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Nutrient Composition of Shade-Dried *Aldenia cissampeloides* (Monkey Rope) Leafy Vegetable

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Abstract

Background: Our locally available vegetables are underutilized due to lack or insufficient information about their health benefit. Consequently, some are going into extinction due to low consumption. *Adenia cissampeloides,* a locally available vegetable used in the preparation of vegetable soup and or some therapeutic purposes is becoming unpopular due to insufficient nutritional and other information on it.

Objective: The study investigated the nutrient composition of shade-dried *Aldenia cissampeloides* leafy vegetables.

Methods: Fresh leaves of *Adenia cissampeloides* were harvested from Opi in Nsukka local Government Area of Enugu State in South Eastern Nigeria. The leaves were sorted, washed with water, and allowed to drain in a colander for about 20 minutes. The leaves were shade-dried for 7 days at room temperature and pulverized using Qlink electric blender model QBL/20L40. The proximate, mineral, and vitamins of the pulverized dried sample were analyzed using standard methods.

Results: The proximate analysis showed an appreciable amount of carbohydrate (42.86%), crude fiber (16.79%), and protein (16.44%). Magnesium (2046.69mg), potassium (1031.33mg) and calcium (555.33mg) was the most abundant mineral while pro-vitamin A had the highest value (298.56 RE) among the analyzed vitamins. This was indicative that the vegetable is a good source of nutrients.

Conclusion: Due to its nutrient-dense quality, it is recommended to be cultivated at home gardens for easy accessibility in meeting the family's nutrient needs.

Keywords: *Proximate, mineral, Adenia cissampeloides, leafy vegetable.*

Introduction

The nutrient composition of food products is usually of interest in making food choices. Diets high in fruits and vegetables are widely recommended for their health-promoting properties. There are varieties of vegetables with potential nutrients that are beneficial to health. Many of these vegetables are green in colour, others with different colours ensuring diversity and attractive meals. These vegetables are high in dietary fiber and are good sources of vitamins, including the antioxidant vitamins Cand E, as well as minerals and trace elements. Some of these vegetables contain high levels of protein and low levels of fat (1); and varying proportions of vitamins such as vitamins, K and B_6; provitamins, minerals, and carbohydrates. Some contain a great variety of phytochemicals (bioactive non-nutrient plant compounds) some of which have been claimed to have antioxidant, antibacterial, antifungal, antiviral, and anticarcinogenic properties (2).

Adenia cissampeloides is a species of flowering plant in the family of *Passifloraceae* and genus *Adenia*. It is a climbing plant attaching itself to the surrounding vegetation by means of tendrils up to 30 meters long and 10cm in diameter at their base. The plant is an edible vegetable with therapeutic potential. A decoction of the leaves or roots is used for the treatment of fever and malaria, leafy extracts for liver diseases, roots and stem extracts for intestinal worms, and blended roots and other plant parts used for wound healing (3). Other curative properties of *Adenia* include the treatment of dysentery and rheumatic pain relief (4).

The health benefit of vegetables can never be overemphasized. Studies have shown that compared with individuals who eat less than three servings of fruit and vegetables per day, those that eat more than five servings have an approximately twenty percent lower risk of developing a coronary disease or cardiovascular accident. (5). Dietary fibre from vegetables, reduces blood cholesterol levels and may lower the risk of heart disease. Consumption of fruits and vegetables have health benefits in the prevention of two common aging-related eye disease, cataracts, and macular degeneration (6). Many indigenous vegetables are cheap, readily available, with therapeutic potentials, and of high nutritional value but are lesser known and of less consumption. Some, especially the wild vegetables are gradually going into extinction. Knowledge about their nutritional benefits may increase utilization, improve the nutritional status of consumers, and sustain the existence of the vegetable hence the aim of this study.

Materials and Methods

Source of *adenia cissampeloides* leafy vegetable

Fresh leaves of *Adenia cissampeloides* were harvested from Opi in Nsukka Local Government Area of Enugu State in southeastern Nigeria. The leaves were identified at the herbarium unit of the Department of Plant Science and Biotechnology, University of Nigeria, Nsukka.

Figure 1: Fresh *Adenia cissampeloides*

Preparation of Sample

Three kilograms (3kg) of the fresh leaves of *Adenia cissampeloides* were harvested from the bush, sorted, washed with water, and allowed to drain in a colander for about 20 minutes. The leaves were shade-dried for 7 days at room temperature and pulverized using Q link electric blender model QBL/20L40. The pulverized dried sample was packaged in a polythene bag and stored on the shelf in an air-tight plastic container at room temperature until needed. The flow chart is shown in Fig.1.

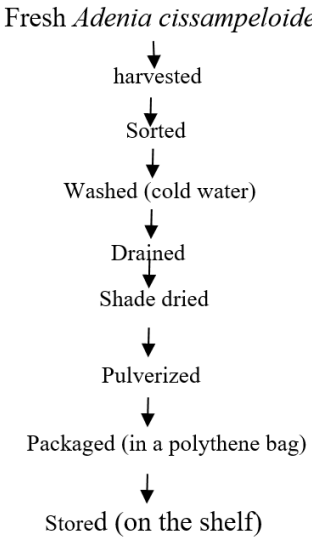

Fig 1: Flow chart showing the steps involved in processing the leaves.

Determination of the proximate composition of shade-dried *Adenia cissampeliodes*

Triplicate samples of the shade-dried pulverized *Adenia cissampeloides* were subjected to proximate analysis using the method of the Association of Official Analytical Chemists (7). Moisture was determined by hot air extraction method, fat by soxhlet extraction, crude fiber by digestion with a standard solution of sulphuric acid (H_2SO_4) and sodium hydroxide, ash by furnace incineration method, protein using the micro-kjedahl method and carbohydrate by difference.

Mineral determination of shade-dried *Adenia cissampeloide*

The minerals iron, magnesium, potassium, copper, manganese, phosphorus, and calcium were determined using the microsampling flame atomic spectrometric method described by AOAC (7).

Determination of vitamins of shade-dried *Aldenia cissampeloides*

The vitamin A content of the sample was determined using the method described by Onwuka (8). Vitamin C (ascorbic acid) and Vitamin E (tocopherol) were determined by the method described by AOAC (7).

Statistical Analysis

Data collected were analyzed using Statistical Product for Service Solution (SPSS) version 21. Analyses of variance (ANOVA) were used to obtain the mean and standard error of the mean and Duncan's Studentized new multiple-range test was adopted to separate and compare the group means. Data were presented as the mean and standard error of the mean. Significance was accepted at $p<0.05$.

Results

Table 1 shows the proximate composition of *Aldenia cissamploides* leaves. The moisture content of *Aldenia*

cissampeloides was 5.20 %, protein 16.44%, fat 3.92%, ash 12.75%, crude fiber 16.79% and carbohydrate 42.86%.

Table 1: Proximate composition of shade-dried *Aldenia cissampeloides* (%)

Nutrients	Percentage content
Moisture	5.20 ± 0.49
Protein	16.44 ± 0.03
Fat	3.92 ± 0.00
Ash	12.75 ± 0.21
Crude fiber	16.79 ± 1.31
Carbohydrate	42.86 ± 0.03

Table 2 shows the vitamin composition of shade-dried *Aldenia cissampeloides*. The provitamin A, vitamin C, and vitamin E content of the leaves were 298.56RE, 33.53mg, and 28.07mg respectively.

Table 2: Vitamin composition of shade-dried *Aldenia cissampeloides*

Nutrients	Values
Provitamin A (RE)	298.56 ± 0.00
Vitamin C (mg/100g)	33.53 ± 0.39
Vitamin E (mg/100g)	28.07 ±0.22

Table 3. The mineral composition of shade-dried *Aldenia cissampeloides* leafy vegetables is shown in Table 3. The result showed that the iron content was 10.19mg, magnesium 2046.67mg, calcium 553.33mg, potassium 1031.33mg, phosphorus 275.75mg, copper 0.19mg, and manganese 0.19mg.

Table 3: Mineral composition of shade-dried *Aldenia cissampeloides* (mg/100g)

Nutrient	Values
Iron	10.19 ± 1.55
Magnesium	2046.69 ±46.19
Calcium	555.33 ± 19.22
Potassium	1031.33 ± 18.48
Phosphorus	275.75 ± 21.76
Copper	0.19 ±0.00
Manganese	0.19 ± 0.00

Discussion

The moisture content of shade-dried *Adenia cissampeloides* 5.2%, is contrary to the findings of Oloyede, Obuotor & Ibronke (9) who reported a moisture value of 80.5 -90.57% in a study of five underutilized fresh green leafy vegetables. The low (5.2%) moisture value was expected since drying reduces the moisture content of food products. The moisture content of a food material is an important consideration as it affects the physical and chemical aspects of food when food is stored for a long period (10). Low moisture delays microbial spoilage and extends the shelf life and sensory quality of food products. The protein value of the vegetable was 16.46%. This is contrary to the result of 27.48% observed by Oly-Alawuba & Ekwe (11) in lesser-known fruits and vegetables. Proteins are polymer chains made of amino acids linked together by peptide bonds (12). They are one of the building blocks of body tissue and can also serve as energy sources. Proteins provide as much energy density as carbohydrates: 4 kcal (17kj) per gram: in contrast to lipids 9kcal (37kj) per gram. The value of carbohydrates, 42.86% is contrary to the 3.92% reported by Agbaire and Emoyan (13) in *Gnetum africanum* leaf. The concentration of carbohydrates and proteins may be a conglomerate of bioactive sugars, glycoproteins, or proteins that give most of vegetables their medicinal potency against certain diseases (14). This appreciable amount of carbohydrate value may suggest that the vegetable is a good source of energy that is needed for daily activities.

The fat content of the vegetable was the least (3.9%) among the proximate values. This agrees with the result obtained by Nnam et al., (15) that among the proximate components, fat content represents the lowest in vegetables. However, the value of fat in this study does not agree with 38.75 to 4.28% observed by Oly-Alawuba and Ekwe (11). Fat is an important nutrient and serves both structural and metabolic functions. Vegetable fats are known to lower blood lipids thereby reducing the occurrence of disease associated with the damage of coronary artery (16). The value of ash in this study is contrary to the 1.92% observed by Agbaire and Emoyan (13) in *Gnetum africanum* leaf. The level of ash (12.75%) in the leaves suggests a high mineral concentration in the vegetable. The fiber content of the leaves was relatively high (16.79%) which is expected as vegetables are known to be good sources of fiber. The level of fiber in this study disagrees with the findings of Agbaire (17) in *Vernomia anydalira* leaf. Dietary fiber is an important component of human nutrition. Fiber is important for proper bowel function, it helps reduce constipation and diverticulosis (18). Fiber-containing foods such as vegetables help provide a feeling of fullness with fewer calories.

The pro-vitamin A content of the leaves was of appreciable amount (298.56RE). Vitamin A plays a role in vision (19). Vitamin A combines with a hexose and hexosamine-containing protein, the opsin to form the visual pigment rhodopsin. The pigment is present in the rod cells of the retina and is responsible for vision in dim light hence regular consumption of this vegetable may be beneficial for maintaining good vision.

The vegetable also contains an appreciable amount of vitamin C (33.53mg) and E (28.07mg). The vitamin C content in the findings is contrary to the result obtained in the study on *Gongronema latifolium* (28.30mg) and *Gnetum africanum* (21.07mg) leaves. Vitamin C improves resistance to infection by improving phagocyte function. Phagocytes are white blood corpuscles whose task is the detection, destruction, and consumption of viruses and bacteria. Vitamin C also converts the inactive form of folate to the active form of ascorbate which is effective in preventing megaloblastic anaemia in infants. It is expected that regular intake of this vegetable will help improve the immune system of individuals. The value of vitamin E (28.07mg) in this study disagrees with 9.59 mg reported by Ayogu et al., (20).

Minerals are essential in the human diet because they form part of the tissues and skeleton and are also essential for growth. Some minerals are part of essential molecules such as thyroxin and haemoglobin. Most minerals in this study were of higher value. The calcium content of the vegetable was (555.33mg). This value disagrees with the findings of Oladiran (21) who reported 282.45mg in Amaratus hybridus leaf. The high value of calcium in the leaves suggests that regular intake of the vegetable will be helpful in the formation, maintenance, and growth component of bones and teeth. The value of potassium (1031.33mg) disagrees with 452.75mg reported by Okudu and Mene (22) in red tropical almond seed. The potassium content of leafy vegetables is good in the control of hypertensive complications (23). The value of magnesium disagrees with the 135.28mg reported by Oladiran (21). The high value of magnesium (2046.69mg), calcium (555.33mg), potassium (1031.33mg), and phosphorus (275.75mg) suggest that this vegetable may serve as a good source of these nutrients.

The iron value was (10.19mg). This value is in line with 9.30-76mg, in the study done by Gebelogiu *et al.*, (24) on the determination of trace metals in soybean and 4) tomato samples. The manganese level (0.19mg) was not comparable with (2.50-39.4mg) observed by Divrikli et al; (25) on the determination of heavy metal contents of green vegetable samples. The level of copper in *Aldenia cissampeloides* was (0.19mg). The copper content of the vegetable in this study is in line with (0.20-8.50mg) in the study of Ferreira et al., (26) on the copper content of commonly consumed food in Brazil. Copper is a component of many enzymes and proteins such as cytochrome C oxidase, ceruloplasmin, and tyrosinase. These help in the binding of iron to haemoglobin. Copper is necessary for body pigmentation, in addition to iron, maintenance of a healthy central nervous system, prevention of anemia, and its interrelation with the function of zinc and iron in the body. However, regular intake of this vegetable may help in the prevention of anemia.

Conclusion

Adenia cissampeloides is a rich source of many nutrients. The amount of carbohydrates (44.92) and protein (16.44) in the vegetable suggest that the vegetable is a good source of energy needed for daily activities.

Conflict of Interests

The authors declare no conflicts of interest regarding this work.

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Authors' Contributions

Eucharia Chinyere Agbo provided major funding and drafted the initial write-up for this paper. Ngozi M. Nnam and Uchenna Agatha Onyechi supervised the work, ensuring accuracy and adherence to standards. E. C. Arene was responsible for typesetting and thoroughly editing the manuscript. Nkechinyerem Gift Onodugo proofread the document, conducted a literature search, served as the corresponding author, and made all necessary corrections as stipulated by the reviewers. C. H. Ugo and A. C. Egbulonu were involved in data collection and coding.

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