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Phytochemical properties of *Ceiba petandra* (Kapok tree), *Moringa oleifera* (Moringa) and *Cymbopogon citratus* (Lemon grass) collected from a home garden in Igbor, Gwer East, Benue State, Nigeria

Abstract

The need for integration of modern science in the study of medicinal plants is very crucial. Without the application of science, herbal medicine would just remain traditional. The broad objective of the study was to identify the phytochemical properties of these three medicinal plants in order to encourage utilization, conservation and management of these plant species. This research sought to contribute to existing knowledge about the phytochemical constituents and medicinal uses of these plants. The highest concentrations of tannin (11.6%) and flavonoid (10.1%) were found in the leaves of *Ceiba petandra*. Anthraquinone was not found in any of the plant species investigated. Alkaloid was found only in the leaves of *Moringa oleifera* with a concentration of 5.4%. Terpenoids were found only in the leaves of *Ceiba petandra* (4.2%) and in the leaves of *Moringa oleifera* (3.5%). The least concentration of cyanoglycosides (0.1%) was found in the leaves of *Ceiba petandra*. It was concluded that leaves *of Ceiba petandra*, *Moringa oleifera* and *Cymbopogon citratus* were the major sources of phytochemicals. The study also revealed that higher quantities of phytochemicals were found in *Ceiba petandra* leaves when compared with other plant species. This showed that the leaves of *Ceiba petandra* are highly medicinal. It is recommended that Clinical trials should be conducted on these medicinal plant species to determine their efficacy in the treatment of diseases.

Keywords: medicinal, plants, phytochemical, ceiba petandra, moinga oleifera, cymbopogon citratus

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Introduction

Phytochemical properties are the bioactive compounds that are naturally present in plants.[1,2] Phytochemical screening therefore means the process of determining the chemical composition in plants. It is the process of determining the chemical constituents in plants. The medicinal plants are useful for curing of human diseases because of the presence of phytochemical constituents.[3]

Knowledge of the phytochemical properties of plants is important because such information will be of value concerning the medicinal uses of plants. The use of plants as medicine is the oldest form of healthcare known to humanity and has been used in all cultures throughout history.[4] The use of plants for healing purposes predates human history and forms the origin of a lot of modern medicine. Plants have been used by all cultures throughout history. The early men observed and appreciated the great diversity of plants available to them. The use of medicinal plants is receiving much attention not only in the developing countries of the world like Nigeria, but also in the western world where it is estimated that about 50 percent of the population uses herbal medicines.[5] Use of medicinal plants has remained a more feasible option due to their affordable prices, relative accessibility, local availability and trust in the efficacy of medicinal plants. Our ancestors recognized their dependence on nature for a healthy life and since that time, humanity has depended on the diversity of plant resources for food, clothing, shelter, and medicine to cure countless number of ailments. The early people treated illness with plants that were not part of their usual diet.[6] Those people lived longer than this present generation who now depend so much on conventional medicine and genetically modified foods. This is because the early people lived their lives mostly on plants (rich in bioactive compounds). They ate natural products from plants and treated themselves with medicines prepared only from plants. Plants are the oldest friends of human being. The use of medicinal plants is receiving much attention not only in developing countries of the world like Nigeria but also in the Western world. About 80% of the world population presently uses medicinal plants for their health needs. According to WHO,[7] about 35,000-70,000 species of plants are used for medicinal purposes around the world. There is no doubt that research in medicinal plants can provide important clues leading to the discovery of new drugs for the modern pharmacies. The medicinal uses of plants lie in some chemical substances that produce a definite physiological action on the human body.[8]

Scientific model for testing phytochemical properties of medicinal plants

According to Africa Research Institute,[9] the properties of medicinal plants should not only be tested in a laboratory. One need to understand how a community thinks about it and uses it. This approach is an integral part of the scientific research in herbal medicine. It provides a line of enquiry for the scientist to explore. Traditional knowledge is the basis for scientific investigation of the biochemical properties of plants. Without this investigation, the scientist would not have

tested the phytochemical properties of the plant fully. The scientific approach used should be founded on knowledge that is already there. Hence science is the confirmation of a claim or a proposed theory. Medicinal plants should be tested using this mindset.

Methodology

Collection of plant materials

The leaves stem barks and roots of *Ceiba petandra* (Kapok tree), *Moringa oleifera* and *Cymbopogon citratus* (lemon grass) were collected from home gardens in Igbor, Gwer east Local government Area of Benue State. The plant materials were all air dried under shade. *Ceiba petandra* leaves were dried under shade for a period of two (2) weeks while the stem barks and roots were air dried for four (4) weeks. The leaves of *Moringa oleifera* were air dried under shade for one week. The stem barks and roots were dried for four weeks. The leaves of *Cymbopogon citratus* were dried under shade for three weeks. After drying, the plant materials were processed into powdered form using mortar and pestle. The essence of pounding the plant materials into powder form was to increase surface area for extraction in order to facilitate easy phytochemical screening.

Extraction of the plant materials

The plant samples were extracted using Methanol. Before extraction, the weights of the powder samples were measured using an electronic scale. The weight of the powder sample of *Ceiba petandra* leaves was 115.2g, *Ceiba petandra* stem barks was 172.6g while the weight of powder form of *Ceiba petandra* roots was 164.5g. The powder form of *Moringa oleifera* leaves weighed 125.6g, stem barks (173.4g) and roots (190.3g). The powder form of *Cymbopogon citratus* leaves weighed 127.4g.

10g of each of the samples (leaves, stem barks and roots) of the three (3) plant species (*Ceiba petandra, Moringa oleifera* and *Cymbopogon citratus*) was poured into a beaker containing 200ml of methanol. It was stirred gently using a glass rod. The solution was left for 4 hours. The solution was then filtered into a conical flask using funnel and whatman filter paper. The filtrates were then used for qualitative phytochemical screening.[10]

Test for alkaloid: About 2ml of each extract was treated with 3ml of 1% aqueous hydrochloric acid on a steam bath. Few drops of Mayer's reagent were added. The presence of white precipitate was taken as preliminary evidence for the presence of alkaloid.[10–12]

Test for cardiac glycosides: 100mg of each extract was dissolved in 1ml of glacial acetic acid containing one drop of ferric chloride solution. This was then underplayed with 1ml of concentrated sulphuric acid. A brown ring obtained at the interphase indicated the presence of cardiac glycoside.

Test for saponin: 2ml Distilled water was added to 2ml of each plant extracts and was shaken for 15minutes. The formation of 1cm layer of foam indicated the presence of saponins.

Test for tanin: Iml of distilled water was added to 0.5ml of each plant extract. The solution was filtered and 2ml of Ferric chloride was added. A greenish black colouration indicated the presence of tannins.

Test for flavonoid: 2g of each of the powdered sample was completely detanned with acetone. The residue was extracted in warm water after evaporating the acetone on a water bath. The mixture was filtered while hot. The filtrate was allowed to cool. 5ml of 20% sodium hydroxide was added to equal volume of the detanned water extract. A yellow solution indicated the presence of Flavonoids.

Test for steroid: 100mg of the extract was dissolved in 2ml of chloroform. Sulphuric acid was carefully added to form a lower layer. A reddish brown colour at the interphase indicated the presence of steroid.[12]

Test for terpenoid: A little quantity of each extract was dissolved in chloroform and 1ml of acetic anhydride was added. 2 drops of concentrated sulphuric acid was added. A pink colour which changed to bluish green on standing showed the presence of terpenoid.

Test for anthraquinone: Sontrager's test was used for the detection of anthroquinone. 0.5ml of each extract was taken in a dry test tube and 5ml of chloroform was added and shaken for 5minutes. The extract was filtered and the filtrate was shaken with an equal volume of 100% ammonia solution. The appearance of red colour indicated the presence of anthraquinone.

Test for Cyanogenic glycosides: About 100mg of each extract was taken in a test tube and 2.5ml of dilute sulphuric acid was added and boiled in a water bath for 15 minutes. This was allowed to cool and was neutralized with 20% potassium hydroxide solution. 5ml of a mixture of Fehling's solutions A and B were added and extracts were concentrated to dryness.

Quantitative phytochemical screening of the methanolic extracts of *Ceiba petandra*, *Moringa oleifera* and *Cymbopogon citratus*

Quantitative determination of alkaloid: The determination of the concentration of alkaloid in the plant samples was carried out using alkaline precipitation gravimetric method described by Harborne.[13] 5g of the powdered sample was soaked in 20ml of 10% ethanolic acetic acid. The mixture was left for four (4) hours at room temperature. There after the mixture was filtered through whatman filter paper (No.42). The filtrate was concentrated by evaporation over a steam bath to $\frac{1}{4}$ of the original volume. To precipitate the alkaloid, concentrated ammoniam solution was added in drops to the extract until it was in excess. The resulting alkaloid precipitate was recovered by filtration using previously weighed filter paper. After filtration, the precipitate was washed with 9% ammonia solution and dried in the oven at 60ºC for 30minutes. It was cooled in a desicator and weighed. The process was repeated two times and the average was taken. The weight of the alkaloid was determined by the difference and expressed as percentage of weight of sample analysed as shown below:

$$\% \text{ alkaloid} = \frac{W2 - W1}{Weight\ of\ Sample} \times 100$$

Where W1=Weight of filter paper, W2=Weight of alkaloid +alkaloid precipitate.

Quantitative determination of flavonoid: Flavonoid content of the plant samples was determined by the Gravimetric method as was described by Harborne.[12] 5g of the powdered sample was placed into a conical flask and 50ml of water and 2ml of hydrochloric acid Hcl solution was added. The Solution was allowed to boil for twenty (20) minutes. The boiled mixture was allowed to cool before it was filtered

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through whatman filter paper (No.42). 10ml of ethyl acetate extract which contained flavonoid was recovered, while the aqueous layer was discarded. A pre-weighed whatman filter paper was used to filter the ethyl acetate layer. The residue was then placed in an oven to dry at 60ºC. It was then cooled in a desicator and weighed. The quantity of the flavonoid was then determined using the formular below;

$$\% \text{ aFlavonoid} = \frac{W2 - W1}{Weight\ of\ Sample} \times 100$$

Quantitative Determination of Tannin: Tannin content of the plant samples was determined using Folin Dennis spectrophotometric method described by Pearson. 2g of the powdered sample was mixed with 50ml of distilled water and was shaken vigorously for 30minutes. The mixture was filtered and the filterate was used for quantitative determination of tannin. 5ml of the filtrate was measured into 50ml volumetric flask and diluted with 3ml distilled water. 5ml of standard tanurie alit solution and 5ml of distilled water was added separately. 1ml of Folin Denis reagent was added to each flask followed by 2.5ml of saturated sodium carbonate solution. The content of each flask was made up to the mark and incubated for 90minutes at room temperature. The absorbance of the developed colour was measured at 760ηm wavelength with the reagent blank zero. The process was repeated two (2) times and percentage tannin was calculated as shown below;

$$\%tannin = \frac{100}{W} \times \frac{\text{Au} \times \text{C}}{As} \times \frac{\text{Vf}}{1000} \times \frac{D}{Va}$$

Where:

W = Weight of sample analysed

Au = Absorbance of the test sample

As = Absorbance of the standard solution in mg/ml

C = Concentration of standard in mg/ml

Vf = Total volume of extract

D = Dilution factor

Va = Volume of extract analyzed

Quantitative Determination of Steroid: The steroid content of the leaves of the plants was determined using the method described by Harborne.[12] 5g of the powdered sample was hydrolysed by boiling in 50ml of hydrochloric acid for about 30minutes. It was filtered using whatman filter paper (No. 42). The filtrate was then transferred to a separating funnel. Equal volume of ethyl acetate was added to it, mixed well and allowed to separate into two layers. The ethylacetate layer (extract) was recovered, while the aqueous layer was discarded. The extract was dried at 100ºC for 15minutes in a steam bath. It was then heated with concentrated amyl alcohol to extract the steroid. The turbid mixture was filtered properly with a pre-weighed filter paper. The dry extract was then cooled in a desicator and reweighed. The process was repeated two more times and an average was obtained. The concentration of the steroid was determined and expressed as a percentage as thus:

$$\% \text{ Steroid} = \frac{W2 - W1}{Weight\ of\ Sample} \times 100$$

Saponin: Saponin content of the samples was determined by double extraction gravimetric method described by Harborne.[12] 5g of the powdered sample was mixed with 50ml of 20% aqueous ethanol solution in a flask. The mixture was heated with periodic agitation in water bath for 90 minutes at 55ºC; it was then filtered through Whatman filter paper (No 42). The residue was extracted with 50ml of 20% ethanol and both extract were poured together and the combined extract was reduced to about 40ml at 90ºC and transferred to a separating funnel where 40ml of diethyl ether was added and shaken vigorously. Re extraction by partitioning was done repeatedly until the aqueous layer become clear in colour. The saponins were extracted, with 60ml of normal butanol. The combined extracts were washed with 5% aqueous sodium chloride (NaCl) solution and evaporated to dryness in a pre-weighed evaporation dish. It was dried at 60ºC in the oven and reweighed after cooling in a dessicator. The process was repeated two more times to get an average. Saponin content was determined by difference and calculated as a percentage of the original sample thus:

$$\% \text{ Saponin} = \frac{W2 - W1}{Weight\ of\ Sample} \times 100$$

Where W1= Weight of evaporating dish

W2= Weight of evaporating dish + Weight of sample

Results (Figures 1-3)

Figure 1 *Ceiba petandra* (Kapok tree) in a home garden in Igbor, Benue State.

Figure 2 *Cymbopogon citratus* (Lemon grass) planted in a home garden in Igbor, Benue State.

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Figure 3 *Moringa oleifera* (Moringa).

Discussion

Qualitative phytochemical screening showed that (*Ceiba petandra*, *Moringa oleifera* and *Cymbopogon citratus*) contained reasonable qualities and quantities of bioactive compounds. The qualitative analysis shows the different phytochemicals at various detected levels in these plants. Flavonoid and tannin were highly present (+++) in *Ceiba petandra* leaves. Flavonoids were found to be moderately present in both the stem barks and roots. Terpenoid and Cardiac glycoside were moderately present (++) in the leaves while Saponin and carbohydrate were slightly present. Cyanogenic glycoside and steroid were absent in the leaves of *Ceiba petandra*. Alkaloid was found absent in the leaves, stem barks and roots of *Ceiba petandra*. *Ceiba petandra* was a well-known home garden plant. The tree is known to have a lot of health benefits. In Benue State, it is used to treat hypertension, mystic diarrhea and partial madness and the stem barks are used to treat fracture. The health benefits are as a result of the presence of many bioactive compounds or phytochemicals in various parts of this plant. Various parts of the plant have been reported to be useful as effective remedies against hypertension, headache, dizziness, constipation, diarrhea and mental illness.[14] In *Moringa oleifera*, flavonoid, alkaloid, terpenoid and cardiac glycoside were highly present (+++) in the leaves. Tannin was moderately present (++) in the leaves and roots. While cyanogenic glycoside and carbohydrate were moderately present (++) in the leaves of *Moringa oleifera*. Steroids were absent only in the leaves while saponnin was completely absent in the three parts (leaves, stem barks and roots) of *Moringa oleifera*. In the case of *Cymbopon citratus*, only the leaves were screened phytochemically since it is the leaves that are mostly used for medicine. The result showed that saponin, anthraquinone and alkaloid were absent in the leaves of *Cymbopogon citratus* (–). Flavonoids were found highly present (+++). Tannin, steroid and cardiac glycoside were moderately present (++) while terpenoids and cyanogenic glycoside were slightly present (+). This is similar to the findings of.[15]

Table 1 Qualitative Phytochemical Properties of three (3) Most Frequently used Medicinal Plants in Home gardens in Benue State, Nigeria

Chemical Group	*Ceiba Petandra*			*Moringa oleifera*			*Cymbopogon Citratus*
	Leaves	Barks	Roots	Leaves	Barks	Roots	Leaves
Alkaloid	–	–	–	+++	–	–	–
Flavonoid	+++	++	++	+++	++	++	+++
Tannin	+++	+	+	++	+	++	++
Terpenoids	++	–	–	+++	–	–	+
Cyanogenic Glycoside	–	+	+	++	+	+	+
Steroids	–	+	+	–	+	+	++
Saponin	+	+	–	–	–	–	–
Anthroquinone	–	–	–	–	–	–	–
Cardiac Glycoside	++	+	–	+++	++	+	++

– = absent, + =slightly present, ++ =moderately present, +++ =highly present

Source: Laboratory work, 2018

Table 2 Quantitative Analysis of Phytochemicals in *Ceiba Pentandra, Moringa oleifera* and *Cymbopogon citratus* Extarcts from different plant parts

Chemical Group	*Ceiba petandra*			*Moringa Oleifera*			*Cymbopogon Citratus*
	Leaves%	Barks %	Roots %	Leaves%	Barks %	Roots %	Leaves%
Alkaloid	–	–	–	5.4	–	–	–
Flavonoid	10.1	3.8	3.2	8.8	4.0	5.5	4.1
Tannin	11.6	0.19	0.1	2.5	3.0	0.4	1.5
Terpenoids	–	0.4	0.3	–	0.5	0.4	1.9
Cyanogenic glycoside	4.2	–	–	3.5	–	–	–
Steroids	2.1	0.8	–	2.9	1.7	0.4	2.1

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Chemical Group	*Ceiba petandra*			*Moringa Oleifera*			*Cymbopogon Citratus*
	Leaves%	Barks %	Roots %	Leaves%	Barks %	Roots %	Leaves%
Saponin	0.1	0.4	0.2	2.4	1	3.2	4.3
Anthroquinone	2.4	1.8	–	–	–	–	–
Cardiac glycoside	–	–	–	–	–	–	–

Quantitative phytochemical screening showed that the concentration of alkaloid in the leaves of *Morinaga oleifera* was 5.4% and was found absent in the stem barks and roots. It was also found absent in the leaves, stem barks and roots of *Ceiba petandra.* Alkaloids were also found absent in the leaves of *Cymbopogon citratus.* Alkaloids are used as basic medicinal agents for analgesics, antispasmodic and bacterial effects.[16] Plants having alkaloids are used in medicines for reducing headache and fever. Alkaloids have anti-inflammatory property.[17] This means *Moringa oleifera* leaves have therapeutic effects against headache and fever. Flavonoids were found to be very high (10.1%) in the leaves of *Ceiba petandra.* In the stem bark, it was 3.8% and in the roots, it was 3.2%. In the leaves of *Moringa oleifera*, flavonoids were 8.8%. In the stem bark, it was 4.0% and 5.5% in the roots. In the leaves of *Cymbopogon citratus*, flavonoids were 4.1%. Flavonoids are natural occurring substances from plants. They have been reported to have therapeutic effects such as; antioxidants, anticancer, antibacteria, cardio-protective agents, anti-inflammation, immune system promoting, skin protection from Utra Violet radiation, and interesting candidate for pharmaceutical and medical application.[18] The highest amount of flavonoids were found in the leaves of *Ceiba petandra* (10.1%) and in comparison, followed by the leaves of *Moringa oleifera* (8.8%). The result disagrees with the findings of Osuntokun et al[19] who reported that more flavonoids were found in stem barks of *Ceiba petandra*. But this agrees with the findings of Chukwuma & Chigozie.[20] who stated that the highest quantity of flavonoid was found in the leaves of *Moringa oleifera.* The result is also similar to the findings of Marcela et al.,[21] who stated that the leaves of *Moringa oleifera* are good sources of flavonoids. Tannin was very high (11.6%) in the leaves, 0.19% in the stem barks and 0.1% in the roots of *Ceiba petandra*. In the leaves of *Moringa oleifera*, tannin was 2.5%. In the stem bark of *Moringa oleifera*, tannins were 3.0% and 0.4% in the roots. In the leaves of *Cymbopogon citratus*, tannins were 1.5%. Steroids were found absent in the leaves of *Ceiba petandra* and *Moringa oleifera*. It was found in the stem barks and roots of *Ceiba petandra* and *Moringa oleifera* and was also found in the leaves of *Cymbopogon citratus*. In *Ceiba petandra*, the concentration of steroids in the stem barks was 0.4% and 0.3% in the roots. While in *Moringa oleifera*, the estimated quantity of steroid in the stem barks was 0.5% and 0.4% in the roots. However, the highest quantity of steroids was found in the leaves of *Cymbopogon citratus* (1.9%). Steroids are used in the treatment of some endocrine disorder, regulation of blood sugar, salt imbalance, and antimicrobial infections. Terpenoids were 4.2% in the leaves of *Ceiba petandra* and in the stem barks and roots, it was found absent. Terpenoids were 3.5% in the leaves of *Moringa oleifera*. In the stem bark and roots of *Moringa oleifera*, terpenoids were found absent. It was also found absent in the leaves of *Cymbopogon citratus*. This study shows that cardiac glycosides were present in the leaves (2.1%) and stem barks (0.8%) of *Ceiba petandra* and was absent in the root. This is contrary to the findings by Mba et al.,[22] who stated that cardiac glycosides were absent in the leaves of *Ceiba petandra*. The highest amount of cardiac glycoside was found in the leaves of *Moringa oleifera* (2.9%) while in the stem barks, it was (1.7%) and 0.4% in the roots. In the leaves of *Cymbopogon citratus*, the concentration of cardiac glycoside was (2.1%). This is similar to the findings by Nwachukwu et al.,[15] who reported that the leaves of *Cymbopogon citratus* contained cardiac glycoside. The leaves of *Cymbopogon citratus* contained the highest amount of cyanogenic glycoside which is the highest phytochemical compound present in *Cymbopogon citratus* leaves (4.3%).

The leaves of *Ceiba petandra* contain the least amount of cyanogenic glycoside (0.1%). It was also the least bioactive compound present in the leaves of *Ceiba petandra*. This disagrees with the findings by Iroka et al. [24] who stated that cyanogenic glycosides were the highest phytochemical compound present in the leaves of *Ceiba petandra*. In *Moringa oleifera*, cyanogenic glycosides were found to be 2.4% in the leaves, 1.0% in the stem barks and 3.2% in the roots. The leaves of *Cymbopogon citratus* as well as the roots and leaves of *Moringa oleifera* are the best sources of cyanogenic glycoside. Saponins are a class of chemical compounds found in particular abundance in various plant species. They are very widely distributed natural products. As evidenced by phytochemical studies of many plants, saponins primarily exist in plant kingdom.[24] In plants, saponins protect the plants against microbes and fungi infestations. They are also used in the manufacture of shampoos, insecticides, various drug preparation and synthesis of steroidal hormone.[25] Previous studies have provided enormous evidences exposing that they have many health benefits. They have been reported to have antioxidant, anti-inflammatory, anti-hyperplasia, antimicrobial, and analgesic activities.[26] The result of phytochemical analysis from this study revealed that the leaves and stem barks of *Ceiba petandra* were good sources of saponins. Upon quantification by gravimetric method, the concentration of saponin was higher in the leaves (2.4%) than in the stem barks (1.8%). However, saponins were absent in the roots of *Ceiba petandra*. It was not found in *Moringa oleifera* and *Cymbopogon citratus*. Accumulated evidence suggests that saponins had the potential of reducing high blood pressure.[24] Therefore, the occurrence of saponins in the leaves and stem barks of *Ceiba petandra* is an indication of its potential for curing hypertension.

Anthraquinone was found absent in *Ceiba petandra*, *Moringa oleifera* and *Cymbopogon citratus*. These phytochemical constituents that have been found in the three (3) medicinal plants selected for the study are precursors for the synthesis of useful drugs**.** This agrees with Iroka et al.,[23] who stated that phytochemical constituents are potent secondary compounds that are found in medicinal plants and are useful for the manufacture of drugs. The result of quantitative phytochemical screening revealed that the leaves of the three (3) plants had higher contents of phytochemicals and as, such will be more effective than any other parts in terms of medicinal use. The total percentage concentration of phytochemicals in the leaves of *Ceiba petandra* (30.5%) showed that *Ceiba petandra* leaves were the best part of the plant to be used in medicine. When compared with the leaves, stem barks and roots of *Moringa oleifera* and *Cymbopogon citratus*, *Ceiba petandra* leaves showed better concentration of phytochemicals.

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The presence of these bioactive compounds in *Ceiba petandra*, *Moringa oleifera* and *Cymbopogon citratus* is an indication of their usefulness in traditional medicine. According to Ugwoke et al.,[27] the healing properties of medicinal plants are usually linked with the presence of phytochemicals. These phytochemicals differ in type and concentration from one plant to another. They account for the difference in the therapeutic effects of medicinal plants.

Conclusion

From the result of phytochemical analysis, it was observed that phytochemical contents were higher in the leaves of *Ceiba petandra*, *Moringa oleifera* and *Cymbopogon citratus*; and therefore recommends the leaves as the major sources of these phytochemicals. The study also revealed that higher quantities of phytochemicals were found in *Ceiba petandra* leaves when compared with other plant species. This showed that the leaves of *Ceiba petandra* are highly medicinal.

Recommendations

i. More efforts are required to conserve or protect these medicinal plant species.

ii. Clinical trials should be conducted on these medicinal plant species to determine their efficacy in the treatment of diseases.

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Conflicts of interest

Author declares that there are no conflicts of interest.

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