



Proximate, Mineral Composition and Phytochemical Screening of Aqueous Leaf Extract of *Alafia barteri* Oliv. (Apocynaceae)

I. O. Adefisan¹, O. A. T. Ebuehi^{1*} and O. S. Odesanmi¹

¹Department of Biochemistry, College of Medicine, University of Lagos, PMB12003, Lagos, Nigeria.

Authors' contributions

This work was carried out in collaboration among all authors. Author IOA performed the laboratory work, analyzed the data and wrote the manuscript. Author OATE designed and supervised the experiments, critically reviewed and edited the manuscript. Author OSO designed and supervised the experiments. All authors read and approved the final manuscript.

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ABSTRACT

Alafia barteri leaves are valued for its efficacy in the traditional medicine system in Nigeria. It has been used over the years for the treatment of various diseases some of which include malaria, sickle cell anaemia, and eye infections. This has necessitated the evaluation of its chemical composition to ensure its safety for human use. This study was undertaken to evaluate the phytochemical constituents, proximate and elemental composition of *Alafia barteri* leaf. The phytochemicals and proximate analyses were carried out using standard methods. The mineral elements were analyzed using atomic absorption spectrophotometry. The proximate analysis of the leaves showed it contained moisture 8.6%, crude fibre 48.29%, protein 15.84%, carbohydrate 13.13%, lipids 7.23% and ash 6.75%. The mineral analysis of the leaves revealed the presence of the following minerals: calcium (96.2 mg/100 g), manganese (74.8 mg/100 g), iron (46.2 mg/100 g), magnesium (31.05 mg/100 g), potassium (3.3 mg/ 100 g), sodium (2.9 mg/100 g). The phytochemical screening indicated the presence of flavonoids, phenols, tannins, anthraquinones, phlobatannins, cardiac glycosides and steroids. The study revealed the leaves of *Alafia barteri* to be a potential source of minerals and nutrients needed for human nutrition.

*Corresponding author: E-mail: ebuehi@yahoo.com;

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1. INTRODUCTION

Medicinal plants have been identified as plants whose roots, stems, leaves and seeds possess therapeutic properties. Many plants that are used in traditional medicine to alleviate symptoms of illnesses have been found to possess phytochemicals. The use of herbs and search for drugs and dietary supplements derived from plants have accelerated in recent years because medicinal plants are known to contain some chemical substances which can be used for treatment purposes or to produce drugs [1,2].

Medicinal plants play vital roles in the health of individuals, in fact most modern drugs are derived from them. Knowledge of the chemical components of plants may help in further development of new drugs to treat different diseases, hence this has necessitated a study on the phytochemicals, nutrients and minerals present in *Alafia barteri* leaves [2,3].

Alafia barteri Olive, of the family Apocynaceae, is a climbing shrub distributed widely in the tropics. It is valued for its efficacy in the traditional medicine system in Nigeria and other African countries, as an anti-inflammatory and fever remedy. The infusion of the leaves and twining stem are used for the treatment of inflammation and fever [4,5,6]. The extracts of the leaves were found to have antibacterial and antifungal activities [5]. The aqueous leaf extract was reported to display potent anti-plasmodial activity [6]. In South-Western Nigeria (Lagos), *Alafia barteri* has been used for the treatment of malaria [7]. In addition, the stem and root decoctions of *Alafia barteri* are used for treating rheumatic pains, toothache, eye infection and sickle-cell anaemia [7].

There is no report on the proximate and elemental analyses of the leaf extract of *Alafia barteri* about its safety for human use, and do not contain some harmful elements. Therefore the present is to determine the proximate, mineral composition and phytochemical screening of aqueous leaf extract of *Alafia barteri*.

2. MATERIALS AND METHODS

2.1 Collection of Plant Material

Fresh leaves of *Alafia barteri* were collected from Olokomeji forest, Ibadan, Oyo State, Nigeria.

Botanical identification and authentication was done at the Department of Botany, University of Lagos, Lagos State, Nigeria, where a voucher specimen was deposited. The leaves were separated from the stalks, washed and air dried for two weeks. They were ground into powdered samples which were stored in clean air tight containers at ambient temperature until when needed for use.

2.1.1 Preparation of leaf extracts

400 g of the powder was soaked in 10L of distilled water for 72hours after which the preparation was filtered using the Whatman filter paper No. 1. The filtrate was evaporated in a rotary evaporator attached to a thermos-chiller (Buchi 700®, Recirculation chiller) at a temperature of 40°C. The residue was freeze-dried to obtain a deep-brown colour.

2.1.2 Proximate and mineral analyses of leaf extracts

The proximate analyses were carried out in duplicates and the results obtained were the average values. The estimation of the various food parameters in *Alafia barteri* leaves plant was carried out using the methods of AOAC [8]. Mineral analysis was carried out after acid digestion of 2g of the grounded leaves sample with 10ml of a mixture of nitric acid and perchloric acid (2:1 v/v) until a clear solution was obtained. The digest was allowed to cool and then transferred into a 100ml standard flask and made up to mark with de-ionized water. The mineral elements were analyzed with atomic absorption spectrophotometer (GBC AvantaVer 2.02 Model, Australia) equipped with air-acetylene flame. Sodium and Potassium were determined using a flame photometer (Gallenkamp flame analyzer, UK).

2.1.3 Phytochemical screening of leaf extracts

The phytochemical screening was carried out on the aqueous plant extract using the methods described by Sofowora [9].

2.2 Statistical Analysis

Results were expressed as the mean \pm standard deviation in triplicate determinations. The data was analysed using Student's t-test. $P < 0.05$ was considered significant.

3. RESULTS AND DISCUSSION

The proximate composition of *Alafia barteri* leaves is presented in Table 1. The results show that it contains carbohydrate (13.13%), crude protein (15.84%), ash (6.75%), crude fibre (48.29%), lipids (7.23%) and moisture (8.76%). Crude fibre has the highest value, while ash had the least. The dietary fibre can lower serum cholesterol level, risk of coronary heart disease, hypertension, constipation, diabetes, colon and breast cancer [10,11].

Crude lipids are the principal sources of energy but should not be more than 30 calories so as to avoid obesity and other related diseases. A diet providing 1-2% of its caloric energy as fat is said to be sufficient in human beings as excess for consumption is implicated in certain cardiovascular disorders for such as atherosclerosis, cancer and aging [12,13].

The ash content of 6.75% indicates that the leaves contain reasonable amount of mineral elements. The low moisture content of the leaves would hinder the growth of microorganism and storage life would be high [14].

Several links between diet and arthritis have been discovered through research. A healthy diet will help decrease strain on joints by keeping a healthy weight [15,16]. Recent research shows that crude fibre now appears to decrease C-reactive proteins (an indicator of inflammation found in the blood of arthritic patients) [12,17,18,19]. Its low lipid content suggests it could lower cholesterol levels. Ash was found to have the lowest concentration in the plant leaf extract.

Minerals are inorganic substances which play important body roles like structural formation of bones and teeth, maintaining normal heart rhythm, muscle contractility, acid-base balance.

Their deficiency is often associated with accelerating arthritic conditions. They are often overlooked as a needed nutrient in the alleviation of arthritis [12,19]. Most common minerals used in pain management include: boron, calcium, magnesium, zinc, manganese, copper.

Alafia barteri leaf was found to contain calcium, manganese, iron and magnesium, potassium, sodium; calcium being the highest and sodium as the least in concentration. Calcium is a macro-

mineral which helps to maintain skeletal integrity [15].

Chemical reactions in the body and intestinal absorption occurs with the help of magnesium.. Magnesium is an important mineral element in connection with circulatory disease, such as ischemic heart disease and calcium metabolism in bone [16,17]. It also gives the bone strength and density decreasing the risk of fractures.

Fluid balance and nerve transmission are ensured by sodium and potassium. This could be useful in lowering blood pressure. Iron is an essential trace element for haemoglobin formation, normal functioning of the central nervous system and oxidation of carbohydrates, protein and fats [17]. Iron is useful in prevention of anaemia and other related diseases [16]. Its presence in the extract suggests the possible reduction of anaemia common to arthritic patients.

Manganese plays a role in energy production and in supporting the immune system. It also aids cartilage development .It also works with vitamin K to support blood clotting, and with B complex vitamins to control the effects of stress [18]. The presence of some of these minerals in *Alafia barteri* leaf suggests its possible usefulness in maintaining bone integrity. Lead and cadmium were not detected in the leaf extract of the plant.

The results of the phytochemical analyses are shown in Table 3. This revealed the presence of phenols, tannins and flavonoids in the aqueous extract. The presence of these secondary metabolites has contributed to its medicinal value as well as physiological activity. Flavonoids generally have been found to have anti-allergic, anti-inflammatory, anti-microbial, anticancer and anti-diarrheal activities [20]. Tannins have antioxidant, antimicrobial, anti-inflammatory, diuretic properties. They reduce feed efficiency and weight gain [21]. Phenols are very important plant constituents because of their scavenging ability due to their hydroxyl groups and may contribute directly to anti-oxidative action.

There are reports that people with arthritis experienced an improvement in their symptoms, when they switched from a typical western diet to a vegan diet with lots of flavonoids [22]. The hexane, ethyl acetate and methanolic stem extracts was also found to contain glycosides, flavonoids and anthraquinones [5].

Table 1. Proximate composition of aqueous leaf extract of *Alafia barteri*

Nutrient	Composition (%)
Crude fibre	48.29 ± 2.67
Protein	15.84 ± 1.43
Carbohydrate	13.13 ± 0.94
Moisture	8.76 ± 0.59
Lipids	7.23 ± 0.71
Ash	6.75 ± 0.58

The results are expressed as mean ± SD in triplicate determinations

Table 2. Concentration of minerals in aqueous leaf extract of *Alafia barteri*

Mineral	Concentration(mg/100g)
Calcium	96.20± 9.75
Manganese	74.80 ± 2.84
Iron	46.20 ± 4.11
Magnesium	31.05 ± 2.76
Potassium	3.30 ± 0.05
Sodium	2.90 ± 0.04
Lead	ND
Cadmium	ND

ND= not detected

Table 3. Concentration of phytochemicals of aqueous leaf extract of *Alafia barteri*

Phytochemical		Concentration (mg/100g)
Flavonoids	+	368.42 ± 26.95
Phenols	+	72.35 ± 6.40
Tannins	+	96.16 ± 8.39
Cardiac Glycosides	+	ND
Phlobatannins	+	ND
Steroids	+	ND
Anthraquinones	+	ND
Saponins	-	-
Alkaloids	-	-

+ means positive detection or presence

- means negative detection or absence

ND = not determined

4. CONCLUSION

Data of the study indicate that the leaves of *Alafia barteri* can serve as a potential source of useful drugs and mineral elements which could help to preserve bone integrity and health status.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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