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Preliminary Proximate Analysis, Chemical Composition and Phytoconstituents of *Eulophia gracilis* Orchid

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Abstract

Eulophia gracilis is a rare important medicinal terrestrial orchid with underground tubers found in the rocky area of Oyo state in Nigeria. Proximate analysis, mineral composition and the qualitative phytochemical analysis of *Eulophia gracilis* were investigated. *Eulophia gracilis* was found to contain 11.88% moisture, 16.93% protein, 3.96% fat, 1.98% ash, 4.95% crude fiber and 72.18% carbohydrates. The result indicate that the tuber of this plant contains high protein. The mineral analysis indicated that the dried tuber contained sodium (0.05%), potassium (0.45%), calcium (0.2%), magnesium (0.24%), zinc (17.5mg/kg) iron (110.5mg/kg), manganese (15mg/kg) and copper (4mg/kg). Phytochemicals detected in aqueous methanol of tubers of *Eulophia gracilis* are Glycoside, alkaloid, tannins, phlobatanins and flavonoid. This reveals that *Eulophia gracilis* can be an important food source and the presence of some phytochemicals like flavonoids, alkaloids and phlobatannin suggested its medicinal action in traditional medicine. Therefore the plant may be a chosen nutraceutical.

Keywords: *Eulophia gracilis*; proximate analysis; elemental composition; phytoconstituents.

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1. Introduction

The global concern on the need to augment agricultural food supply to meet growing population has taken different dimension. Mostly, agricultural development is biased against the production of some plants whose benefits are not locally well known and placed emphasis on production of staples and plant that are of export value [1, 2]. This has geared many scientists to research into the use of alternate food in addition to the staple agricultural products in the recent years [3]. One important tool employed is evaluation of nutritional value of less common wild edible plant and physically appealing plant used solely for medicinal and cultural purpose [4]. This will go a long way in discovering new alternate food and nutraceutical sources to cater for the growing population. This diversification coupled with increase in food production will increase food varieties and suppress world food crisis [5]. Many researches on root crops in the world centered on staple root tubers like yam, potatoes and cassava and few on wild edible plants that have considerable potential to add protein to the diet [6]. There are very few researches, if at all, on nutritional qualities of medicinal tubers. *Eulophia gracilis* is an important medicinal orchid with underground tubers found in the rocky area of Oyo town in Nigeria and also in Western Tropical Africa to Angola. *Eulophia gracilis* is terrestrial orchid with leaves up to 6, 20-30 cm long, 0.7-2.5 cm wide, oblong-lanceolate, acuminate, plicate, long petiolate, erect. The plant tubers are used to treat diabetes, cancer, reducing excessive stomach fats and to improve man copulatory performance by traditional healers in Nigeria especially among indigenous people in Oyo and Jigawa in Nigeria. Though various medicinal values have been attached to this plant by local healers in different parts of Nigeria yet till date no scientific validation has been evidenced for nutritional values, chemical composition and phytochemical components of this plant. This is the first report dealing with proximate analysis, chemical compositions and phytochemical screening of this plants. Therefore, the aim of this present study is to determine the proximate analysis, elemental analysis and preliminary qualitative phytochemicals of aqueous methanolic extract of *Eulophia gracilis* tubers.

2. Materials and Methods

2.1. Plant Materials

Fresh *Eulophia gracilis* plants were harvested from rocky area in Oyo, Nigeria and was identified by Mr. Donathus from Department of Botany, University of Ibadan, Nigeria with University of Ibadan Herbarium (UIH) number 22528. The tubers were removed and thoroughly washed with tap water, sliced into pieces and shed dried. The dried tubers were ground into powder using mechanical grinder and powdered sample was used for proximate analysis, elemental composition determination and phytochemical analysis of 80% methanolic extract of the tubers.

2.2. Proximate Analysis

The estimation of Moisture content, crude fat, ash and crude fibre were determined following the procedure described in official methods of the association of official analytical chemists [7], while nitrogen was determined by the micro-kjeldahl method [8] and crude protein was determined by multiplying percentage of nitrogen by 6.25. Carbohydrate content was determined by difference.

2.3. Mineral Analysis

5.0g of the dry sample *E. gracilis* was digested with concentrated nitric acid and concentrated perchloric acid in ratio 5:3 and incubated in water bath at 80°C for three hours. The resultant solution was cooled and filtered and used for mineral analyses using atomic absorption spectrophotometer.

2.4. Phytochemical screening

Phytochemical screening procedures carried out were adapted from the previous work on plant analysis by Odebiyi and Sofowora [9]. The analysis determined the biologically active non-nutritive compounds such as tannins phlobatannins, alkaloids, glycosides, saponins and flavonoids that contribute to the flavor, color and other characteristics of plant parts.

3. Results

Table 1: Proximate Composition of the Tuber of *Eulophia gracilis* as a Percentage of the Dry matter

| Serial No. | Proximate Composition | Values (%) |
|------------|-----------------------|--------------|
| 1 | Moisture | 11.88 ± 0.01 |
| 2 | Ash | 1.98 ± 0.01 |
| 3 | Crude fibre | 4.95 ± 0.0 |
| 4 | Protein | 16.93 ± 0.14 |
| 5 | Fat | 3.96 ± 0.04 |
| 6 | Carbohydrate | 60.31 ± 0.08 |

Table 2: Mean Values for Mineral Contents of Nutritional Importance in the Tubers of *Eulophia gracilis*

| Serial No. | Name of Mineral | Values |
|------------|-------------------|--------|
| 1 | Sodium (%) | 0.05 |
| 2 | Calcium (%) | 0.2 |
| 3 | Magnesium (%) | 0.24 |
| 4 | Potassium (%) | 0.46 |
| 5 | Iron (mg/kg) | 110.5 |
| 6 | Zinc (mg/kg) | 17.5 |
| 7 | Manganese (mg/kg) | 15 |
| 8 | Copper (mg/kg) | 4.0 |

Table 3: Qualitative Phytochemical Constituents of *Eulophia gracilis* Tubers

| Parameters | Aqueous methanol |
|--------------|------------------|
| Saponin | - |
| Glycoside | + |
| Alkaloids | + |
| Tannins | ++ |
| Phlobatanins | +++ |
| Flavonoids | +++ |

4. Discussion

The root and tuber crops are essential constituent of diet in developing country especially among the rural folk. Tuber crops are in general more starchy and marginal in protein content. Impact of civilization in developing countries especially in Nigeria has shifted the focus of people from consumption of these carbohydrate rich food crops to more of cereals and cereal products. The carbohydrate content of tuber crops constitute the major class of naturally occurring organic compounds that are essential for the maintenance of plant and animal life and also provide raw materials for many industries [10]. The result of proximate analysis from this study establishes it that *Eulophia gracilis* can be ranked as carbohydrate rich tuber because of its high carbohydrate content of 60.3%. This is comparable to cocoyam and irish potato [11]. Dietary fiber from plant foods has also been shown to possess therapeutic effects because they are rich in associated polyphenol compounds [12]. Consumption of dietary fiber has been associated with reduced absorption of total bile acid and dietary lipid which facilitate an improvement in risk factor for colon cancer [13]. This present study shows that *Eulophia gracilis* has high amount of crude fibre content. Though this is lower when compared to *Amorphophallus campanulatus* tuber [14]. Dietary fibre helps to prevent many diseases prevalent in affluent societies [15]. Fibre offers help in prevention and management of cardiovascular disease by lowering total cholesterol and low-density lipoprotein levels. In addition to its nutritional importance in absorption of trace elements in gut, fibres has been shown to be useful in regulation of blood sugar [16, 17]). The moisture content especially at high side ensure greater activity of both water soluble enzymes and co-enzymes required for metabolic activities in leafy vegetables [18]. The residual moisture content of *E. gracilis* in this study is 11.88%. The high total moisture content in this plant may enhance normal body development as it provide favourable milleau for enzymatic activities. Tuberous vegetables are generally less considered as good protein source. This is because the quantity and quality of the protein in most starchy staples are variable and relatively low on a fresh weight basis but compare favourably with some cereals on a dry weight basis. The proximate composition of *E. gracilis* when compared to some cereals in Africa indicated that the protein content of this tuber (16.93%) was comparable to that of the cereals including that of Nigerian staple maize (7-9%). The presence of this high amount of protein showed that it can be a right substitute for Nigerian staple rice without compromising the dietary protein content. More also, the protein content of *E. gracilis* is higher than most of Nigerian staple tubers such as African yam (13.54%), water

yam (11.14%), cassava (8.90%) and sweet potato (10.65%) but lower than that of cocoyam (30.85%) [11]. Food item with low fat content has been considered safe for consumption by mankind in this present dispensation where obesity poses a serious threat to health and life of people. The crude fat content of this medicinal tuber is close to the fat contents of various under-utilized tubers such as *Dioscorea oppositifolia*, (2.51 ± 0.21) and *Curculigo orchoides* (4.44 ± 0.27) [19]. This may make it suitable for individual on weight reduction scheme and also to reduce the level of cholesterol [15]. The tubers of *Eulophia gracilis* contains considerable amount of macro and micro elements. The elemental analysis results showed high potassium content which has been shown in humans to play a protective role against cardiac dysfunctions, hypertension, renal damage and hypercalciuria, and osteoporosis [20]. Sodium and potassium ions are important intracellular and extracellular respectively. Sodium ion play a significant role in the regulation of acid-base balance, plasma volume, nerve and muscle contraction [21]. The ratio of sodium (Na) to potassium (K) in *Eulophia gracilis* is less than one. This conforms to recommendation. Therefore, *Eulophia gracilis* tubers would not promote high blood pressure [22]. Also, high calcium (Ca) content (0.2%) in the elemental analysis of the tuber may be of therapeutic value in hypocalcaemia state like osteoporosis. Moreover, zinc plays an essential role in the process of genetic expression through its effect in polynucleotide transcription. Zinc is an important micronutrient that affects a number of cellular and humoral immunity and optimal human growth [23, 24]. Its deficiency or inadequacy poses a risk factor to the world population at large and it is more pronounced in children, lactating mothers and pregnant women [25, 26]. The level of Zinc in this medicinal plant sample is 17.5% which is moderately high and is comparable to those of leafy vegetables earlier reported [22, 27]. Magnesium is an important element present in extracellular fluid and it is useful in maintaining osmotic equilibrium [28]. It is a metal ion activator to some enzymes and its deficiency is associated with convulsion and abnormal muscle irritability [29, 30]. In this study, the tuber serve to be a good source of magnesium (15mg/kg) and this is relatively higher than the amount of magnesium in spicy root crops reported by Odebunmi and his colleagues [11]. Iron is a trace element functioning in erythropoiesis and its deficiency resulted in anemia in human [31, 32]. The iron and manganese contents of *E. gracilis* were lower when compared with RDA (mg/day) and seven leafy vegetables reported by Asaolu and his colleagues [22] but were however higher when compared to the six staple root and tuber crops presented by odebunmi and his colleagues [11]. This shows that this tuber could supply these mineral elements in reasonable quantity. Phytochemicals are crucial nutritional components or plant chemical which biologically function as antinutrient or antioxidant and possess ability to prevent chronic diseases and reduce the risk of several deadly diseases such as cancer, diabetes, cardio-vascular diseases and ageing [33, 34]. The results from phytochemical analyses of *E. gracilis* are shown in Table 3. This revealed the absence of saponins. Glycoside, alkaloid, tannins, phlobatanins and flavonoid were present in the aqueous methanolic extract. The presence of these secondary metabolites has contributed to its medicinal value as well as physiological activity [35]. Alkaloids are heterocyclic nitrogenous compound with therapeutic efficiency against microbes and have been found to possess several biologic functions such as pain relieving effect, antipyretic action and used as CNS stimulant [36, 37, 38, 39]. The presence of glycoside in the extracts gives a prediction that the plant may be used as stimulant in the treatment of cardiac failure or cardiac disease and probably in the management of hypertension [40]. Flavonoid as phytochemical contribute greatly to antioxidant defense system and have been reported to offer help in protection against cancer, inflammation, atherosclerosis, ageing and neuro degenerative diseases [41, 42, 43]. Report from Alan and Miller [44] showed that flavonoid elicited anti-inflammatory,

antiallergic, antimutagenic, antiviral, antibacterial, anti-thrombotic and vasodilatory activities and displayed antioxidant activity by scavenging hydroxyl radicals, lipid peroxy radicals and superoxide anions.

5. Conclusion

The study showed that *Eulophia gracilis* has high content of carbohydrate, moderately high protein with low fat, ash and crude fibre. The tuber also contained minerals with iron, zinc, magnesium, calcium, sodium, potassium in reasonable quantity while manganese, nickel and copper contents were low. The results of phytochemical screening also showed that the tubers of *Eulophia gracilis* possessed phytochemical substances that are of pharmacological importances. This result suggests that this tuber may be of nutritional value in addition to its medicinal importance in traditional medicine. It is therefore suggested that further work should be carried out to determine the anti-nutrient components of this plant. Moreover, it is recommended that detailed quantitative phytochemical analysis be carried out on this plant and its active principles be determined.

Conflicts of interest

There is no conflict of interest.

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