Jewel Journal of Scientific Research (JJSR) 3(1): 173 -176, 2015
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Comparative studies of phytochemical constituents of leaf, bark and root of *Moringa oleifera* Lam

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Abstract

Comparative analysis of phytochemical constituents of the leaf, bark and root of *Moringa oleifera* (drumstick) was carried out, Qualitative and Quantitative Analyses of the phytochemical constituents were carried out using standard procedure. The results showed that aqueous extract of the plant parts tested positive for tannins, phlobatannins, saponins, flavonoids, terpenoids and alkaloids except cardiac glycosides which were present only in the root. Significant differences ($p \leq 0.05$) in phytochemical constituents were observed between the plant parts and they were found to be significantly higher in the leaf compared to the other parts. Among the phytochemical constituents investigated, saponin was found to be highest with mean value of 20.81 ± 2.38 mg/100g, followed in decreasing order by flavonoids, alkaloids, phenols and tannins with respective mean values of 4.00 ± 0.75 mg/100g, 2.00 ± 0.60 mg/100g, 1.73 ± 0.60 mg/100g and 1.03 ± 0.14 mg/100g. The present study therefore conclusively points out that *M. oleifera* is a good source of various pharmacologically active substances most especially saponin and cardiac glycoside, in which the latter is a drug of choice for the treatment of congestive heart failure.

Keywords: Alkaloids, Cardiac glycosides, Drumstick, Flavonoids, Phenols, Saponin

Introduction

Moringa oleifera commonly known as drumstick or horseradish tree is a pan-tropical species that is known by such regional names as benzolive, drumstick tree, kelor, marango, saijhan, and sajna (Fahey, 2005). It is the most widely cultivated species of a monogeneric family, the Moringaceae. Its origin is traceable to the sub-Himalayan tracts of India, Pakistan, Bangladesh and Afghanistan. Today it has become naturalized in many locations in the tropics and the subtropics. The plant is widely cultivated in Africa, Ceylon, Thailand, Burma, Singapore, West Indies, Sri Lanka, India, Mexico, Malabar, Malaysia and the Philippines (Fahey, 2005). In Nigeria, Furo and Ambali (2012) had established the plant as highly honoured by people in the tropics and subtropics for the many ways the plant is used both nutritionally and medicinally by people and local herbalist respectively. This could be one of the reasons the plant is highly relish and cultivated in many homes.

The plant can be grown on variety of soil conditions preferring well-drained sandy or loamy soil that is slightly alkaline (Abdul, 2007; Anjorin *et al*., 2010). It is considered one of the world's most useful trees, as almost every part of the tree can be used for food, or has some other beneficial properties (Bamishaye *et al.*, 2011). For instance the leaves, especially young shoots, are eaten as greens, in salads, in vegetable curries, and as pickles. The leaves can be eaten fresh, cooked,

or stored as dried powder for many months without refrigeration, and reportedly without loss of nutritional value. The leaves are considered to offer great potential for those who are nutritionally at risk and may be regarded as a protein and calcium supplement (Rajangam *et al*., 2001). *Moringa* leaves have been shown contain vitamin C content equivalent to that of seven oranges and four times of the amount of vitamin A in carrots and five times the protein milk (Owen, 2010). The roots have also been known to be used in the treatment of dental caries, common cold, fever, diarrhea, flatulence and edema (Fuglie, 1999). In folks remedies the bark is used for treatment of toothache, common cold, snake bite , epilepsy and scorpion bites (Fahey, 2005). The seed is eaten like peanut and the coagulant seeds could be used for waste water treatment.

The foregoing discourse had shown that almost every part of the plant is of tremendous values. The fact that the phytochemical constituent in plant varies from one part of the plant to other, the present study was carried out with view of providing information on the phytochemical constituents as found in leaves, bark and roots of this plant which are parts that are often utilized in traditional medicine for treatment of various ailments.

Materials and Methods

Collection and preparation of plant samples

Fresh plant samples (leaf, bark and root) of *M. oleifera* were collected in March 2014 from Iree Town, Boripe Local Government in Osun state. The plant samples were air-dried for 12 days and thereafter pulverized with the use of a sterile electric blender. The powdered samples were stored in hair tight container, stored in dark cupboard to prevent photo-oxidation of the phytochemical constituents until they were subjected to screening.

Extraction procedure

The aqueous extract of the dried powder were obtained by soaking 20 g of each of the plant parts (leaf, bark and root) in 200 ml in distilled water at room temperature (27-28^{o}C) for 48 hrs. The extracts were filtered through Whatmann filter paper No. 42 (125 mm) and concentrated by gentle evaporation on a heating mantle (John-Dewole and Oni, 2013). The concentrated aqueous extract was then subjected to both qualitative and quantitative phytochemical screening.

Qualitative phytochemical examination

The aqueous extract of leaf, bark and root were subjected to qualitative phytochemical analysis to test for the presence of secondary metabolites following the standard procedures of Sofowara (1993).

Quantitative phytochemical examination

Quantitative phytochemical examination carried out on the aqueous leaf, bark and root extract of M. *oleifera* was done using standard procedures (Onwuka, 2005). Phytochemical constituents determined were alkaloids, flavonoids, saponins, tannins, phenols terpenoids and phenols each in milligram per 100 g of the sample. Each of the constituents was done in triplicate for each of the plant parts.

Results and Discussion

Aqueous extract of *M. oleifera* leaf, stem and bark investigated for phytochemical constituents reveals that the root of the plant tested positive for tannins, phlobatannins, saponin, flavonoid, terpenoid, alkaloid, and cardiac glycoside, however, there was absence of cardiac glycoside in the leaf and bark (Table 1). This result corresponds with that of Pinal *et al*. (2014) who also reported the presence of alkaloid, flavonoid, steroid, saponin, tannin but absence of glycoside in the aqueous extract of *M. oleifera*. Similarly, Hasan Pasha and Basanagouda (2012) found no cardiac glycoside in the ethanolic and petroleum ether extracts of *M. oleifera* bark. The presence of cardiac glycoside in the root was further supported by Furo and Ambali (2012) who found the presence of saponins, cardiac glycosides, terpenes, flavonoids and alkaloids in the aqueous root extract of the plant. However, variations in the presence or absence of phytochemical constituents of *M. oleifera*, observed in several studies could be attributed to the difference in polarity of the solvents used, method of extraction, duration of extraction or the period of the year the plant was obtained.

Table 1: Qualitative analysis of phytochemical constituents of *M. oleifera*

Phytochemical	Plant parts		
	Leaf	Bark	Root
Tannins	+	+	+
Phlobatanins	+	+	+
Saponin	+	+	+
Flavonoids	+	+	+
Terpenenoids	+	+	+
Alkaloids	+	+	+
Cardiac glycoside	-	-	+

Presence of phytochemical constituents: +
Absence of phytochemical constituents: -

Table 2: Quantitative analysis of phytochemical constituents of *M. oleifera*

Phytochemical constituents	Plant parts				
	Leaf mg/100g	Bark mg/100g	Root mg/100g	Mean mg/100g	LSD value (P≤0.05)
Alkaloid	4.29 ± 0.03^{a}	0.42 ± 0.36^{b}	1.30 ± 0.03^{c}	2.00 ± 0.60	1.69
Phenol	4.00 ± 0.35^{a}	1.00 ± 0.45^{b}	0.2 ± 0.06^{c}	1.73 ± 0.60	2.28
Tannin	1.2 ± 0.13^{a}	0.85 ± 0.42^{a}	1.03 ± 0.09^{a}	1.03 ± 0.14	1.41
Flavonoid	6.80 ± 0.61^{a}	2.40 ± 0.54^{b}	2.80 ± 0.28^{b}	4.00 ± 0.75	4.23
Saponin	29.55 ± 0.42^{a}	19.33 ± 0.32^{b}	13.59 ± 0.55^{b}	20.81 ± 2.38	15.49

Values followed by the same superscript along the row are statistically the same at $p \leq 0.05$.
Values are presented as mean ± SEM
n=3 plant parts used (leaf, bark and root)

Quantitative amounts of constituents in this plant were significantly highest in the leaf compared to the bark and root (Table 2). This could account for why the leaf have been reported to possess various biological activities, including hypocholesterolemic, antidiabetic, hypertensive agent (Kar *et al*., 2003), regulates thyroid hormone (Tahiliani and Kar, 2004), central nervous system, digestive system, nutrition and metabolism, genitor-urinary system, to treat gastric ulcers and scurvy (Selvakumar and Natarajan, 2008).

As observed in this study, saponin was found to be most abundant among the phytochemical constituents that were analyzed and this was most concentrated in the leaf, followed by the bark and root respectively. Saponin has been shown to have hypolipidemic and anticancer activity (Sarker and Nahar, 2007). Flavonoid which was next to saponin in hierarchy of abundance was also highest in the leaf, followed by the root and bark respectively. Flavonoids enhance the effect of vitamin C and function as antioxidants. They are also known to be biologically active against liver

toxins, tumors, viruses and other microbes (Korkina and Afanas'ev, 1997). Similarly, alkaloid, phenol and tannin were found to be to be highest in leaf compared to the root and bark, with mean values 4.29 ± 0.03, 4.00 ± 0.35 and 1.2 ± 0.13 respectively. Alkaloid functions in the defense of plants against herbivores and pathogens, and are widely exploited as pharmaceuticals, stimulants, narcotics, and poisons due to their potent biological activities (Madziga *et al*., 2010). Phenol also plays a role in plant defense against pathogens and herbivore predators, and thus applied in the control of human pathogenic infections (Doughari, 2012). Tannins have been shown to have potential Antiviral, Antibacterial and Antiparasitic effects; useful in wood healing and as astringents (Singhal, 2001).

Conclusion

From this study, it can be concluded that variation exists in the concentration of phytochemical constituents of *M. oleifera* leaf, bark and root, however, the leaf had significantly highest amount of phytochemicals while the root had the presence of all phytochemicals observed. Furthermore, the richness leaf in saponin and also the presence of cardiac glycosides in the root could pave the way for pharmacological exploration into more health benefits of this plant.

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