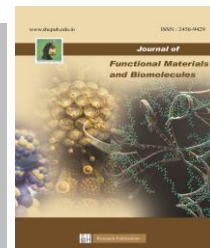




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Biomolecules and Phytominerals Profiling of *Pausinystalia yohimbe* (K. Schum.) Pierre ex Beille Root Extract

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Abstract

The phytochemical constituents of methanol root extract of *Pausinystalia yohimbe* (K. Schum.) Pierre ex Beille was assessed. The mineral and proximate analyses were done on the root extract. The present study was carried out to ascertain the bioactive principles and nutritional content values of *Pausinystalia yohimbe* root. The period of harvesting was in the month of June, 2014. The roots were air dried at room temperature, pulverized to powder and their phytochemical, proximate and mineral contents determined using standard analytical techniques. The result of the qualitative phytochemical constituents of root extract of *Pausinystalia yohimbe* showed presence of all the tested phytochemicals (saponins, alkaloids, phenols, flavonoids, tannins, steroids and cardiac glycosides). Proximate analysis revealed the presence of moisture (10.77%), protein (6.92%), fat (1.37%), ash (8.86%), crude fibre (14.93%) and carbohydrates (57.15%). Results showed the presence of calcium (0.42 g/100 g), magnesium (0.37 g/100 g), phosphorus (0.29 g/100 g), iron (1.92 g/100 g), copper (0.068 g/100 g) and zinc (1.03 g/100 g). The results from this study prove the extensive use of the root of this plant in ethnomedicine and its potentials in drug formulation.

Keywords: Ethnomedicine, medicinal plants, *Pausinystalia yohimbe*, phytoconstituents

1 Introduction

Medicinal plants have constituted the source of health care all over the world since time immemorial and has thus remain the mainstay of drug discovery [1]; this is believed to be as a result of the presence of certain plant chemicals (phytochemicals). Phytochemicals which may also be referred to as phytonutrients/phytoconstituents are present in diverse kinds of plants which are consumed as essential components of both human and animal diet where they have marked physiological effects [2]. The bioactive principles of note in plants are alkaloid, flavonoid, tannins, saponins and phenolic compounds; this active principles, alongside the vitamins and minerals have been implicated to contribute to their various physiologic, metabolic and protective effects [2]. Other important classes of phytonutrients/phytoconstituents present in plants are

the proximate and minerals. Proximate and minerals are considered as compound and elements that possesses specific metabolic functions, some of which are present in diverse range of medicinal plants.

Pausinystalia yohimbe (K. Schum.) Pierre ex Beille is a medicinal plant of great medicinal values that is known to be used in pharmaceuticals and food industries [3]. *Pausinystalia yohimbe* (Yohimbe/Johimbe) is a tree that belongs to the family Rubiaceae which is found growing in abundance in West and Central Africa in lowland forest. It is a tree indigenous to tropical West Africa. The tree grows about 30m tall, with a straight bole/trunk that is rarely larger than 50-60 cm in diameter. The bark is grey to reddish-brown, with longitudinal fissures, easy to peel and bitter-tasting. The inner bark is pinkish and fibrous. The sapwood is yellowish and the heartwood is ochre-yellow; the wood is fine-grained and relatively dense and moderately hard. The leaves grow in groups of three, with short (about 2 cm) petioles. The blades are oval-shaped, 11-47 cm long and 5-17 cm wide. It exhibits tap root system, and the root can be erect, bend, folded and branching. The fruit (Jan. to March) is spindle-shaped, measuring up to 2cm long with narrowly elongated winged seeds. Its geographical spread is from south-western Nigeria to Gabon and Zaire. Yorubas call it 'Idagbon', Ibos call it 'Likiba' while Hausas call it 'Burantashi', respectively in Nigeria. The plant drug has been used as an aphrodisiac [3], and has wide patronage among the Yorubas, as a powerful stimulant and blood tonic. The root or stem bark of the tree are either taken in a powdered or tinctured form.

There is only sparse information available from older literature about the use if *Pausinystalia yohimbe* and its preparations thereof. Decoctions of the bark were used mainly in West Africa as an aphrodisiac to stimulate sexual desire and performance [4]. It has long been used for a variety of purpose across the tropics e.g. EFSA [5] reported the use if *Pausinystalia yohimbe* as a local anaesthetic, a mild stimulant to prevent drowsiness, a hallucinogen, a treatment for angina, hypertension, intestinal worms, a

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general tonic, a performance enhancer for athletes, and to increase the clarity of singers' voices during long cultural festivals. The traditional healers among the Yoruba peoples also claimed that the root of this plant could equally be used as a stimulant, general tonic, a hypotensive agent and as well as an aphrodisiac. Regarding these claims, there is dearth of information on the use of *P. yohimbe* root in the open literature. The plant contains a number of indole-alkaloids of biological relevance. Yohimbine, the major alkaloid of *P. yohimbe* is used as active ingredients in a number of medicinal products [4], [5].

Nutritional analysis indicates that *Pausinystalia yohimbe* contains a wealth of essential disease preventing nutrients which make it suitable to be included in diets as food supplement [6]. In ethnomedicine, *Pausinystalia yohimbe* has been estimated to cure many diseases by taking its supplement along with hundreds of other health benefits, it contains "tyramine", a red wine food containing substance of ester and its compounds [7].

Heavy metals are natural mineral components of the earth crust. They cannot be degraded or destroyed. To a small extent they enter our bodies via food, drinking water and air. Heavy metals include zinc, calcium, copper etc. As trace elements, some heavy metals (e.g. Cu, Zn, Fe) are essential for maintaining the human body metabolism, agriculture and environment [8]. However, it has been reported that climatic factors and stages of maturity could cause variation in distribution of phytochemicals present in any plant material [9], as well as the choice of solvents, as different solvents have different extraction capabilities and spectrum of solubility for phytoconstituents [10]. Also, soil variability and some environmental properties may charge equilibrium found in the soil and cause leaching of mineral elements tightly bound to soil particles [11]. In this view, the experiment was to evaluate the phytochemical constituent of the methanol extract and determine the nutritional values of the root of *Pausinystalia yohimbe*.

2 Experimental

2.1 Collection and Identification of Plant Material.

A substantial quantity of the roots of *Pausinystalia yohimbe* were collected from village area of Okomu National Park, Udo, Edo State, Nigeria and was identified and authenticated in the Phytomedicine unit of the Department of Plant Biology and Biotechnology, University of Benin, Benin city, Nigeria.

2.2 Preparation of Plant Extracts

2.2.1 Drying Process

The fresh roots of *Pausinystalia yohimbe* were harvested, washed and dried for eight hours a day for two weeks under shed, at room temperature, to avoid loss of bioactive compounds. The dried roots were ground to powder using mechanical grinder and weighed with a Mettler balance. The powder sample was then stored in an airtight bottle for further use.

2.3 Extraction Process

Fifty grams of the powdered sample were subjected to absolute methanol extraction using Soxhlet apparatus, and the extract obtained was used for the study.

2.4 Phytochemical Assay, Mineral and Proximate Analyses

2.4.1 Qualitative and Quantitative Assay

Qualitative phytochemical screening of the root was determined using the standard methods described by Edeoga *et al.* [12] and Oluduro [13], while the quantitative phytochemical analysis estimating the quantity of saponins, alkaloids, phenols, flavonoids, tannins, steroids and cardiac glycosides were determined using the standard methods described by Mbaebie *et al.* [14]

2.4.2 Mineral and Proximate Analyses

The mineral and proximate compositions of the whole root extract were assessed following the standard analytical methods described by Oluduro [13]. Also, the respective minerals were analysed using Atomic Absorption Spectrophotometer.

2.5 Data Analysis

The results of this study were assessed, and data expressed in percentage (%).

3 Results and Discussion

3.1 Qualitative Phytochemical Screening of *Pausinystalia yohimbe* Root

Table 1 present the results of the qualitative phytochemical screening of root of the medicinal plant. The qualitative phytochemical screening of the root of *Pausinystalia yohimbe* revealed the presence of a variety of plant secondary metabolites such as saponins, alkaloids, phenols, flavonoids, tannins, steroids and cardiac glycosides.

Table 1: Qualitative phytochemical result of the methanol root extract of *Pausinystalia yohimbe*

Phytochemicals	Inference
Saponins	+
Alkaloids	+
Phenols	+
Flavonoids	+
Tannins	+
Steroids	+
Cardiac glycosides	+

Legend: + = present

3.2 Quantitative Phytochemical Screening of *Pausinystalia yohimbe* Root

Table 2 presents the results obtained for the quantitative phytochemical analysis of root of the medicinal plant (*P. yohimbe*). The medicinal plant had the presence of some secondary metabolites in varying quantities.

Table 2: Quantitative phytochemical result of the methanol root extract of *P. yohimbe*

Phytochemicals	Concentrations (%)
Saponins	0.583
Alkaloids	2.427
Phenols	0.433
Flavonoids	0.821
Tannins	0.294
Steroids	0.387
Cardiac glycosides	0.929

3.3 Proximate Composition Analysis of *Pausinystalia yohimbe* Root

Table 3 and Table 4 presents the results obtained for the proximate composition analysis of whole root extract of *Pausinystalia yohimbe*. For the qualitative analysis as shown in Table 3, *P. yohimbe* revealed the presence of all the nutrient tested; for the quantitative analysis (Table 4), *P. yohimbe* had varying percentage concentration/ quantities of the nutrient tested.

Table 3: Qualitative proximate composition of *P. yohimbe* root extract

Nutrient	Inference
Moisture	++
Protein	+
Fat	+
Ash	+
Crude fibre	++
Carbohydrates	+++

Legend: + = present; ++ = highly present; +++ = very highly present

Table 4: Quantitative proximate composition of *P. yohimbe* root extract

Nutrient	Composition (%)
Moisture	10.77
Protein	6.92
Fat	137
Ash	8.86
Crude fibre	14.93
Carbohydrates	57.15

3.4 Mineral Elemental Screening of *Pausinystalia yohimbe* Root

Furthermore, Table 5 and Table 6 presents the results obtained for the mineral analysis of root extract of *Pausinystalia yohimbe*. For the qualitative analysis as shown in Table 5, *P. yohimbe* revealed the presence of appreciable quality/number of some elemental composition; equally importantly, for the quantitative analysis (Table 6), *P. yohimbe* had varying appreciable percentage concentration/quantities of calcium, magnesium, phosphorous, iron, copper and zinc.

Table 5: Qualitative mineral composition of *P. yohimbe* root extract

Minerals	Inference
Calcium	+
Magnesium	+
Phosphorus	+
Iron	+
Copper	+
Zinc	+

Legend: += present

Table 6: Quantitative minerals composition of *Pausinystalia yohimbe* root extract

Minerals	Composition (g/100g)
Calcium	0.42
Magnesium	0.37
Phosphorus	0.29
Iron	1.92
Copper	0.068
Zinc	1.0

Plants used in the treatment of diseases contain bioactive principles with biological activity some of which are responsible for the characteristic odour, pungencies and colour of plant, while others give the particular plant its culinary, medicinal or poisonous virtue [15]. The result of the qualitative phytochemical constituents of root extract of *Pausinystalia yohimbe* showed that the tested phytochemicals (saponins, alkaloids, phenols, flavonoids, tannins, steroids and cardiac glycosides) were present. This corresponds with the report by Kasolo *et al.* [16]. However, Oluduro [13] reported absence of steroids and cardiac glycosides while Bamishaiye *et al.* [9] reported absence of cardiac glycosides in the leaf extract of *Moringa oleifera*. The presence of alkaloids together with saponins is the reason why *Pausinystalia yohimbe* is used as an aphrodisiac and as well to treat hypertension; because yohimbine is the indole-alkaloid responsible for aphrodisiac activity while saponins prevent the excessive intestinal absorption of cholesterol and thus reduce the risk of cardiovascular diseases such as hypertension. The flavonoids have long been recognised to possess anti-allergic, anti-inflammatory, antiviral, antiproliferative and anti-carcinogenic activities as well as to affect some aspects of mammalian metabolism [17].

Also, the results showed that *Pausinystalia yohimbe* root contain appreciable nutritious compound making it to be a good source of food supplement. Appreciable level of crude in *Pausinystalia yohimbe* root is acceptable as it prevents the occurrence of diseases thereby promoting good health. Carbohydrate deficiency causes depletion of body tissues. Sufficiency of carbohydrate is however, necessary for optimum functioning of the brain, heart, nervous, digestive and immune system [18]. High content of moisture (10.77%) and ash content of 8.86% were recorded in this study which were relatively higher than that obtained in similar researches with moisture content value of 3.21% and ash content value of 7.13% [19]. The variation in nu-

tritional makeup of the dried *P. yohimbe* root analyzed in this study and that of other similar researches could be attributed to the difference in genetic makeup of the plant and varying climatic and soil factors.

Intakes of elements such as macronutrients and micronutrients are essential for physiological and metabolic processes. The result reported in this study for minerals shows that *Pausinystalia yohimbe* root contain appreciable amounts of mineral elements. Calcium (0.42 g/100 g) which is required for normal growth, strong muscles and skeletal development was detected in the root. Thus, *Pausinystalia yohimbe* roots are available as a good source of Ca to farm animals or humans. The Mg content recorded in this study was 0.37g/100 g. It is an essential element that the body required for structuring of skeleton and muscles [20]. Fe is an essential trace element for normal functioning of the central nervous system and in the oxidation of carbohydrates, protein and fats. It is also a necessary component of haemoglobin and myoglobin for oxygen transport and cellular process of growth and division. The plant root contained Cu, which is considered to have strong effects on the immune system. The presence of Zn in any plant material is of special interest in view of important Zn in the diet of humans. Zinc is essential for the synthesis of DNA, RNA, insulin and function of several enzymes, zinc is also required for cell reproduction and growth especially the sperm cells [20].

4 Conclusions

The root of the plant used in this study was found to contain important phytochemical constituents needed to combat various kinds of infection in human and nutritional contents, which are useful for wide range of metabolic functions. The result of the phytochemical constituents in this study has authenticated *P. yohimbe* usefulness by traditional herbalists in ethnomedicine. Also, results of the proximate and mineral elemental analyses revealed the presence of appreciable amount of nutritious compounds in the roots of *Pausinystalia yohimbe*, and this proves why root of this plant is used as food supplement. However, effort should be directed towards harnessing its potentials in drug formation and development.

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