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Nutritional, Phytochemical and Mineral Profiling of *Uvaria Chamae* Leaves: Implications for Functional Food and Pharmacological Applications

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Abstract: As the application of plants for food, functional foods and medicine is increasing, it is necessary to identify and analyze plants by medicinal value and nutrition. With this in view, the present study aimed to find out the nutritional, phytochemical and mineral profile of the leaves of Uvaria chamae by following standard procedures. Proximate, qualitative phytochemicals, and minerals assays of the fresh leaves were carried out. The results from the proximate analysis indicated that the main constituents of the leaves include carbohydrate (48.36 ± 0.06%), followed by crude fiber (17.94 ± 0.04%), crude protein (13.26 ± 0.05%), moisture (9.12 ± 0.02%), ash (7.45 ± 0.03%), and crude fat (3.87 ± 0.01%). Qualitative phytochemical screening was performed which showed the presence of alkaloids, flavonoids, tannins, saponins and phenols. In terms of minerals, it was observed that there was an abundance of potassium (162.40 ± 0.12 mg/kg), calcium (134.25 ± 0.10 mg/kg), magnesium (88.60 ± 0.08 mg/kg), iron (52.10 ± 0.05 mg/kg), and sodium (28.75 ± 0.03 mg/kg). The results indicate that the leaves of Uvaria chamae could have medicinal and nutritive uses, supporting the ethnobotanical uses and potential applications of this plant as a functional food or a phytopharmaceutical.

Keywords*: Uvaria Chamae, Proximate Composition, Phytochemicals, Minerals, Functional Foods, Ethnomedicine.*

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I. INTRODUCTION

In the past few years, the interest of the people around the world has increased in using plants as food and to manage diseases. This is because they contain a lot of active substances and essential nutrients. Traditional medicinal plants have been used for centuries to provide food and medicine, and their importance in providing natural products, functional foods and medicines has grown with the rising demand for natural products [11][34]. Although some medicinal plants can be more effective when scientifically validated [12][26], many people prefer to use them because they are readily available, inexpensive, and safe to use. The medicinal plants are gaining significant importance as a new source of therapeutic drugs and nutraceuticals with active compounds [9]. Underutilized medicinal plants hold promise as sources of new active substances for dietary supplements and treatments.

Uvaria chamae P. Beauv., commonly known as bush banana or finger root, is a small shrub in the Annonaceae family. It thrives in tropical regions of West and Central Africa, naturally growing in both savannah and forest areas (Moron et al., 2015). In Nigeria, the plant is known by various

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local names, such as Kaskaifi or Lukuki among the Hausas, mmịmị ohea among the Igbos, and Oko-oja among the Yorubas [28]. Different parts of Uvaria chamae P. Beauv.have been used in various traditional medicine practices to treat diseases like malaria, fever, diarrhea, dysentery, skin infections, and inflammation ([1]). The plant's wide use in traditional medicine has attracted scientific interest in its pharmacology, aiming to uncover the potential antimicrobial, antioxidant, anti-inflammatory, antimalarial, and anticancer effects of Uvaria chamae P. Beauv. (Kabore et al., 2024; [1][28]).

The efficacy of the use of herbs as a remedy is often associated with the availability of diverse types of secondary metabolites including alkaloids, flavonoids, tannins, saponins, phenols, terpenoids, and glycosides [31]. These secondary metabolites influence biological activities in plants greatly due to their role in protecting them against oxidation, pathogens, inflammation, and diseases. In addition to having medicinal value, phytochemicals can be used as food ingredients due to their nutraceutical nature [2].

In addition to phytochemicals, nutrition value and minerals found in medicinal plants contribute significantly to the provision of health benefits by herbs to human beings. The information regarding the nutrition value of herbs can be obtained through the proximate analysis technique where proteins, carbohydrates, fats, fibers, moisture, and ashes in plants are determined quantitatively [6]. Besides, minerals that are essential for physiological activities in the body include calcium, magnesium, potassium, sodium, iron, zinc, manganese, and phosphorus [13].

Despite many studies concerning the ethnomedicinal uses and biological properties of U. chamae, little is known about its leaf nutritional, phytochemical, and mineral compositions [1]. Leaves, which are renewable parts of plants that can be collected sustainably, have been found promising sources for studying the nutritionally valuable and pharmacologically active elements of plants. For this reason, the nutritional composition, phytochemicals, and mineral contents of the leaves can be evaluated to understand the possible functional food uses of leaves and to obtain bioactive molecules. Hence, the current study attempted to determine the nutritional composition, phytochemicals, and minerals of Uvaria chamae leaves.

II. MATERIALS AND METHODS

- *Sample Collection and Preparation*

Leaves of Uvaria chamae P. Beauv. fresh from harvest were obtained from Ikirun in the Ifelodun Local Government Area of Osun State in Southwestern Nigeria. This material was identified at the Herbarium Unit, Department of Botany, University of Ibadan, Nigeria. The freshly harvested leaves were cleaned by thorough washing with distilled water to remove any form of dirt from the plant material and air-dried for two weeks at room temperature (25 ± 2℃). The dried leaves were then ground into fine powder using a mechanical grinder after sieving through a 0.5 mm mesh sieve.

- *Proximate Analysis*

Proximate analysis of the leaves of Uvaria chamae was conducted using the methods prescribed by the Association of Official Analytical Chemists [5. The determination of moisture content involved oven drying, while ash content determination involved combustion in a muffle furnace. Crude protein content was analyzed using the Kjeldahl method, while crude fat content was analyzed using the Soxhlet method. Fiber content was determined using the acid-alkali method.

- *Phytochemical Screening*

Qualitative phytochemical analysis was done in accordance with the protocol give for leaf powder [30]. The qualitative phytochemical test was done to find whether alkaloids, flavonoids, tannins, saponins, and phenols are present or not.

- *Mineral Analysis*

The mineral content was determined following the procedure reported by [27]. Specifically, 0.5 g of the dried leaf sample was digested with the aid of a combination of concentrated nitric acid (HNO_3) and perchloric acid ($HClO_4$) for approximately 1 h at 115℃ till a clear solution is formed. The solution was then cooled, filtered, and finally diluted appropriately before determining the concentration of potassium, sodium, calcium, magnesium, and iron using atomic absorption spectroscopy (AAS).

- *Statistical Analysis*

The analysis was performed thrice, and the results were reported as mean ± SD. Statistical analysis was done using descriptive statistics in IBM SPSS Statistics 29.

III. RESULTS AND DISCUSSION

Table 1 illustrates the proximate composition of Uvaria chamae leaves. From the results, the proximate composition shows the nutritional properties of the plant which can be used in functional foods. Carbohydrate was the most prevalent proximate composition, making up 48.36 ± 0.06 % of the total leaf composition. Fiber and protein content came second with fiber comprising 17.94 ± 0.04 % and protein content being 13.26 ± 0.05 %. On the other hand, moisture, ash, and fat content was found to be 9.12 ± 0.02 %, 7.45 ± 0.03 %, and 3.87 ± 0.01 %.

The carbohydrate composition of the Uvaria chamae leaf was determined to be 48.36 ± 0.06%. The figure compares to 40.47% found in V. amygdalina leaves, one of the most consumed vegetables in West Africa, but lesser than 87.76 ± 0.06% recorded by [22]. The relatively high amount of carbohydrates in the plant could serve as a good energy source in foods and feeds. Carbohydrates are essential nutrients needed for several metabolic activities [15].

Crude fiber was found to be 17.94% in Uvaria chamae leaf, which shows that the leaf is a good source of dietary fiber. It is higher compared to 12.80% crude fiber found in Vernonia amygdalina leaves by [10] and higher than the

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4.41% found by [29], thereby making the plant a better nutritional source of fiber. Fiber is known to enhance digestion, reduce constipation, and protect against heart disease and diabetes [4].

The protein level of 13.26% is considered medium and signifies that there is a presence of a fair amount of proteins within Uvaria chamae leaves. It can be noted from literature that Moringa oleifera leaves had a 14.10% protein content as found by [14], and thus the studied leaves can be a useful source of plant protein. Proteins are required for growth, repair of tissues, production of enzymes, and various other metabolic activities [3].

Crude fat levels of 3.87% are considered low and signify that the tested leaves have very little quantity of lipids. Compared to V. amygdalina leaves, which had an oil content of 6.50%, as well as the 2.25% crude fat in O. gratissimum as found out by [27], the studied leaf samples may be used as a healthy choice for low-fat foods.

The moisture percentage of 9.12% is low and signifies that the tested leaves are suitable for long-term storage. The ash content of 7.45% in the Uvaria chamae leaf is much lower compared to the 11.50% reported for dried Moringa oleifera leaves [7]. The low moisture content is an indication of the low susceptibility of the sample to microbial attack and decomposition after harvesting. The advantage of having low moisture content is that it increases the longevity of the plant material by preventing microbial activities and maintaining its nutritional quality [24]. Thus, the moisture content of the leaves enhances its usability in any desired application.

The 7.45% of ash content in the Uvaria chamae leaf signifies the presence of mineral components in the samples tested. This value is slightly lower compared to the 7.20% ash content of Ocimum gratissimum leaves reported by [23]. In addition, [22] recorded 5.51% of ash content in some plants. Ash content is considered as an indicator of the overall mineral content in plant samples [16].

The higher presence of ash can be attributed to the composition of minerals found in the leaves of the plant, which included potassium, calcium, magnesium, iron, and sodium (see Table 2). Higher concentrations of potassium, calcium, and magnesium were observed, while low concentrations of sodium and iron were noted. Also, similar results were obtained from the works of [29] where the presence of calcium, potassium, magnesium, iron, sodium, copper, zinc, selenium, and manganese in the leaves were documented; however, the presence of high quantities of iron and calcium were observed. Among the different minerals tested in the current analysis, the highest quantity was seen with potassium at 162.40 ± 0.12 mg/kg, while the least amount was seen for sodium at 28.75 ± 0.03 mg/kg. Potassium and sodium are essential electrolytes that have major functions like transmission of nerve impulses, muscle contraction, fluid balancing, and blood pressure regulation [20]. The higher amounts of potassium observed suggest the importance of the plant in maintaining heart and muscle health, and those of calcium at 134.25 ± 0.10 mg/kg make the leaves suitable in contributing to bone and teeth formation and blood clotting.

Calcium consumption is also necessary for promoting good bone health and decreasing osteoporosis risk [32].Magnesium content measured in Uvaria chamae leaves was found to be 88.60 ± 0.08 mg/kg. It plays an important role as a cofactor for various enzymes, involved in energy production and protein and nucleic acid metabolism [8]. This considerable amount m akes this mineral highly valuable from the standpoint of nutrition. Iron content measured in the leaves was found to be 52.10 ± 0.05 mg/kg. Hence, Uvaria chamae leaves can also be regarded as a potential source of the nutrient needed by the body. Iron is a very important trace element, required for the synthesis of hemoglobin and cellular respiration; its consumption prevents iron-deficiency anemia [21]. Qualitative phytochemical analysis of the leaves showed the presence of alkaloids, flavonoids, tannins, saponins, and phenolics (Table 3). The presence of these bioactive compounds implies that the leaf extracts contain enormous potential for medicinal purposes. These phytochemical compounds are already known to occur in the Uvaria chamae and are thought to be responsible for many of its pharmacological effects and applications in herbal medicine [1]; Kaboré et al., 2024).

Flavonoids and phenolics are some of the most important antioxidants produced by plants and are known for scavenging free radicals, inhibiting oxidative stress, and protecting cells from oxidative damages (Oboh et al., 2026). Oxidative stress is one of the primary contributors to the development of chronic diseases such as heart conditions, diabetes, neurological conditions, and cancer (Reddy, 2023). Hence, the presence of such compounds suggests that there is an anti-oxidant property associated with the leaves of Uvaria chamae. This conclusion is reinforced by earlier findings demonstrating the strong antioxidant properties and antimicrobial activities exhibited by the plant [17].

Among many pharmacologically active secondary metabolites, alkaloids represent an important group of compounds exhibiting antimicrobial, analgesic, antimalarial, and anti-inflammatory properties [19]. The presence of these compounds in leaves may be responsible for the medicinal properties observed in the plant against the different infections, fever and the symptoms of disease. The next secondary metabolite found in the plant is the tannins. Tannins have astringent, antimicrobial, antioxidant and anti-inflammatory activity (Kovac et al., 2022).

Other secondary metabolites found in Uvaria chamae leaves are saponins. These compounds are currently the subjects of much scientific interest for their cholesterol-lowering and immune-modulating, antimicrobial and anticancer properties [33]. Saponins has been identified to boost uptake of nutrients and enhance the properties of the foods and are also valuable sources of nutrients and drugs [25].

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Table 1: Proximate Composition of *Uvaria chamae* Leaves

Parameter	Value (%)
Moisture	9.12 ± 0.02
Ash	7.45 ± 0.03
Crude Protein	13.26 ± 0.05
Crude Fat	3.87 ± 0.01
Crude Fibre	17.94 ± 0.04
Carbohydrate	48.36 ± 0.06

Values are expressed as mean ± standard deviation (n = 3).

Table 2: Mineral Composition

Mineral	Value (mg/kg)
Potassium	162.40 ± 0.12
Calcium	134.25 ± 0.10
Magnesium	88.60 ± 0.08
Iron	52.10 ± 0.05
Sodium	28.75 ± 0.03

Values are expressed as mean ± standard deviation (n = 3).

Table 3: Phytochemical Composition

Phytochemical	Result
Alkaloids	+
Flavonoids	+
Tannins	+
Saponins	+
Phenols	+

Key:(+)Present;(-)Absent

IV. CONCLUSION

The present study investigated the nutritional value, phytochemical profile and mineral constituents of the leaf of Uvaria chamae, offering scientific evidence of the important nutritional and ethnomedicinal properties of the leaf of Uvaria chamae. In terms of nutrition, the leaf is shown to have considerable content of carbohydrates, fibre, and protein, which indicates the possible role of this species in human nutrition and in the production of functional foods. The leaves are rich in minerals, which are important physiological elements of bone formation, enzymatic processes, transport of oxygen and maintenance of electrolyte balance: potassium, calcium, magnesium, iron and sodium. The phytochemical screening also reveals the presence of other compounds like alkaloids, flavonoids, tannins, saponins, and phenols, known for their antioxidant, antimicrobial, and anti-inflammatory properties. The findings of the present study further substantiate the beneficial attributes of the Uvaria chamae plant, and indicate potential applications in functional foods, nutraceuticals, and medicine.

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