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Evaluation of the Phytochemical, Proximate and Mineral Contents of *Phyllanthus niruri* (L). Found in Sokoto State

[1]Aisha Umar and [2]Hauwa'u Bello Abubakar

[1]Biological Sciences Department, Sokoto State University, Sokoto, Sokoto State, Nigeria.
[2]Microbiology Department, Sokoto State University, Sokoto, Sokoto State, Nigeria.

Corresponding Author's Email: aishaumar258@gmail.com

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ABSTRACT

This study is aimed at evaluating the phytochemicals, proximate and mineral content of the stems and roots of *Phyllanthus niruri* plant. The plant was collected from Bado area in Wamakko Local Government area of Sokoto State. The extracts obtained from extraction were screened for phytochemicals. The proximate analysis of the stem and root of *P. niruri* yielded low moisture content (3.0-3.5%) and high ash, protein and carbohydrates. The plant was shown to contain important minerals like potassium, magnesium, calcium, and phosphorus. The order of extraction was methanol > ethyl acetate > n-hexane. The extracts revealed the presence of carbohydrates, alkaloids, tannins, saponins, steroids, cardiac glycosides and anthraquinones respectively. The presence of these constituents accounts for the local medicinal uses. It was concluded that the extract of *Phyllanthus niruri* consists of constituents of pharmaceutical importance. It was concluded that the extract of *Phyllanthus niruri c*onsists of important constituents of pharmaceutical importance and could also be used as a dietary supplement.

Keywords*: Phyllanthus niruri*, extraction, medicinal, extracts, pharmaceutical.

1.0 INTRODUCTION

Herbal medicine (also known as Herbalism or Botanical medicine) is a branch of medicine that involves the study and use of plants or plant parts for therapeutic purposes. Though the field dates to prehistoric times, it remains vital and relevant in today's medical research, and about a quarter of modern medicines are sourced from plants (Ackerknecht, 1973; Majno, 1975; Duke and Martinez 1994; WHO, 2002 and WHO, 2005). World Health Organization (2014) reported that herbal or traditional medicine is fundamental to meeting the primary health care needs of the population in many developing countries. Today, even in advanced countries, a lot of people rely on medicinal plants for diseases This has arisen because of several factors including the high cost of conventional drugs, problems associated with side effects of some drugs, the inability of existing conventional medication to cure certain ailments and resistance of some diseases to some drugs (Srivastava *et. al.*, 1996).

To date, a wide range of medically active agents have been isolated from different parts of plants as extracts in many countries and these have been used as sources of many potent and powerful drugs (Srivastava *et al.*, 1996) and for developing new pharmacologically active compounds (Vieira *et al*., 2014). Some drugs that have been developed from plants and are still in use today include the analgesic drug aspirin, from *Filipendularulmaria; the a*ntimalaria agent, quinine from *Cinchona spp*; antineoplastic alkaloid, vincristine from *Catharantusroseus* and *digitalis* leaf as remedy for congestive heart failure (Sanusi, 2006) and artemisinin derivatives from *Artemisia annua* plant for possible treatment of malaria and COVID-19 (Gilmore, 2020). It is well-known that the root, stems, flower, fruit, twigs; exudates modified plant organs are plant parts that have served as sources of extracts for these medically-active compounds (Mendes *et. al.*, 2010).

Medicinal plants are widely distributed throughout the world and have been used by almost all cultures (Barnes *et. al.*, 2007). And though many reports have highlighted numerous plant species with great potential in the control of microorganisms, a vast number remain largely unexplored. Among the estimated 250,000 plant species, only a small percentage has been investigated phytochemically (Gerharts *et al.*, 1985).

In Sokoto State, Nigeria, *Phyllanthus niruri (L*) is a plant that is well-known in traditional medicine

with all parts of the plant being used locally for treating one form of ailment or the other (Table 1). For example, the plant is traditionally believed to cure malaria, snake bite, and sore throat (Aisha, *et al*., 2019). Though some studies exist on some species of these plants (Kamal, *et al.*, 2012; Ibrahim *et al.*, 2013 Shanmugam *et al.*, 2014*)*, the studies are limited in either the part of the plant analysed or the solvent used for extraction. This study, therefore, extends previous studies by examining the proximate and phytochemical contents of the plant grown in Sokoto State. The mineral content of the plant was also evaluated.

2.0 METHODOLOGY

2.1 Study area

The plants were collected from Bado area in Wamakko local government area of Sokoto State located within longitude 5^0 11'-5^0 12'E and latitude 13^0 06' -13^0 08'N. The plant was taken to the herbarium of the botany unit of the Biological Science Department of Usmanu Danfodiyo University Sokoto for authentication.

2.2 Plant Processing

Each of the collected plant parts was separately processed into a fine powder and stored in a polythene bag for further analyses.

2.3 Proximate Analysis

The processed plant samples were analysed for their proximate contents. This involved the estimation of the main components of plants using procedures AOAC (Association of official analytical chemists; official methods of analysis) (1990). that allow reasonably rapid and acceptable measurement of various food fractions. In this analysis, moisture content, ash content, crude protein, carbohydrates, lipids and Mineral content of *Phyllanthus niruri* stem and root were determined as described in Edward and Kenneth (2005).

2.4 Extraction of *Phyllanthus niruri*

For the extraction, 500 g of the crude powdered plant material (stem and root of the plant were extracted using the maceration process in an airtight clean flat bottom container in 1500 mL of the solvent for 24 h and the content was filtered using Whatman filter paper. The filtrate was concentrated to dryness at 39 ^oC using a rotatory evaporator. After extraction with n-hexane, the residue was weighed before successively extracting with ethyl acetate and methanol (Hadiza, 2017).

2.5 Phytochemical Screening

The Phytochemical screening of the plant was determined using standard methods as described by Harbone (1973), Soforowa (1984), Soforowa (1993), and El-Olemyl *et al*., (1994). The different extracts of *P. niruri* were screened for the presence of alkaloids, proteins and amino acids, anthraquinones glycosides, flavonoids, carbohydrates, saponins, steroids tannins and steroids.

3.0 RESULTS AND DISCUSSION

3.1 Proximate composition of the stems and roots of *P. niruri*

The proximate contents determined were moisture, ash, lipid, fibre, crude protein and carbohydrates. These were measured as percentages of the dry powdered samples of the plants. Table 1 gives the proximate contents of the stems and roots of the *P. niruri* plant. The table reveals that the stems and roots of the plant were low in moisture, ash and lipid contents. Also, it shows that the stems and roots of the plants had good percentages of fibre, crude protein and carbohydrates.

Table 1: Percentage proximate composition of the stems and roots of *P. niruri*

Proximate content (%)	***P. niruri***	
	Stem	**Root**
Moisture content	1.5	1.0
Ash content	7.5	5.0
Lipid content	1.5	0.5
Fibre content	14.5	8.5
Crude protein	12.95	8.75
Carbohydrate	62.05	76.31

3.2 Mineral composition of the stems and roots of *P. niruri* plant

The amount (%w/w) of sodium, potassium, calcium, magnesium and phosphorus in the stems and roots of the plants, *P. niruri* were investigated. The results are presented in Table 2. The results showed that sodium and potassium were major components in the plants whereas calcium, magnesium and phosphorus were present in minor amount in the plants.

Table 2: Mineral composition of the stems and roots of *P. niruri* plant

Minerals(%)	***P. niruri***	
	Stem	**Root**
Sodium	82.5	65.0
Potassium	42.0	21.0
Calcium	0.60	0.65
Magnesium	1.30	1.06
Phosphorous	4.14	3.70

3.3 Qualitative Phytochemical Screening

The phytochemical test was done on all the fractions and the results obtained are presented in Table 4. Alkaloids, tannins, saponins, glycosides and steroids were present in the ethyl acetate and methanolic fractions whereas only glycosides and steroids were present in the hexane fractions. Flavonoids were present only in the methanolic extracts whereas anthraquinones were absent in all the fractions. The yield of fractions with various solvents is also presented in Table 3.

Table 3: The Yield of Fraction with Various Solvents

Plants extracts		**Fraction**	**Weights (g)**	**Yield (%)**
P. niruri	Stem	Hexane	4.0	0.8
		Ethyl Acetate	10.5	2.1
		Methanol	13.5	2.7
	Root	Hexane	4.5	0.9
		Ethyl Acetate	5.0	1.0
		Methanol	9.0	1.8

Table 4: Phytochemical Analysis of extracts of stems and roots of P. Niruri in various solvents

Phytochemicals	**Extracts**					
	Stem			**Root**		
	HX	**ET**	**MET**	**HX**	**ET**	**MET**
	P. niruri					
Alkaloids	-	+	+	-	+	+
Tannins	-	+	+	-	+	+
Saponins	-	-	+	-	-	+
Glycosides	+	+	+	-	+	+
Flavonoids	-	-	+	-	-	+
Steroids	+	+	-	+	+	-
Anthraquinones	-	-	+	-	-	+

Key: - = absent, + = present, HX= hexane fraction, ET = ethylacetate fraction, MET = methanol fraction.

4.0 DISCUSSION

The proximate analysis showed that the moisture content of the stem and root of *P. niruri.* are relatively low which is an indication of better storage ability as low moisture content indicates the possibility of low microbial attack by microorganisms during storage (USDA,2013). The ash content reported in the plant was higher than those reported by Okiki *et al.* (2015) and Chidi*et al.* (2007) for *P. amarus*. This high ash content is an indication of its suitability as a good source of fertilizer (anonymous 2020). High ash content also makes it a good ingredient for anti-

ageing, skin smoothening and for reducing inflammations (Anonymous, 2010).

The lipid and fibre contents were high and Fat is important in diet because it promotes fats-soluble vitamin absorption and contributes to the energy content production (Olaole and Adediran, 1994). The crude protein in *P. niruri* was higher than those reported by Ibrahim *et al.* (2013) and compare favourably with most cases or surpassed those reported for most medicinal plants. This is suggestive of the healing properties of the plants as an enzyme and for the repair of worn-out tissues. Although folk history does not have a record of *P. niruri* being used as a vegetable, the plant contains a high percentage composition of carbohydrates and crude fibre. This may be the reason why the plant's extract is allegedly used as a tonic (Thyagarajan *et al.*, 1988). The appreciable concentration of minerals such as sodium, potassium, calcium and magnesium observed in the plant is interesting. These minerals function in the maintenance of osmotic pressure and water distribution in the various body fluid compartments. This explains the traditional use of *P. niruri* extract in the treatment of oedema, kidney problems and Oliguria (Thyagarajan *et al*., 1998). The plant materials were sequentially extracted with different organic solvents in order of increasing polarity (i.e. n-hexane, ethyl acetate and methanol). The sequential extraction method ensured the extraction of active compounds from the plant materials according to their polarity and also is likely to reduce the antagonistic actions of compounds in the extracts; good yields were obtained when compared to other studies (Shina, 2014). Extractions in Methanolic solvents gave the highest percentage yields (2.7, 2.5 and 2.3% respectively). Extractions in n-hexane followed closely while extractions in ethyl acetate gave the least percentage yield. Often non-polar solvents yield more lipophilic compounds whereas alcoholic and polar solvents yield both polar and moderately polar components (Shina, 2014). The high yield using methanol solvent may be a result of the ability of methanol to extract both polar and moderately polar components. The phytochemical analysis of n-hexane, ethyl acetate and methanol extracts of the stem and root of *P. niruri* showed the presence of anthraquinones in addition to the phytochemicals. It was observed that more phytochemicals were extracted with increasing polarity of the solvent with the methanolic extracts having more phytochemicals while the n-hexane extracts had the least phytochemicals. This agrees with the findings of Shanmugan *et al.* (2014). The phytochemicals detected in the extract of *P. niruri* are consistent with those reported by Kamal *et al.* (2012), Ibrahim *et al.* (2013) and Shanmugan *et al.* (2014) for the leaf of *P. niruri*. The extracts of *P. niruri* were previously shown to contain a range of bioactive phytochemicals including saponins, alkaloids, cardiac glycosides, tannins and flavonoids (Aisha, 2018; Aisha, *et al*., 2019). The presence of these compounds in the extracts suggested their activity. Phytochemicals like saponins and alkaloids have been linked to antimicrobial activity (Aisha, 2019) and the possible use of extracts containing these phytochemicals as antifungal agents (Nino *et al.*, 2006; Rani and Murty, 2006). Steroids and cardiac glycosides were observed in the n-hexane extracts. Saponins were present in the ethyl acetate and methanol extracts while flavonoids and tannins were present in the methanolic extract. Generally, the methanolic extract has more phytochemicals. This may be as a result of its polar nature which enables it to extract moderately polar and polar components. Shinkafi (2013) have reported a high quantity of saponins and flavonoids in methanol extracts of plants. The presence of flavonoids in the plants may justify their use in the traditional treatment of skin diseases and wound healing. Tannins from indigestible and insoluble compounds with proteins, and this is the basis of their extensive use in the leather industry and the treatment of wounds and diarrhoea (Serker and Nahar, 2007).

5.0 CONCLUSION

Therapeutic products from plants have become indispensable in primary healthcare, particularly in developing countries and understanding the proximate and mineral content of the products has become fundamental to modern medical research. The present study has shown that the stems and roots of *P. niruri* contain good proximate and mineral contents such as carbon hydrate, lipids, sodium, potassium, magnesium and phosphorus and that good yields of natural products can be extracted from the stems and roots of the plant using solvents of increasing polarity.

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