

Original Research Article

Phytochemical and nutrient composition of *Pterocarpus erinaceus* stem bark

ABSTRACT

The use of plants for medicine is gaining more acceptability worldwide due to its availability, affordability, efficiency and considerable safety. This study sought to gather information on the phytochemical and nutrient composition of *Pterocarpus erinaceus* stem bark. This will be a guide to the importance of the plant healthwise. Phytochemical, proximate, mineral and vitamin analysis was done using standard procedures. Alkaloids, saponins, tannins, flavonoids, steroids were present in both aqueous and ethanolic stem bark extracts of *Pterocarpus erinaceus*. Anthraquinone was present only in the ethanolic extract. Proximate analysis shows high carbohydrate and fibre content 39.33 ± 0.05 % and 31.22 ± 0.32 % respectively. The extract also contains 8.70 ± 1.10 % protein and 0.45 ± 0.50 % fat. *Pterocarpus erinaceus* stem bark is a rich source of vitamin A (75.87 ± 0.12 IU/100g) and B₉ (71.25 ± 1.23 mcg/100g). Heavy metals (Cd, Pb and Ni) were not detected in this study. Phosphorus and iron were detected in high amount. This therefore justifies the use of this plant for the treatment of diseases such as anaemia and diarrhea. Research should be carried out on this stem bark to explore more potentials of this plant.

Keywords: Anaemia, antioxidant, , heavy metals proximate analysis, *Pterocarpus erinaceus*

Introduction

22 Medicinal plants play an important role in maintenance of human and animal health. A wide
23 array of diseases including life threatening diseases such as cancer, diabetes, hypertension etc.
24 are being treated successfully with medicinal plants. These plants are widely consumed not only
25 for medicinal purposes but also as food. These role played by plants are due to the presence of
26 phytochemicals and nutrients. Phytochemicals which include tannins, flavonoids, saponins,
27 terpenoids, and alkaloids play key role in defense against numerous diseases [1].

28 Reports on the role of minerals (elements) present in plants have been on the increase in recent
29 years [2]. Minerals are essentially required for tissue functioning, [3], osmotic adjustment and to
30 activate enzymes [4]. Humans do not synthesize it and so, obtain it from their diet [5].Major
31 minerals such asCa, Mg, Cl, Na, S, K, P serve as structural components of tissues, function in
32 cell metabolism and acid-base balance [6]. Many trace elements play vital roles in prevention
33 and treatment of diseases [7]

34 Vitamins have diverse biochemical role which include antioxidation [8], precursors for enzyme
35 cofactors and hormones [9]

36 *Pterocarpus erinaceous* (family: Leguminosae-papilionoideae) is a deciduous legume tree of
37 African savannas and dry forest.The tree grows to about 12-15m tall and 1.2m in diameter. The
38 stem bark is dark grey and scaly, The leaves are compound and imparipinnate, upto 30cm long.
39 It has yellow flowers. The fruits present winged outgrowth [10] [11]. The seed is kidney shaped
40 to oblong and usually narrowed and curved near the minute hilum [10}. It is commonly known
41 as Afican rosewood. The leaves and seeds are edible after proper cooking [10]. It produces one
42 of the finest wood in its native region. Foliage and immature pods are sometimes cut down at the
43 end of the dry season to fatten sheep, goats, cattle and horses. The leaves are used in

44 abortifacient mixtures and as a febrifuge. The bark is used for treatment of scalp infections due
45 to ringworm, for chronic ulcers, blennorrhagia and is gargled for tooth and mouth troubles. The
46 bark and resin is used for urethral discharge and as an astringent for severe diarrhea and
47 dysentery. The grated root is mixed with tobacco and smoked in a pipe as a cough remedy [10].
48 The trunk and root bark are used in malnutrition, debility, pregnancy and anaemia [11];[12].



49
50 Fig. 1: *Pterocarpus erinaceus* plant.

51 Despite its popular use in traditional medicine, little has been reported about its nutritional and
52 phytochemical constituents. This study was therefore conducted to provide information on the
53 phytochemical, proximate, element and vitamins composition of *Pterocarpus erinaceus*.

54 Methodology

55 Collection and preparation of plant material

56 The stem bark of *Pterocarpus erinaceus* were collected in the month of January, 2016 at Vakuna
57 village in Maiha (coordinates: 9° 59' 44" N 13° 13' 5" E) local government area of Adamawa state,

Nigeria. The plant was taxonomically identified and authenticated in Biological Science Department of Modibbo Adama University of Technology, Yola. The stem bark was air-dried. It was then reduced to powdered form by grinding in pestle and mortar.

Phytochemical screening

Qualitative analysis was carried out on the aqueous extracts to identify the constituents using standard procedures as described by [13][14][15]..

Proximate Composition

The proximate composition of the sample was determined using the standard methods of analysis of Association of Official Analytical Chemists [16]. Moisture content of the samples was determined by air oven (Gallenkamp) method at 105°C. The crude protein of the sample was determined using micro-Kjeldahl method. Crude lipid was determined by Soxhlet extraction method using petroleum ether as extracting solvent. The ash content was determined using a muffle furnace set at 550°C for 4hours until constant weight of ash is obtained. Crude fibre was determined using the method of [17]. The carbohydrate content was obtained by difference.

Determination of vitamins

Vitamins A, B and C content of the vegetable were determined using [16].

Mineral analysis

Mineral content was determined using atomic absorption spectrophotometric analysis as described by [18] .

Results

80 Phytochemical screening shows the presence of alkaloids, flavonoids, glycosides, phlobatannins,
 81 saponins, steroids and tannins in both aqueous and ethanolic extract of the plant. Anthraquinone
 82 was present in the ethanolic extract but absent in the aqueous extract of *P.erinaceus* as shown in
 83 table 1.

84 Table 1: Phytochemical analysis of aqueous and ethanolic extracts of *P. erinaceus*

Phytochemical	Aqueous extract <i>P.erinaceus</i>	Ethanolic extract <i>P.erinaceus</i>
Alkaloids	+	+
Anthraquinones	-	+
Flavonoids	+	+
Glycosides	+	+
Phlobatannins	+	+
Saponins	+	+
Steroids	+	+
Tannins	+	+
Terpenoids	-	-

85 Results of proximate analysis of *Pterocarpus erinaceus* stem bark shows that it has high
 86 carbohydrate content (39.33%). It also contains fibre (31.22%), proteins (8.70%) and moisture
 87 content of 1.85% as shown in table 2.

88 Table 2: Proximate analysis of *pterocarpus erinaceus* stem bark

Constituents	%
Ash	18.40 ± 0.12
Carbohydrate	39.33 ± 0.05
Fibre	31.22 ± 0.32
Fats	0.45 ± 0.50
Moisture content	1.85 ± 0.26
Proteins	8.70 ± 1.10

89 Results are mean ± SEM (n=3)

90

91 Table 3 shows that *P.erinaceus* contains high amount of vitamin B₉ (Folic acid) and vitamin A.
 92 Vitamin C and K is present in very low amount ;2.18 ± 0.99mg/100g and 3.76 ± 1.00mg/100g
 93 respectively.

94 Table 3: Vitamins content of *Pterocarpus erinaceus*

Vitamin	Amount
A	75 ± 0.12 IU/100g
B ₉ (Folic acid)	71.25 ± 1.23 mcg/100g
B ₁₂	0.89 ± 0.08 mcg/100g

C	$2.18 \pm 0.99\text{mg}/100\text{g}$
E	$0.12 \pm 0.07 \text{ mcg}/100\text{g}$
K	$3.76 \pm 1.00 \text{ mcg}/100\text{g}$

95 Results are mean $\pm$ SEM (n=3)

96 Table 4 shows that the stem bark of *P.erinaceus* contains high amount of Phosphorus, copper
97 and iron. Lead, cadmium and nickei were not detected.

98 Table 4: Mineral/element contents of *P. erinaceus* stem bark

Element	mg/100g
Cadmium	ND
Copper	10.88 ± 0.78
Iron	18.65 ± 0.89
Lead	ND
Manganese	0.93 ± 0.97
Nickel	ND
Phosphorus	27.30 ± 0.68
Zinc	0.42 ± 0.85

99 Results are expressed as mean $\pm$ SEM of three determinations.

100 Discussion

101 Phytochemical screening shows the presence of alkaloids, flavonoids, glycosides, saponins,
102 steroids and tannins . The presence of theses phytochemicals n *P. erinaceus* stem bark was also
103 reported by [19][20]. The absence of anthraquinone in aqueous extract observed in this work
104 was also reported by [21]. [19][20] reported the presence of terpenoids in the aquoues and

105 methanolic stem bark extracts of *P.erinaceus*. Differences in phytochemical components of
106 plants arise due to genetic variations and environmental conditions [22]

107 The phytochemicals found in *P.erinaceus* stem bark have been reported to be beneficial in
108 treatment of various diseases.. Alkaloids and their synthetic derivatives exhibit antispasmodium,
109 antibacterial and analgesics properties [23]. Steroids and triterpenoids also exhibit analgesic
110 properties [24][25]. This may justify its use in the treatment of fever. Saponins lowers blood
111 cholesterol, stimulates immune system [26]. It also have antitumor, anti mutagenic and
112 antihypoglycemic property [27]. Tannin is used in the treatment of Diarrhea [28] and may be the
113 justification for its use in the treatment of diarrhea. Flavonoids are free radical scavengers, they
114 prevent oxidative damage and have strong anticancer activity [27] they also function to protect
115 against allergies, inflammation, ulcer and tumor [29]. The presence of these phytochemicals in
116 *P.erinaceus* stem bark makes the plant a potential in the treatment of a wide array of disease.]

117 *P.erinaceus* stem bark is a good source of carbohydrate and fibre and may serve as animal feed.
118 Vitamin B₉ is necessary for rapid cell division and growth. In combination with vitamin B₁₂, it is
119 essential for the productions of red blood cells. It is necessary for efficient neural tube
120 development during pregnancy. Vitamin A stimulates the production and activity of white blood
121 cells for normal immune function. *Pterocarpus erinaceus* is a rich source of vitamins A and B₉.
122 This may be the justification for the use of this plant during pregnancy and in anemic
123 conditions. It also contains slight amount of Vitamin C ($2.18 \pm 0.99\text{mg}/100\text{g}$). Vitamin C serves
124 as an antioxidant [3], and can prevent the body from free radicals that can cause cancer.

125 The results of the mineral composition (table 4) show that stem bark is rich in sources of copper,
126 iron and phosphorus. Heavy metal such as lead, cadmium and nickel were not detected. Copper,

iron and zinc are essential micro nutrients while others such as cadmium and lead have no biochemical or physiological importance and are considered toxic pollutant [18]. . Phosphorus is involved in many metabolic processes including those involved in many metabolic processes including those involving the buffers in body fluids [30]. Zinc is essential for the production of insulin [31] and helps prevent and manage diarrhea. Vitamin A and E metabolism and bioactivity are dependent on zinc status [32]. It is also necessary for fertility [33], for wound healing and plays vital role in protein synthesis and digestion. [34]: [35]. Copper is a constituent of enzymes like cytochrome c oxidase, catalase, ascorbic acid oxidase etc, it plays a role in iron absorption [36], and incorporation in hemoglobin [35]. It is thus, necessary for the hematological and neurological systems [37]. Iron is a part of the hem of hemoglobin, myoglobin and the cytochromes [36]. It is required for making hemoglobin [38].

Conclusion

This study reveals that *Pterocarpus erinaceus* stem bark is a rich source of vital vitamins and minerals such as vitamins A, B₉, Phosphorus and iron. It also contains useful phytochemicals such as alkaloids, flavonoids, tannin and saponin. The presence of these substances makes it a potential for the treatment of a wide array of diseases such as anemia, cancer, diarrhea, diabetes, etc. Further studies should be carried out to reveal and ascertain these potential

Abbreviations

ND- not detectable. P.erinaceus – Ptericarpus erinaceus.

Declaration

The authors declare that the work is an original work and has not been published in any journal.

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