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Phytochemical Screening, Proximate and Metal Content Analysis of the Stem Bark of *Psidiumguajava Linn,* (Myrtaceae).

[1]Okunrobo OL,* [2]Imafidon EK, [3]Okoye KM

Departments of [1]Pharmaceutical Chemistry, Faculty of Pharmacy, [2]Biochemistry, Faculty of Life sciences, University of Benin, Benin city, and [3]Pharmaceutical Chemistry, Faculty of Pharmacy, Madonna University, Elele, Nigeria.

ABSTRACT

Herbal medicine has been in use for centuries and the need for proper standardization remains a pressing issue among users and health practitioners. This work looks at the phytochemical analysis of dried powder *Psidiumguajava* stem bark, proximate and metal content. The phytochemical analysis of the dried powder stem bark of *Psidiumguajava* shows that it contains most of the medicinal constituent like glycosides, tannins, terpenoids, saponins, carbohydrates, flavonoids, and alkaloids. This explains its wide use in the treatment of disease by traditional healers. Proximate analysis also showed that it has a high nutritional carbohydrate with low protein, lipid and fiber content. Metal analysis revealed that the powdered bark has low calcium (1.51 mg/kg), magnesium (0.69 mg/kg), iron (12.97 mg/kg), potassium (0.72 mg/kg) and sodium (0.03 mg/kg) value, while manganese (25.33 mg/kg) and zinc (49.69 mg/kg) values are very high, in comparism with the tolerable upper intake value and the dietary recommendation as stipulated by the dietary reference intakes (DRIs). Hence adequate screening and standardization are necessary before administration of the crude extract.

KEY WORDS: Proximate analysis, Phytochemicals, Metal content,*Psidiumguajava,* Stem bark

INTRODUCTION

According to the World Health Organization, approximately 80 % of the world's population use herbal drugs as part of their normal health care routine [1]. In Africa and across the United States, herbal medicines represent the fastest growing segment of pharmacy trade; certainly, the cost of medical care cannot be overlooked when considering the reasons for interest in alternative form of medicine [2]. Nature has been a source of medicinal agents for thousands of years and an impressive number of modern drugs have been isolated from natural sources, many based on their use in traditional medicine. Higher plants, as sources of medicinal compounds, have continued to play a dominant role in the maintenance of human health since ancient times [3]. Over 50 % of all modern clinical drugs are of natural product origin [4] and natural products play an important role in drug development programs in the pharmaceutical industry [5]. Herbal preparations are most often used as crude mixtures and are not standardized or analyzed for content of their active principles, hence the chemistry of medicinal herbs cannot be treated in the same way as that of say a pure antibiotic or calcium blocker. The medicinal chemistry of the actions, interactions and side effects of herbal products is complex and difficult to access clinically and chemically [6].

Heavy metals are those metals having high atomic weights (usually greater than 23) or molar masses and some of them are transition metals e.g Iron, Mercury, Lead, Zinc etc [7]. The wide spread contamination of surface water by heavy metals is of increasing concern to scientist. The concentration of various elements in air, water, and land may be increased beyond their natural levels due to agricultural, domestic and industrial effluents. In Nigeria, the growing rate of industrialization is gradually leading to contamination and deterioration of the environment. Since industrialization and heavy metal pollution are correlated, it is imperative to ascertain if the concentration of heavy metals found in these areas is safe for use hence the thrust of this study [8].

Psidiumguajava is a native of Mexico, Central America and North South America, most likely naturally spreading (by means of ocean drifting) to part of Caribbean and some parts of North Africa

* Corresponding author: Email: okunrobo@uniben.edu, Phone 234-8034725416

Guavas are now cultivated and naturalized throughout the tropics and due to growing demand they are also grown in some tropics and subtropical regions [9]. Mature trees of most species are fairly cold-hardy and can survive as low as 5°C (41° F) for short periods of time, but younger plants will not survive [9].

The active constituent of the leaf part of the plant is quercetin, spasmolytic and antidiarrhea effect is associated with its querctin-derived flavonoid glycosides, which supports the use of this ancient leaf remedy in treating gastrointestinal disorders [10]. Guava bark is used medically as an astringent and to treat diarrhea in children [11]. The leaf and bark extracts have *in vitro* antimicrobial activity mostly associated with flavonoids such as quercetin and quercetin glycosides [12]. Having seen the various medicinal and non-medicinal uses of *Psidiumguajava* we went ahead to determine the proximate and metal composition of the stem bark in order to evaluate the tolerability profile of the stem bark of *Psidiumguajava*

M ATERIALS AND METHODS

Collection and identification of plant materials

The stem bark of the plant *Psidiumguajava*was collected on 12th November 2009 from Elele in Kelga Local Government Area of Rivers State, Nigeria. The stem branches of the tree were cut off and the bark was peeled off using a machete. The bark samples were sundried and packed in bags. The sample was further dried in the laboratory for 21 days. The plant was identified and authenticated by Pharm (Mrs) A. Ogah, Department of Pharmacognosy, Madonna University Elele.

The dried stem bark were reduced to coarse sample in a ceramic mortar using a pestle, in order to increase the surface area. The plant sample in its reduced size was then milled to powder using Wiley Mill after which it was sieved to obtain a fine powder with Sieve numbers 8 & 10. Suitable precaution was taken to avoid contamination of the sample. The milled powder sample was collected and stored in glass jars, tightly covered and kept for further studies.

Phytochemical screening

Qualitative assay, for the presence of plant secondary metabolites such as carbohydrate, alkaloids, glycosides, flavonoids, tannins and saponins were carried out on the powdered stem bark following standard procedure[13,14].

Analysis of metals

The powdered sample (2g) was accurately weighed into a clean platinum crucible, ashed at 500°C, and cooled to room temperature in a desiccator. The ash was dissolved in 10 ml 20 % nitric acid and filtered into 100ml volumetric flask. The crucible was rinsed with distilled water and transferred to the flask, shaken to mix well and made up to the 100 ml mark with distilled water. Analysis of the sample for calcium, sodium, potassium, magnesium, zinc, iron and manganese content was carried out in triplicate on the Atomic Absorption Spectrophotometer (AAS) [15].

Proximate analysis

The proximate evaluation for the ash, moisture, fibre, protein, fat and carbohydrate content was done using the Association of Official Analytical Chemists method [16].

DISCUSSION AND RESULTS

The phytochemical screening carried out on the powdered stem of *Psidiumguajava* revealed the presence of the following secondary metabolites: carbohydrates, tannin, saponins, anthraquinones, alkaloids, cardiac glycosides.

Table 1: Result of the phytochemical screening of powdered stem bark of *Psidiumguajava*

Secondary Metabolites	Powdered stem bark
Alkaloids	+
Anthraquinone	+
Cardiac glycosides	+
Flavonoids	+
Reducing sugars	+
Tannins	+
Saponins	+

Key: + means present

The presence of these constituent gives an indication of the medicinal value of the stem bark. For example, flavonoids have been found to have antioxidant properties, antibacterial and antimicrobial properties [17,12]. Alkaloids have pronounced physiological effect particularly on the nervous system [18]. The presence of these constituents in the stem bark suggests that the plant is pharmacological active, supporting the claim by traditional healers.

Table2: Result of proximate analysis of *Psidiumguajava* stem bark powder

Powdered stem bark of *Psidiumguajava*	Content	Dietary Recommended Allowances in a male aged 40-50 years old[a]	Dietary Recommended Allowances in a female aged 40-50 years old[a]
Percentage ash	3.20±0.80		
Percentage Protein	2.60±0.60	56g/day	46g/day
Percentage Fibre	3.60±0.40	38g/day	25g/day
Percentage Fat	1.30±0.30	20-35 % of calories	20-35 % of calories
Percentage Carbohydrate	88.30±0.70	130g/day	130g/day

Proximate evaluation (Table 2) conducted on the powdered stem bark of *Psidiumguajava*revealed that it had a relatively low moisture and ash content (1.0 % and 3.2 % respectively). The ash content value is an indication of its inorganic constituents which means that the stem bark is mostly composed of inorganic molecules. The result also showed that it has low fat and protein content which indicates that the calories constituent is very low. The fibre content is also low (3.6 %) and depicts a very small bulk which provides important protection against gastrointestinal disease. Carbohydrate composition is relatively high (88.30 %) which provides the major constituent of the stem bark and serves as a source of energy.

Table 3: Result of metal screening of powderedstem bark of*Psidiumguajava*

Powdered stem bark of *Psidiumguajava*	Content (mg/kg)	Dietary Recommended Allowances in a healthy 25-year old male[a]	Tolerable Upper Intake level[a]
Calcium	1.51±0.30	1000 mg	2500 mg
Magnesium	0.69±0.03	400 mg	350
Zinc	49.69±0.04	11 mg	40 mg
Manganese	25.33±0.60	2.3 mg	11 mg
Potassium	0.72±0.01	4700 mg	–
Sodium	0.03±0.02	1500 mg	2300 mg
Iron	12.97±0.13	8 mg	45 mg

[a]Institute of Medicine [19]

The metal content analysis revealed that the metals in the stem bark of *Psidiumguajava*are well below the tolerable upper intake value and the dietary recommendations stipulated by the dietary reference intakes (DRIs) but that of manganese is far higher than the tolerable intake value and the dietary allowance (Table 3). The natives use an average of 500g of the powder bark in the treatment of most diseases and result from the metal screening shows that the manganese value for the average powder bark used by the natives is about 25.33 mg while the dietary allowance is 2.3 mg and the tolerable intake value is 11 mg showing that the value of manganese is higher than both the dietary allowance and the tolerable upper intake value. The value for zinc is 49.69 mg which is also higher than the dietary allowance which is 11 mg.

In conclusion, the metal analysis revealed that the plant is not safe when used in its crude state as the patient might suffer some metal toxicity as in manganese and zinc in the case of this powder sample, hence adequate screening and standardisation is necessary before administration of the crude extract.

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