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Phytochemical Analysis of Selected Indigenous Medicinal Plants used in Rwanda

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Abstract
The medicinal properties exhibited by various medicinal plants are driven by the phytochemicals present in the plants. The purpose of this study was to identify the phytochemicals present in the six selected medicinal plants used in Rwanda. Standard procedures for phytochemical screening were used to test for the presence of various phytochemicals. All the selected medicinal plants were found to contain tannins and flavanoids, saponnis and phenols. Alkaloids were also present in all the selected plants except *Aloe myriacantha* and Eucalyptus *camaldulensis*. The study concluded that medicinal plants used in Rwanda possessed various phytochemicals that aids in the medicinal properties of the studied plants.

Keywords: Phytochemical, *Vernonia mygdalina, Zehneria scabra, Leonotis nepetifolia, Tetradenia riparia, Aloe myrianantha*

1. Introduction
Globally, the use of plants and plant products as an alternative remedy for various health conditions has increased. The use of herbal medication has been in existence for many decades and the contribution of these traditional medicines towards production of the modern drugs can never be overemphasized. In the past, use of herbal medication was limited to those who could not afford the synthetic medicine and was to some extent associated with witchcraft and poverty. Little research had been carried out to scientifically confirm the curative or preventive activity of plants that were traditionally claimed to possess medicinal properties. However, with the increasing recognition of the effectiveness of herbal medicine by health professionals and researchers amidst growing concerns of adverse side effects associated with most of the synthetic drugs, herbal medication is globally being viewed as a potential alternative [1]. The cost of synthetic medicine is not so friendly to most people especially in the developing countries. Providing such people with sufficient knowledge on the use and safety of medicinal plants which are normally readily available would be a great relief.
In Rwanda, people have been using medicinal plants since time immemorial. Medicinal plants constituted Rwandan traditional medicine used by local people to treat different human and livestock diseases.
Currently there are numerous research studies which have been conducted on various medicinal plants worldwide. The evaluated medicinal properties of traditionally claimed medicinal plants include anti-inflammatory and anti-nociceptive activities of *Lantana trifolia* [2], anthelmintic activity of *Sansevieria trifaciata* against fasciola hepatica [3], anti-inflammatory activity of Australian and Chinese plants activities [4] among others.
The medicinal properties in all medicinal plants arise from the various bioactive constituents present. Past studies have associated the bioactive constituents found in plants commonly known as phytochemicals with therapeutic activities such as wound healing [5] antimicrobial [6] and antioxidant [7] activities among others. Classification of phytochemicals in plants is based on the phytochemicals present. Two classes of phytochemicals exists namely primary and secondary constituents [8]. Primary constituents include, sugars, proteins and amino acids among others with the secondary constituents consisting of tannins, phenols, saponins and others [9].
Identification of phytochemicals in medicinal plants is among the initial steps in the process of discovering new plant-based drugs. The purpose of this study was to identify the secondary constituents found in the selected medicinal plants commonly used in Rwanda.

Material and Methods
Plants collection and preparation
Plants used in this study were collected from Kicukiro District of Rwanda and its surroundings.

The plant samples were washed with tap water and rinsed with distilled water. The samples, apart from *Aloe myriacantha* were then dried, crushed and powdered with electrical grinder and powders stored in conical flasks for further processes. The description of these plants including the parts used preparation and health conditions managed by the plant preparation are shown in table 1.

Extracts preparation

For each of the plant, 20g of the powdered material was placed in 200 mL conical flasks and added 100 mL of distilled water and 95% ethanol individually. The mouth of the conical flasks were covered with aluminum foil and kept in drawer within the laboratory for two days. The conical flasks were frequently agitated to ensure thorough mixing for complete elucidation of active components to dissolve in the respective solvent. For the case of *Aloe myriacantha,* freshly cut leaves were kept in 200 mL conical flasks containing 100 ml of 95% ethanol and 100 ml of distilled water separately for 48 hours with frequent shaking. The extracts were filtered by using Whatman no 1 filter paper and then concentrated using warm water maintained at 50^0C. The concentrated extracts obtained were placed in labeled beakers and kept in a refrigerator at 4^0C for later use.

Table 1: Plants descriptions

Botanical name	Kinyarwanda name	Health condition	Preparation
vernonia mygdalina	*umubirizi*	Malaria and others	Boil leaves and drink the extract
Eucalyptus camaldulensis	*inturusu*	Cough, flu	Boil leaves and drink the extract
Aloe myriacantha	*Igikakarubanga*	Malaria, intestinal worms etc	Boil leaves and drink the extract
Tetradenia riparia	*umuravumba*	Many	Boil leaves and drink the extract
Zehneria scabra	*Umushishiro*	Back and lower abdominal pain	Boil leaves and drink the extract
Leonotis nepetifolia	*Igicumucumu*	Heart burn	Boil leaves and drink the extract

Phytochemical tests

Both ethanolic and aqueous extracts of the plants in table 1 were screened for the presence of phytochemicals following procedures described by [10-12] as outlined in table 2.

Table 2: Phytochemical test procedures

Phytochemicals	Test procedure	Observation
Tannins	2ml extract + 2ml H_2O + 2-3 drops $FeCl_3$ dilute	Blue-green coloration
Saponins	**Foam Test:** 5ml extract + 5ml H2O shake vigorously	Foam produced that persist for 10 minutes
Alkaloids	***Wagner's Test:*** Extract + few drops of dilute HCl filter + few drops of Wagner's reagent	Brown precipitate
Phlobatannins	***Precipitate Test:*** 2ml extract + 2ml HCl dilute + heat	Red precipitate
Steroids	***Salkowski Test:*** 2ml extract + 2ml CHCl3 + 2ml conc. H2SO4	Reddish brown ring at the junction
Flavanoids	2ml extract + few drops of NaOH solution	Yellow precipitate that clears on adding dilute HCl
Phenols	**Ferric Chloride Test**: Extract + 4 drops $FeCl_3$ dilute	Blue-black coloration

Results

Results of the phytochemical screening for all the plants are indicated in table 3. Presence of the phytochemicals is indicated by a + sign while a – sign indicate absence of the tested phytochemical.

The phytochemical screening showed that *Vernonia mygdalina, Zehneria scabra, Leonotis nepetifolia* contains tannins, saponins, alkaloids, phenol and flavanoids. *Tetradenia riparia* was found to contain all the tested phytochemicals except tannins. Aqueous extract of *Aloe myrianantha* and *Eucalyptus camaldulensis* tested positive for all the tested phytochemicals except alkaloids. Both aqueous and ethanolic extracts of *Zehneria scabra* showed that the plant possessed all the tested phytoconstituents except steroids

Table 3: Qualitative analysis of phytochemicals in the selected medicinal plants

Botanical name	Extract type	Tannins	Saponins	Alkaloids	Phenol	Steroids	Flavanoids	Phlobatannins
vernonia mygdalina	Water	+	+	+	+	+	+	-
	Ethanol	+	-	+	+	+	+	-
Eucalyptus camaldulensis	Water	+	+	-	+	+	+	-
	Ethanol	+	+	-	+	+	+	
Aloe myriacantha	Water	+	+	-	+	+	+	+
	Ethanol	+	-	-	+	+	+	-
Tetradenia riparia	Water	-	+	+	+	+	+	+
	Ethanol	-	+	+	+	+	+	+
Zehneria scabra	Water	+	+	+	+	_	+	+
	Ethanol	+	+	+	+	_	+	+
Leonotis nepetifolia	Water	+	+	+	+	+	+	-
	Ethanol	+	+	+	+	+	+	-

Discussion

The study revealed that all the selected medicinal plants had phytochemicals considered to be responsible for the medicinal properties exhibited by most medicinal plants. Almost all the selected plants contain tannins. Past studies show that plants rich in tannins exhibit anti diarrhea activity [13] and anti-inflammatory and antioxidant activity [14]. Tannins have been reported to hasten the process of wound healing as well as

boosting antimicrobial activities of medicinal plants [15]

Saponins, phenols and flavanoids are present in all the studied plants. These phytochemicals are known to be behind the antimicrobial activities, antifungal, anti-allergenic, antispasmodic [16] and anti-inflammatory [17] properties of medicinal plants. Plants that contain saponins in large quantities have been found to possess antibacterial activity [18].

Alkaloids were found in all the studied plants except *Aloe myriacantha*. Alkaloids have been found to aid in anti-diuretic activity of medicinal plants [19]. Additionally, alkaloids have been found to be antimicrobial, antidiarrheal and anthelmintic hence contributing to the antimicrobial, antidiarrheal and anthelmintic properties of various medicinal plants [20]. Other biological uses of alkaloids reported in other studies include antiarrhythmic and antimalarial [21]. *Aloe myriacantha*, *Tetradenia riparia* and *Zehneria scabra* were found to possess Phlobatannins. The presence of this phytochemical implies that these plants may be used as anti-microbial agents.

Conclusion

In conclusion the selected medicinal plants used in Rwanda contain phytochemicals that have previously been found to have significant medicinal values. Saponins, alkaloids, tannins, flavanoids, steroids and phenols are present in these plants. These phytochemicals render the medicinal values of the studied plants.

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