.89 ± 0.13 – 4.16 ± 2. 11 %), crude fiber (2. 10 ± 1.34 – 11.21 ± 0.19 %), carbohydrate (16.07 ± 1.1 5 – 23 – 14 ± 6.97 %) and energy value (400.68 ± 0.21 – 450.59 ± 12.01 kcal/100g). This study has shown the phytochemical, vitamin, and proximate composition of D. edulis fruit at the different stages of maturation.

Keywords: Phytochemicals, vitamins, proximate composition, *D.edulis*

INTRODUCTION

The contribution of plants and their products to human nutrition cannot be overstated. In Africa, fruits are on high demand. This is because they are complemented with food to ensure balanced diet, and some serve as raw materials to industries. Fruits serve as sources of vitamins and minerals hence, they also become important when the functions of these vitamins and minerals, are being considered in the body [31]. Also, some of these fruits are used in folk medicine to salvage some diseases [19,26,36]. The ability of these fruits to remedy diseases could be as a result of bioactive constituents, which are generally present in plants [13,26,28, 30,30]. However, some of these bioactive substances are also anti-nutrients since they render some of the essential nutrients unavailable for human nutrition [13, 14].

Dacryodesedulis fruit, a *Burseracea*, is one of such fruits that could serve the dual purpose of being a source of minerals and vitamins to human nutrition and as a raw material for industries, if properly harnessed. The consumption of the fruit is wide spread in Nigeria especially in the southeastern part of the country. [3] noted that the fruit pulp is eaten and the seeds usually thrown away. [5] noted that *D. edulis* seed oil have potential of being used as domestic and industrial oil. *D. edulis* fruit is consumed traditionally in Nigeria, raw, roasted or boiled in hot water, and is eaten alone or used in garnishing cooked or roasted maize [9]. It could also be used as butter to eat bread. [11] reported that Africa pear (*D. edulis*) has many medicinal uses. The leaves, bark, stem and root of *D. edulis* tree, are used as local medicine against diseases [15,8,17].

Previous works on *D. edulis*, addressed the phytochemical parameters of the oil, mineral elements, fatty acid composition of the pulp and seeds and few on anti-nutrient composition [5, 9, 13, 18 25,]. A look at the rate of consumption of this fruit especially in the southeastern Nigeria, there is need to extend the study on the fruit.

The present study investigated the phytochemical, vitamin and proximate composition of *D. edulis* fruit at different stages of maturation.

MATERIALS AND METHODS

Collection of materials: *D. edulis* fruits used in this study were collected from *D. edulis* tree in Umunchi Village, Isiala Mbano L.G.A of Imo State, Nigeria. The collected fruits were properly identified at the Department of Plant Science and Biotechnology, Imo State University, Owerri, Imo State, Nigeria. The Identified *D. edulis* fruits were separated into three stages of maturation. The stages were fully matured but not darkened stage, half darkened stage, and fully darkened stage.

Preparation of samples:- The separated fruits were washed thoroughly with distilled water and cut open with a sharp knife to remove their seeds from the pulps. The prepared pulp samples were ground using a blender. The ground sample for each stage was separated into three for anti- nutrient, vitamin and proximate composition analyses respectively.

Phytochemical analysis:- Alkaloids flavonoids, saponins, oxalates, phytates, cyanogenic glycosides and tannins were determined as described by [33].

Vitamin analysis: - Vitamin analysis was carried out using the methods of [2].

Proximate composition analysis:- The proximate composition of *D edulis* was determined using [2] method.

Statistical analysis: All the experiments were carried in triplicates. The mean and standard deviations were reported. Data were subjected to analysis of variance (ANOVA). Significance of mean difference was determined using least significant difference (LSD). Significance was accepted.

RESULTS AND DISCUSSION

The distribution of phytochemicals in some crops and their effects on nutrients has been reported by [38] and [20]. The phytochemical contents of *D. edulis* at different stages of maturation are presented in Table 1. The Table revealed that flavonoids (2.42 ± 0.32 – 0.67 ± 0.27 mg/100g) and saponins (1.29 ± 0.41 – 0.21 ± 0.04 mg/100g), decreased significantly ($p<0.05$) as the fruit darkened.

Table 1: Phytochemical constituents of *D. edulis* fruit at different maturation stages (mg/100g)

Phytochemical	Fully matured and not darkened fruit	Half darkened fruit	Fully darkened fruit
Flavonoids	2.42 ± 0.32^{c}	1.00 ± 0.57^{b}	0.67 ± 0.27^{a}
Alkaloids	1.50 ± 0.25^{a}	1.00 ± 0.73^{a}	0.42 ± 0.13^{a}
Saponins	1.29 ± 0.41^{b}	1.00 ± 0.41^{b}	0.21 ± 0.04^{a}
Tannins	5.30 ± 0.08^{b}	5.78 ± 0.67^{c}	3.10 ± 0.11^{a}
Cyanogenic glycosides	0.03 ± 0.02^{a}	0.05 ± 0.00^{a}	0.05 ± 0.01^{a}
Oxalates	1.34 ± 0.91^{a}	2.44 ± 0.22^{ab}	4.97 ± 0.24^{b}
Phytates	0.71 ± 0.08^{a}	0.77 ± 0.03^{ab}	1.41 ± 0.20^{b}

Values are means ± standard deviations of triplicate determinations.
Values in the same row bearing the same letters are not significantly different at 5% level.

flavonoids has been associated with the inflammation of some tissues in the body and represent the most studied plant polyphenols [29]. Some properties of saponins include foaming ability and bitterness [26] at high concentration; it could confer bitterness to food substances and deter their consumption. The values of the present study pose no problem to *D.eduils* taste since they are low. Tannins (5.78 ± 0.67-3.10 ± 0.11 mg/100g) produced the highest value at half darkened stage. [6, 42] reported that higher intake of tannic acid hasbeen associated with carcinogenic effect in man, poor utilization of protein, liver and kidney toxicity. Tannic acid is associated with lowering the nutritive value of protein food [6], and impacts astringency in food. This could be the source of astringent taste normally noticed on consumption of *D. edulis.* Tannins values in the present study are not comparable to the values reported by [13] on two varieties of *D. edulis* (African pear). Stages of darkening had no effect on alkaloids and cyanogenic glycosides content of *D. edulis* in this study. Cyanogenic glycosides at increased concentration are known to produce hydrocyanic acid in the system [33]. Hydrocyanic acid is a potent donor of

cyanide which inhibits cytochrome oxidase and hydrophenol oxidase enzymes [10].The values of cyanogenic glycosides (0.03 ± 0.02 – 0.05 ± 0.01mg/100g) in this study indicate that consumption of *D. edulis* fruit will not affect human system. Phytic acid intake of 4.00 – 9.00mg/100g reduces iron (Fe) absorption by 4-5 folds in humans [12]. This effect could not be noticed on consumption of this fruit because of low levels of phytate (0.71 ± 0.08 – 1.41 ± 0.20 mg/100g) observed in this study. Phytate values in this study fall within the range reported by [13]. [6] noted that a daily intake of 450mg of oxalic acid interferes with metabolism. [21] reported that the lethal level of oxalate in man is 2-5g. [35, 41] have demonstrated that ability of soluble oxalates to inhibit calcium, potassium, and sodium absorption due to their insolubility properties. [6] reported that oxalates form insoluble complexes with calcium, magnesium, iron, and zinc thereby interfering with utilization of these mineral elements. The oxalate values (1.34 ±0.91 – 4.97 ± 0.24 mg/100mg) in this study increased significantly ($p<0.05$) with darkening stage and are not comparable to the values reported by [13] for total oxalates in two varieties of *D. edulis*. Oxalates observed in *D. edulis* in the present study are low to pose a problem to the system.

The values of vitamin analyzed in *D.edulis*fruit at different stages of maturation are presented in Table 2. The Table revealed that all the vitamins investigated, increased with in thedarkening of the fruits. Full darkened stage of maturation of *D. edulis*, makes these vitamins available hence, the stage could be said to be the vitamin rich stage of *D edulis*. These vitamins become important when they are required in the system. Vitamin B_1 is anti-beriberi, vitamin B_3 is anti-phophobia, vitamin B_3 is anti-pellagra vitamin, vitamin C is anti-scurvy and vitamin E is anti-sterility [31,33].

Table 2: Vitamin contents of *D. edulis*fruit at different maturation stages (mg/100g)

Vitamins	Fully matured and not darkened fruit	Half darkened fruit	Full darkened fruit
Thiamin	0.26±0.06^a	0.95±0.53^b	0.96±0.43^b
Riboflavin	0.23±0.11^a	1.23±0.00^b	1.69±0.21^c
Niacin	0.17±0.02^a	0.59±0.07^b	0.93±0.19^c
Ascorbic acid	0.02±0.00^a	0.04±0.01^{ab}	0.07±0.01^b
Tocopherol	0.29±0.16^a	0.58±0.0.33^{ab}	0.90±0.46^b

Values are means ± standard deviations of triplicate determinations.
Values in the same row bearing the same letters are not significantly different at 5% level

Table 3 shows the proximate contents of *D edulis* at different maturation stages. Moisture content of food is an indication of its water activity [32], and is of great importance to every food processor as a number of biochemical reactions and physiological changes in food depend very much on it [14,31,33]. The moisture content (26.12 ± 0.16 – 32. 10 ± 2.10%) increased with increased darkening stage. The highest value observed at full darkened stage in this study could mean low shelf life. This may be connected with the reason why the full darkened *D edulis* fruit spoils easily on storage. The high moisture content values observed in this study could be compared to the high values reported by [13] on a related study. The protein content (5.13+2.39 – 8.25 ± 1. 12%), also increased insignificantly ($p>0.05$) with increased in darkening stage. Full darkened stage had the highest content of protein although the protein content of the investigated fruits is low. The implication of this low protein is that the potential usage of *D. edulis* fruits for food and feed formation is limited. The protein values observed on this study are in line with [13]. Darkening had no effect on lipid content (37.31±1.07 – 31.52±10.72%) of *D edulis* fruits studied. The observed high value of lipid from the investigated fruits could be an indication that the studied fruits are good sources of oils and fats. This observation is in line with [3, 13,5]. Ash content houses mineral element in food [31].

Table 3: Proximate composition of *D. edulis* fruit at different maturation stages

Proximate content	Fully matured and not darkened fruit	Half darkened fruit	Full darkenedfruit
Moisture (%)	26.12 ± 0.16^a	28.73±6.14^a	32.10±2.10^b
Crude protein (%)	5.13±2.39^a	6.48±2.37^a	8.25±1.12^a
Lipid (%)	37.31±1.07^a	33.72±4.23^a	31.52±10.73^a
Ash (%)	4.16±2.11^b	4.13±2.62^b	2.89±0.13^a
Crude fibre(%)	11.21±0.19^b	9.12±4.28^b	2.10±1.34^a
Carbohydrate (%)	16.07±1.15^a	17.82±3.00^a	23.14±6.97^b
Energy value (kcal/100g)	450.59±12.01^b	400.68±0.21^a	409.24±0.06^a

Values are means ± standard deviations of triplicate determinations.
Values in the same row bearing the same letters are not significantly different at 5% level.

Darkening had no effect on the ash content of the studied fruits. The ash contents (4.16±2.11 – 2.89 ± 0.13%) are comparable to [3,13,4, 40,]. Epidemological evidences have shown that consumption of reasonable amount of dietary fibre (20 – 35g/day) lower risk of a number of chronic diet related diseases such as diverticular disease, coronary heart disease, Obesity, type 2 diabetes, mellitus, irritable bowel syndrome, etc., [1]. The fibre content of *D. edulis* fruits in this study decreased with increase darkening stage. The lowest level of crude fibre was observed at

full darkened stage of fruit. This may imply poor source of fibre on consumption of *D. edulis* fruit at full darkened stage. The carbohydrate content increased significantly ($p<0.05$) in full darkened stage when compared to other stages investigated. The energy values observed in this study may imply that more energy is gotten by consuming non darkened *D. edulis* fruit than half or full darkened ones[13]. The carbohydrate values in the present study are comparable to [4]. The energy values in the present study do not agree with the values earlier reported by[13] on two varieties of Africa pear (*D. edulis*).

CONCLUSION

The present study has revealed the phytochemical, vitamin and proximate composition of *D. edulis* fruit at different stages of maturation.

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