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Zakawa NN
Department of Botany,
Adamawa State University
P.M.B. 25, Mubi, Nigeria

Timon D
Department of Botany,
Adamawa State University
P.M.B. 25, Mubi, Nigeria

Yusuf CS
Department of Botany,
Adamawa State University
P.M.B. 25, Mubi, Nigeria

Oyebanji EO
Department of Biological
Sciences, Mountain Top
University, Ogun State Nigeria

Batta K
Department of Botany,
Adamawa State University
P.M.B. 25, Mubi, Nigeria

Jalani RT
Department of Botany,
Adamawa State University
P.M.B. 25, Mubi, Nigeria

Corresponding Author:
Zakawa NN
Department of Botany,
Adamawa State University
P.M.B. 25, Mubi, Nigeria

Ethno-botanical survey and phytochemical analysis of *Moringa oleifera* in mubi local government of Adamawa state

Zakawa NN, Timon D, Yusuf CS, Oyebanji EO, Batta K and Jalani RT

Abstract

Moringa oleifera (Lam) is a small tree, medium-sized about 10m high, perennial softwood tree with timber of low quality pantropical species. *Moringa oleifera* (Lam) is the most widely cultivated species of a monogenetic family, the Moringaceae that is native to the sub-Himalayan tracts of India, Pakistan, Bangladesh and Afghanistan, it also now naturalizes in West Africa and Nigeria as a whole. Survey was conducted among two (2) traditional medical practitioners at the three selected locations. In all, 6 traditional medical practitioners were questioned using an interview guide with eight questions. The ethnobotanical survey revealed that various plant parts can be used to relief various sickness (Malaria, Fever, Stomach pain etc.) with the leaves (40) being the most frequently used part. Phytochemical analysis of most used part of the plant were carried out which revealed the presence of major classes of secondary metabolites, namely; saponins, tannins, alkaloids, phenols, glycosides and flavonoids. Further research should be carried out to extract the active component in *Moringa oleifera* which will serve as a potential medicine for the phytotherapeutic arsenal.

Keywords: Ethnobotany, phytochemical, *Moringa oleifera*, and medical practitioners

Introduction

From time immemorial, man depended on plants as medicine. From a historical perspective, it is evident that the fascination for plants is as old as mankind itself [15]. The plant kingdom represent a rich store house of organic compounds, many of which have been used for medicinal purposes and could serve as lead for the development of novel agents having good efficacy in various pathological disorders in the coming years [11]. Plants are the richest source of drugs for traditional medicine, modern medicine, nutraceuticals food supplements, folk medicine, pharmaceuticals intermediate and chemical entities for synthetic drugs [13]. The use of plant products as medicines could be traced as far back as the beginning of civilization. The earliest mentioned medicinal used plant in Hindu culture is found in "Rigveda" which is said to have been written between 4500-1600BC and is supposed to be the oldest repository human knowledge [12]. The active principle component isolated, have provided leads in the development of several lifesaving drugs, which are in use today [26].

The isolated active compounds of the plants are secondary metabolic chemical compound that occur naturally in plants with no nutritional value to human life [10]. These phytochemicals play protective roles in plants, each labeled phytochemical works in different ways, not all are the same for human and not all come from the same plants [22]. Some have shown more promise than others in fighting disease and illness in humans. There are some basic types of these active compounds that are found in different fruits and vegetables [11]. We have some of them like oxidants they are present in onions and some other fruits and tea, they act as preventive measure for premature cell death and some forms of cancer and aging [12]. Isoflavone or plant estrogen; they are found in soy and soy products; they are helpful in the year just before and after menopause [8]. *Moringa oleifera* (Lam) is a small tree, medium-sized about 10m high, perennial softwood tree with timber of low quality pantropical species plant that is known by such regional name as life tree, drumstick tree, benzolive, mulangay, sajan. It is known by regional name in Nigeria kabi, zogale, glegenji.

Over the past two decades, many reports have appeared in the mainstream scientific journals describing its nutritional and medicinal properties. *Moringa oleifera* (Lam) is the most widely cultivated species of a monogenetic family, the moringaceae that is native to the sub-Himalayan tracts of India, Pakistan, Bangladesh and Afghanistan, it also now naturalizes in West Africa and Nigeria as a whole [11].

Ethnobotany is the study of region's plants and their and their practical uses through the traditional knowledge of a local culture and people, the people, plants interaction and uses [5]. An ethnobotanist thus strives to document the local customs involving the practical uses of local flora for many aspects of life, such as plants as medicines, foods and clothing. Each culture has different perspectives to plant use and application. Drug discovery, design and development, cultural use of plant species, timber processing, soup making and other areas of plant products have long recognized the usefulness of ethnobotanical studies [23]. Most studies on ethno-botanical knowledge have always concluded that there is an unequal indigenous knowledge concerning plant use among local populations with respect to differences in ecological regions, ethnicities, gender, age, professions, religion, cultural belief, abundance and usefulness of the species [7, 20, 4]. The study intends to gather relevant indigenous information on the ecotypes, collect accessions, mode of use locally.

Phytochemicals are non-nutritive plant chemicals which occur naturally in plant that have protective or disease preventive properties [6]. They are non-essential nutrients, meaning that they are not required by the human body for sustaining life. It is well known that plant produces these chemicals to protect them but recent studies show that they can also protect humans against diseases [23]. There are more than a thousand known phytochemicals. Some of the well-known chemicals are lycopene in tomatoes, isoflavone compounds soy and flavonoids in fruits. Alkaloids (examples are caffeine, theobromine, theophylline), organosulphides (examples are allicin, glutathione, indole 3-carbinol, isothiocyanates), tannins, steroids, glycosides etc. [18]

Materials and Methods

Sample Collection and Identification

The leaves, stem, bark, root and flowers of *Moringa oleifera* was collected from Kasuwan gwari in Mubi and also from Zhedinyi, Hong Local Government. The plant was identified and authenticated by Dr. Akesa T Maurice of the Department of Botany, Adamawa State University Mubi. Fresh leaves, seed, bark, flower and root of *Moringa oleifera* were collected and air-dried in the Botany Laboratory, Adamawa State University, Mubi at a normal room temperature. The dried samples were grinded into fine powder using mortar and pestle and were stored in tight containers until use.

Ethnobotanical Surveys

Survey was conducted among two (2) traditional medical practitioners at the three selected locations. In all, 6 traditional medical practitioners were questioned; an interview guide with eight questions was used to collect information from the traditional medical practitioners concerning knowledge of the plant and set modes of preparation.

1. What is the local name of the plant?
2. What do you know about the plant?
3. Do you know anything about the origin of the plant?
4. Was it planted? When? How?
5. For which diseases do you use the plant?
6. Which parts of the plant do you use? (Root, stem, flower, leaves, etc.)
7. How do you prepare the plant for use?
8. How and when do you use the plant?

Phytochemical Analysis

Tests for phytochemistry were carried out on powders prepared before-hand from each plant organ using conventional tests reagents. The extracts were analyzed for the presence of alkaloids, tannins, flavonoids, phenols, saponins, glycosides. The methods described by [27, 14, 19, 25] were adopted.

Results and Discussion

The ethno-botanical survey of *Moringa oleifera* in the study area, revealed that the plant is used in treating malaria, fever, diabetes mellitus, eczema, measles, high blood pressure, stomach ache, sexual weakness and toothache as shown in the Table 1. Regarding the parts of the plant utilized differently as medicine, findings show specificity and overlap of the different parts with robust ability to cure many ailments. This observation is not different from previous studies on its nutritional, therapeutic, and prophylactic properties [12, 6, 10, 17]. The use of crushed seeds to relieve stomach pains, diabetes and for lowering of lipid levels in the liver, which is common to most ethnic groups in Nigeria was earlier reported in Ghana and Indian [6, 12, 10, 17] also reported that the plant is used in treating toothache, stomach ache, and also for curing sexual weakness. The survey also revealed that the leaf of the plant were the most used part constituting 57.14%, followed by the root (21.42%), the bark (11.42%) and the seed (10%) respectively (Table 4), which corresponds with the report of [2], that the leaves of the plant are used for curative purposes. It has also been reported by [18] and [12] that the leaves are the most used plant part through different cultures. Studies on medicinal and therapeutic properties by [6] and [12] also confirmed the many-sided medicinal uses having high potential to cure different kinds of ailments. A wide variety of food supplements, nutritional and medicinal properties have also been attributed to its leaves, seeds, roots, bark, flowers and pods [6, 17]. *Moringa oleifera* is one of the most studied and used species with various use categories [15]. The cultivation of the species is relatively easy with diverse density according to the aim of the production. Actually, *Moringa oleifera* opens new dimension in field of agroforestry due its easily established, fast growing, diversify nature of its products, multiple benefits to people [21].

Table 1: Different Plant Parts Used and the Illness Used in Treatment.

Plant part used	Illnesses treated	Recipes	Guidelines for use
Leaves	Hunger	Leaves cooked with or without groundnut paste. Leaves boiled and mixes with "kwulikwuli" with pepper, onion and tomatoes.	Eat as vegetable soup and also salad at will.
Leaves	Abscess	Ground leaf + potassium hydroxide	Apply on the abscess until the wound is healed
Leaves	Cough	Infusion of leaves + lemon	Drink regularly
Leaves	Hemorrhoids	Powder of leaves	Put in the meals (not very hot) regularly
Leaves	High blood pressure	Powder of leaves	Put in the meals (not very hot) at will
Leaves	Infertility	Powder of leaves	Put in the meals (not very hot) until conception

Leaves	Intestinal worms	Powder of leaves	Put in the meals (not very hot) every day for 7 days
Leaves	Eyesight problems	Grind fresh, carefully washed leaves; press out the juice	Put some drops in the eyes
Leaves	Stomach pains	Powder of leaves	Put in the meals (not too hot) for 2–3 days
Leaves	Malaria	Ground leaves + little water	Drink regularly 3 small glasses/day until you are healed
Leaves	Headaches and migraine	Grind fresh, carefully washed leaves; press out the juice	Put some drops in the eyes or massage the forehead in case of pain
Leaves	Typhoid fever	Infusion of leaf in association with other leaves	Drink regularly for 7–10 days
Leaves	Sexual weakness	Powder of leaves	Put in the meals (not very hot) at will
Leaves	Diabetes	Powder of leaves	Put in the meals (not very hot) in case of attack
Root	Dysentery	Crush fresh root and press out the juice	Drink 2 teaspoons/day for 5–7 days
Root	Stomach pain	Powder of dried roots + water or alcohol or crushed fresh roots + alcohol	Drink 3 small glasses/day morning, afternoon, and evening until it is healed
Root	Swellings	Crush fresh root	Apply the paste to the swelling morning and evening until it is healed
Root	Tooth decay	Wash, scratch the root and cut it in small pieces	Put a piece on the decayed tooth in the evening at bedtime until it is healed
Root	Flu and sinusitis	Scrape root and put in a handkerchief	Inhale the smell in case of attack
Root	Sexual Weakness	Infusion of root + fresh groundnut + onion	Drink 3 small glasses/day at will
Root	Fever	Crushed root + water	Bathe with the potion in case of attack
Bark	Tooth decay	Cut bark as chew stick	Chew on chew stick and hold the juice for some time in the mouth morning and evening until it is healed
Bark	Fever	Soak bark in water	Use water for bath for 3–5 days
Bark	Stomach pains	Cut bark as chew stick	Chew on chew stick and swallow the juice at will
Bark	Malaria	Soak bark, collect the mousse, and add sugar	Drink 2 small glasses/day for 5–7 days
Seed	Diabetes	Remove the shell of the seed	Eat two kernels per day regularly
Seed	Sexual Weakness	Remove the shell of the seed	Eat two kernels morning and evening at will.

Table 2: Percentage of Parts Used in the Treatment of Diseases

Plant part Used	Ethnobotanical Usage	Percentage (%)
Leaves	40	57.14
Root	15	21.42
Bark	8	11.42%
Seed	7	10.00
Total	70	100

The phytochemical screening of the ethanolic leaves, root, bark and seed extract showed the presence of phytochemicals such as Flavonoids, Alkaloids, Tannins, Glycosides, Saponins and Phenols (Table 3 and 4). The result of these findings is line with the work of [1] who reported that tannins, flavonoids and alkaloids were present in ethanolic bark and root extracts of *Moringa oleifera*. However, saponins were reported to be absent in the ethanolic extract which disagrees with the findings of this research. The result of the findings is also in line with the works of [9, 1] on ethanolic seed extract of *Moringa oleifera*. However, the works of [9, 5, 1] contradicts with the findings of this research on the ethanolic leaf extracts of *Moringa oleifera* where they found alkaloids and tannins to be absent. This may be due to difference in the environmental factors/conditions.

Phenol is the highest occurring phytochemical throughout the plant extracts and this finding is line with that of [5]. Saponin occurred highest in the seed and lowest in the root of the plant. In the leaves of *Moringa oleifera* phenol is the highest phytochemical and the lowest is saponin; in the bark of the plant phenol is also the highest phytochemical and tannin the lowest; in the seed of *Moringa oleifera* phenol occurred highest and flavonoid is the lowest and also in the root of this plant phenol is the highest and tannin is the lowest. According to [24] phenols and flavonoids are the highest occurring phytochemical in the leaves, bark, seed, flowers and root of *Moringa oleifera* and tannin is the lowest. The presence of

these compounds is an indication that the plant might offer medicinal benefits to its users as phytochemicals have been shown to confer protection on human health. Apart from their roles in human health, phytochemicals also play important roles in plant survival. They give plants their colour, flavour, aroma and are parts of a plant's natural defense system [3].

Moringa oleifera possess active ingredients which have so many important effects, the most active ingredient are polyphenol compounds such as phenolic acids and flavonoids. Phenolic acids are a sub-group of phenolic compounds, derived from hydroxybenzoic acid and hydroxycinnamic acid, naturally present in plants, and these compounds have antioxidant, anti-inflammatory, antimutagenic and anticancer properties [24]. Flavonoids is the second most active ingredient in *Moringa oleifera*, it is being synthesized in the plant as a response microbial infections have a benzo- γ -pyrone ring as a common structure. Intake of flavonoids has been shown to protect against chronic diseases associated with oxidative stress, including cardiovascular disease and cancer which is followed by alkaloids which is a group of chemical compounds, which contain mostly basic nitrogen atoms [24]. Alkaloids possess a group of secondary metabolites in plants and have been found to possess important health-promoting properties and then followed by tannins which are water-soluble compounds that precipitate alkaloids and proteins. Tannin is found in lesser quantities in the bark and root of *Moringa oleifera* which agrees with findings of [16]. Phenol were present in all plant parts and occurred highest in the leaves, seed, bark and root of *Moringa oleifera* as recorded by [2]. Phenol compounds possess anti-inflammatory, anti-microbial and anticoagulant activities. This may justify the use of the plant by traditional medical practitioners as an anticoagulant, ant-inflammatory, to treat diarrhea, diabetes and other diseases [8]. Alkaloids have many pharmacological properties including antihypertensive and antimalarial [28].

Alkaloids is present in bark, seed and root in higher forms as compared to the leaves where it occurs in the lowest amount [16]. The presence of alkaloids in the extract might be responsible for the plant's use in the treatment of malarial infection as reported by [16]. Alkaloids have many pharmacological properties including antihypertensive, antimalarial [28]. The presence of alkaloids in the extract might be responsible for the plant's use in the treatment of malarial infection as reported by [16]. Tannin compounds were also found in the plant part extracts but occur in small amounts in the bark and root, tannin compounds possess anti-diarrhoeal activity, used in treating sexual weakness and can also be used in the treatment of dysentery [11]. Flavonoids were present in plant parts of *Moringa oleifera* but occurred in lesser amount in the bark, the occurrence of flavonoids might account for its use for the treatment of aches, pains and other ailments [16]. These flavonoids compounds found in these plant parts might justify the prescription of *Moringa oleifera* by traditional medical practitioners to treat malaria, fever, headache and migraines [2] responsible for antifungal activity. The phytochemical screening of the leaves, root, bark and seed extract vary from one to another which may be due to geographical variation, climatic conditions and soil composition of the area. Therefore it is possible to have different chemical composition of the same plant under research in other areas [2].

Table 3: Qualitative Phytochemistry of *Moringa oleifera*

Phytochemicals	Leaves	Bark	Seed	Root
Saponin	+	+	+	+
Flavonoid	+	+	+	+
Tannin	+	+	+	+
Alkaloids	+	+	+	+
Phenol	+	+	+	+
Glycosides	+	+	+	+

Key: + = Positive

Table 4: Quantitative Phytochemistry of *Moringa oleifera*

Phytochemicals (mg/g)	Leaf	Bark	Seed	Root
Saponin	0.82	0.63	1.31	0.29
Flavonoid	4.97	0.27	1.18	0.14
Tannin	3.55	0.20	5.26	0.12
Alkaloids	0.93	1.65	1.26	1.53
Phenol	14.17	9.15	22.15	11.75
Glycosides	2.84	1.42	4.64	1.49

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