



**PHYTOCHEMICAL CONSTITUENTS OF SOME MEDICINAL
PLANTS FOUND IN KAPTUMO DIVISION IN NANDI COUNTY,
KENYA**

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ABSTRACT

Medicinal plants are widely used by the traditional healers to prevent or treat various human diseases since time immemorial due to the chemical substances found in them. The phytochemical constituents of most of these plants has not been determined hence the present study conducted at Kaptumo Division in Nandi County seeks to profile the phytochemicals found in medicinal plants namely: *Kigelia africana* (Lam.) and Benth, *Ekebergia capensis* Sparrm and *Fagaropsis angolensis* (Engl.) Dale that are commonly used to treat infectious diseases. The objective of the research is to determine the phytochemicals present in the three medicinal plants that are

commonly used to treat infectious diseases. Fresh plants were collected from the field and air dried under shade at 25°C and later ground into powder and extracted using acetone and water. Phytochemicals from the extracts were profiled using thin layer chromatography method. All the plant extracts indicated presence of phenols, terpenoids and flavonoids. Saponins were absent in *Fagaropsis angolensis*. This study demonstrated support for the claimed uses of the plants in the traditional medicine probably due to the phytochemicals present. This asserts the need for further investigations using fractionated extracts and purified chemical components.

KEYWORDS: Phytochemical Constituents, Medicinal Plants, Acetone extracts and Water extract.

INTRODUCTION

The use of medicinal plants and herbs are of great importance to the health of individuals and communities. This is due to the presents of the secondary metabolites that produce a definite physiological action on the human body. There has been emergence in the consumption and demand for medicinal plants all over the world due to their availability and affordability, (Maneemegalai, 2008). For example, it is estimated that 80% of the population in Asia, Latin America and Africa use such remedies as they are reported to have minimal side effects (Doughari, 2006).

Similarly, a number of Kenyan medicinal plants have been found to possess antimicrobial properties (Kareru and Bii *et al.*, 2003) However, such plants should be investigated to understand their properties. Most of these indigenous medicinal plants are use as spices and food plants and also added to food used by pregnant and nursing women for medicinal purposes especially by the pastoral communities like the Maasai and the kalenjin of Kenya. (Okwu, 2001).

Herbal knowledge is widespread in the Nandi community; Families are often able to care for their own health. For example, berries and other wild fruits are used to supplement the diet before they are eaten, mostly by women and children this is due to the chemical substances found in these plants (Rainer , 2006). The most important of these active substances in medicinal plants are the alkaloids, terpenoids and flavonoids, whose presence is attributed to the antimicrobial activity in plants (Nostros *et al.*, 2000). For example, the phenolic compounds which are germicidal and are used in formulating disinfectants. Alkaloids which are one of the largest groups of phytochemicals in plants have been reported to have antimicrobial activities. They also have some effects on humans which has led to the development of powerful pain killers, anesthetic and stimulants for example, cocaine, caffeine, nicotine, and antimalarial drug quinine (Omulokoli *et al.*, 1997)

Terpenoids are active antimicrobials; their mechanisms of action are assumed to involve bacteria membrane disruption by the lipophilic compounds (Barre *et al.*, 1997). Flavonoids and flavonoids-derived plant natural products have long been known to function as

antimicrobial defense compounds in plants (Kazmi *et al.*, 1994, Kimutai *et al.*, 2014). Their role is to protect plants against microorganisms and insect attack (Cowen, 2008)

MATERIALS AND METHODS

Collection and Identification of plant materials

The information on the medicinal plants were gathered from the traditional practitioners, herbalists using a structured questionnaires in order to obtain information on the medicinal plants that are traditionally used for management of infectious diseases in the Kaptumo Division. The plant parts collected for identification consisted of flowers, roots, stems and leaves that were obtain from their natural habitats in Kaptumo Division and identified by a taxonomist at the Department of Botany herbarium University of Eldoret where the Voucher specimens were deposited (Table 1).

Preparation of extracts

After collection of the barks that were used by the herbalists. The plant materials were transported to Kenya Medical Research Institute (KEMRI) Phytochemistry laboratory and washed thoroughly with running tap water. They were then chopped into small pieces and air-dried for two weeks at room temperature by spreading evenly in the open drying area. The dry samples were ground separately into fine powder using a Willy mill and labeled appropriately using their voucher numbers. Fifty grams of the ground bark powder for each plant was exhaustively extracted with acetone to obtain the organic extracts for of the phytochemical profiling. The extracts were filtered through Whatman No. 1 filter paper and the solvents were removed using a rotary evaporator.

Water extraction was done by weighing (50 g) of dry powder of each considered plant soaked by adding distilled water to cover the materials then shaken for five minutes and put in a water bath at 65 ° C for one hour. The suspension was then filtered using filter paper and the filtrate was freeze dried using dry ice until they were semi-solid before it was evaporated to dryness for three days using freeze drying machine. The lyophilized dry powder was then put in a stoppered sample vial, weighed and kept in desiccator to avoid absorbing moisture. The later was stored in sterile airtight vials at 4° C in readiness for phytochemical tests.

Phytochemical profiling

Phytochemical screening of the crude water and acetone extract of the plants was carried out using standard phytochemicals methods as described by (Harborne, 1998). A spot of a

dissolve acetone extract was applied 2 cm from the edge of the TLC plate using a micro-tube. TLC (Thin layer chromatography plate) was put in a solvent system of acetone: petroleum ether at the ratio of 1:9 in a solvent tank, and allowed to develop till the solvent front. They were removed and allowed to dry in an open air after marking the solvent front. After, drying the TLC plates was observed under UV light at a wavelength of 365 nm and sprayed with the appropriate reagents as explained below. The best mobile phase giving best results was presented (Harborne, 1973 and 1984). The detection of alkaloids and other nitrogen compounds was indicated by the formation of brown spots on yellow background after spraying with Dragendroff reagent (Harborne, 1973).

A test for anthraquinones was done by spraying the TLC plates with a solution of Kedde reagent. Change of the original yellow brown colour to purple showed a positive test for anthraquinones (Harborne, 1973).

The test for flavonoids was done by exposing ammonia fumes on TLC plate. Their presence was indicated by coloured spots e.g. yellow, pink and brown spots (Harborne, 1973). Ferric Ferricyanide reagent was used to detect Phenols. Presence of Phenols was indicated by an instant change of colour to blue (Harborne, 1984).

Vanillin reagent was used for testing terpenoids. The presence of terpenoids was indicated by the separation into different colours; brown, dark green and purple colour (Harborne, 1984).

Tests for saponins was done by shaking 0.5grams of each of the plant extract in a test tube and left for 5 minutes, a persistent foam showed a positive test for saponins (Harborne, 1973 and 1984)

RESULTS

Table 1: Ethnobotanical information of the selected medicinal plants from Kaptumo Division

Botanical name	Part collected	Family Name	Traditional use
<i>Faragopsis angolensis</i>	Bark	Rutacea	Barks are boil in water for treatment of Pneumonia, Rheumatism and chest problems
<i>Kigelia africana</i>	Bark	Bignoniaceae	Barks are boil in water for the treatment of Stomach problems and candidiasis
<i>Ekebergia capensis</i>	Bark	Meliaceae	Barks are boil in water for the treatment of Gonorrhoea, tuberculosis and diarrhea



Plate: 2.1: A young *Fagaropsis angolensis* (Engl.) Dale



Plate 2. Mature tree *Kigelia africana* (Lam.) Benth. with hanging fruits



Plate 3: The upper part of *Ekerbergia capensis*

Table 2. Phytochemical Profile of the Plant extracts

Plant species	Solvent	Plants compounds					
		Terpenoids	Alkaloids	Flavonoids	Phenolics	Anthraquinones	Saponins
<i>E.capensis</i> (bark)	A	+	++	++	++	+	++
	W	+++	++	+++	+++	++	+
<i>K. africana</i> (bark)	A	+++	+++	+++	+++	++	+
	W	++	+++	+++	+++	+	+
<i>F.angolensis</i> (bark)	A	+	+++	++	+++	-	-
	W	+++	+++	++	+++	+	-

*Key: - = Not detected; + = Trace; ++ = moderate, +++ = High1. W-Water 2 A- Acetone

The phytochemical profile of showed that all the plant extracts indicated the presence of phenols, terpenoids and flavonoids. (Table 2)

DISCUSSION

A total of 6 water and acetone extracts from different parts of the three plant species were investigated for phytochemical analysis. The phytochemical analysis of water and acetone extracts indicated the presence of terpenoids, alkaloids, flavonoids, phenolics for all the three plants analyzed (Tables 2). Their presence could have contributed to the medicinal activities claimed by the traditional practitioners as observed by Jeruto *et al.*, (2008). The plants containing more of these metabolites have more medicinal uses. This observation is in agreement with findings by Geyid *et al.*, (2005).

It was found that the most commonly used part of the plant was found to be the bark which due to high concentration of secondary metabolites hence high activity, this agrees with the findings of (Grace, 2002) and the herbalist who mostly use the barks for treatment (Table1). This is because leaves manufacture secondary metabolites that are transported away and stored at barks at high concentration for being excretory and storage organs (Bibitha *et al.*, 2002). The concentrations and proportions of the active compounds in plant extracts components depend on the plant variety, origin, time of harvest, solvent used, conditions of processing and storage (Deans and Ritchie 1987).

The medicinal practitioners use water as an extractant make concoctions and decoctions that are normally medicinal active probably because water is very polar and it extracted some compounds that were not extracted by acetone (Nostro *et al.*, 2000). This is also in conformity with (Vinoth-Raja, 2009) who found that water extracts were more effective than acetone extracts particularly on *Pseudomonas sp.*

Flavonoids are known for their anti-allergic effect as well as a wide variety of activity against bacteria, fungi and viruses (Afolayan & Meyer, 1997).The mechanisms thought to be responsible for phenolic toxicity to microorganisms include enzyme inhibition by the oxidized compounds, possibly through reaction with sulfhydryl groups or through more nonspecific interactions with the proteins. The activity of flavonoids is probably due to their ability to complex with extracellular and soluble proteins and to complex with bacterial cell walls. The lipophilic flavonoids disrupt microbial membranes. This is in agreement with the

studies of Duke (Duke, 1985) who considered Eugenol to be fungistatic and bacteriostatic against both fungi and bacteria respectively.

Terpenes or terpenoids are active against bacteria and fungi. The triterpenoid betulinic acid is just one of several terpenoids which have been shown to inhibit HIV. The mechanism of action of terpenes is not fully understood but is speculated to involve membrane disruption by the lipophilic compounds (Mendoza *et al.*, (1997)

Alkaloids have been found to have antimicrobial properties. The mechanism of action of highly aromatic planar quaternary alkaloids such as berberine and harmaline is attributed to their ability to intercalate with DNA of the microbes Dassonville *et al.*, (2000).

Anthraquinone are known to be bacteriostatic, Kazmi *et al.*, (1994) described an anthraquinone from *Cassia italica*, a Pakistani tree, which was bacteriostatic for *Bacillus anthracis*, *Corynebacterium pseudodiphthericum*. The antibacterial compounds may target bacterial cell wall (penicillins, cephalosporins), cell membrane (polymyxins,) and bacterial enzymes (quinolones and sulfonamides which are bactericidal in nature). Those which target protein synthesis such as the aminoglycosides, macrolides and tetracyclines are usually bacteriostatic Finberg *et al.*, (2004).

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REFERENCES

1. Afolayan J and Meyer J. The antimicrobial activity of 3,5,7-trihydroxyflavone isolated from the shoots of *Helichrysum aureonitens* J. Ethnopharmacol, 1997; 57(3): 177-81.
2. Bibitha B, Jisha K, Salitha V, Mohan S and Valsa K. Antibacterial activity of different plant extracts: A short communication. Indian Journal of Microbiology., 2002; 42: 361-363.
3. Deans S G. and Ritchie G. Antibacterial properties of plant essential oils. International Journal of Food Microbiology., 2002; 5(3): 165-180.
4. Cowen L. The evolution of fungal drug resistance: Modulating the trajectory from genotype to phenotype. Nat. Rev. Microbiol, 2008; 6: 187-198.

5. Doughari J H. Antimicrobial activity of *Tamarindus indica* Linn. Tropical J. Pharm. Res. 2006; 5(2): 592-603.
6. Duke J. Handbook of biologically active phytochemicals and their activities. CRC Press, Boca Raton, 1992; 5(7): 22-25.
7. Finberg R, Moellering R and Tally F. The importance of bactericidal drugs: future directions in infectious disease. Clin. Infect. Dis, 2004; 39(9): 1314–20.
8. Geyid A, Abebe D, Debella A, Makonnen Z, Aberra F, Teka F, Kebede T, Urga K, Yersaw K, Biza T, Mariam BH, Guta M. Ethiopian Health and Nutrition Research Institute, 2005; 4(3): 1242-1254.
9. Harbon J.B. Phytochemical Methods. A guide to Modern Techniques of Plant., 1998.
10. Harbon J.B. Phytochemical Methods a Chapman and Hall, 1984 ed. London., 1984.
11. Jeruto P. Catherine L, George O, Dennis O and Charles M. An ethnobotanical study of the medicinal plants used by the Nandi people in Kenya. Journal of Ethno-pharmacology., 2008; 116(1): 370-376.
12. Kareru G, Gachanja, A, Kenji J and Mungai, G. Traditional medicines among the Embu and Meru peoples of Kenya .African Journal of Traditional ,Complementary and Alternative Medicines., 2007; 4(1): 75-86.
13. Kazmi, M., Malik, A., Hameed, S., Akhtar, N. and Ali, S. An anthraquinone derivative from *Cassia italica*. Phytochemistry., 1994; 36(8): 761-763.
14. Kigondu, I. Phytochemical and anti-parasitic activity studies of some selected Kenya Medicinal plants, Msc Thesis Jomo Kenyatta University of Agriculture and Technology., 2007; 89-99.
15. Kimutai N , Mutai C, Njenga W.E, Jeruto P, Ng'eny L, Korir R, Antimicrobial Activity and Cytotoxicity of Selected Medicinal Plants Found in Nandi County, Kenya. Afric. J. of pharma. and Theurapeutics, 2015; 4(3): 86-91.
16. Mendoza L, Wilkens M, Urzua A. Antimicrobial study of the resinous exudates and of diterpenoids and flavonoids isolated from some Chilean *Pseudognaphalium* (Asteraceae). J. Ethnopharmacol., 1997; 58(3): 85–88.
17. Nostro, A., Germano, M., D'Angelo, V., Marino, A. and Cannatelli, M. Extraction methods and bioautography for evaluation of medicinal plant antimicrobial activity. Lett. Applied Microbial., 2000; 30: 379-384.
18. Omulokoli, E, Khan B and Chhabra S. Antiplasmodial Activity of Four Kenyan Medicinal Plants. J. of Ethnopharm., 1997; 56(9): 133-137.

19. Okwu, D. Evaluation of the chemical composition of indigenous spices and flavoring Agents .Global J. pure and Appl. Sci., 2001; 7(3): 455-459.
20. Rainer W, Bussmann G. and Gilbreath G. Plant use of the Maasai of Sekenani Vinoth Raja R. Journal on the studies of wound healing property of coastal medicinal plants., 2009; 1(9): 139-44.