Antimycobacterial evaluation of some medicinal plants used in plateau State of Nigeria for the treatment of tuberculosis

Nvau, J. B¹, Oladosu, P.O², Orishadipe, A.T².

¹Department of Minerals Resources Engineering, Plateau State Polytechnic, Barkin Ladi, Plateau state, Nigeria.

²National Institutes for Pharmaceutical Research and Development, Abuja Nigeria.

ABSTRACT

Tuberculosis (TB) continues to be a devastating disease worldwide in the 21st Century and it is believed that one third of the World's populations are infected. 22 Countries are responsible for over 80% of the global TB burden, Nigeria is rank 4th and have the highest burden in Africa. A number of anti tuberculosis drugs are ineffective against this disease due to the emergence of resistance strains. As part of the effort in developing a new anti tuberculosis agent, we decided to interact with traditional medicine practitioners of the Plateau region on their approach to the management of TB. A total of fourteen (14) plants representing nine families were identified as the most often used plants to manage TB symptoms in the region. The plants materials were extracted using 70% aq. methanol and the extracts obtained after concentration were screened against BCG. The results of the assay showed that 56% of the plants screened had MICs within the range of 800µg/ml to 2000µg/ml and as such had antimycobacterial activity. These plants are potential sources for herbal drugs for exhibiting these strong inhibitory properties and could also provide leads to tuberculosis drug development.

Keywords: tuberculosis, antimycobacterial, herbal drugs.

INTRODUCTION:

Tuberculosis (TB) remains a leading cause of mortality worldwide and infects a third of the world's population. The world health organization (WHO) estimated that 9 million new cases and 3 million TB related death occur annually ((Raviglione et al., 1995). The largest number of mortality and new cases occur in South Eastern-Asia region, which accounted for 34% of the incident cases globally ((Global tuberculosis programme, WHO report 1998). The estimated incident in sub-Sahara Africa is nearly twice that of South-Asia countries. The less develop countries are worse hit with Africa having the highest burden, as a result WHO declared TB to be a global burden in 1993. 22 countries, mostly in Africa and Asia are responsible for over 80% of the global TB (Global tuberculosis Control, WHO report 2007).

Nigeria is rank 4th among the 22 countries and has the highest burden in Africa. The WHO also estimated that incidences of 123/100,000 of new cases of TB occurred in 2005 in Nigeria, this situation is alarming Global tuberculosis Control. WHO report 2007). The combination of long treatment duration (6-9 months), increase in multidrug resistance strain and synergy with HIV are the driving factors of this trend. Therefore, there is urgent need to source for new and more effective anti-TB from natural/synthetic sources.

Traditional medicine practice has been known for centuries in many parts of the World. The drug of choice is mostly plants extracts (Sofowora, 1984). The biodiversity of Plateau State of Nigeria is rich in flora that offer great possibilities to search for Natural product with anti-mycobacterial potential and that may offer different mode of action in its activity against the bug. The state has unique climate and weather. For this reasons, we attempt to search for anti tuberculosis from plants, exploiting the traditional medical practices of the indigenes. Fourteen crude extracts obtained from fourteen plants belonging to nine families were screened against BCG.

Pavetta corymbosa had been previously reported by Weniger, *et al (2004)* to possess anti plasmodium activities which further supported the claimed by the traditional healers for its use in treating malaria fever. *Canarium schweinfurthii* Engl is the next best with a MIC of 1000μ g/ml, this suggested that it had broader antibacterial spectrum, in comparison to the previous antioxidant and antimicrobial studies of the essential oil of the plants (Obame *et a,l* 2007). *Piliostigma* *thonningii* Schum and *Syzygium guineense* (Willd.)Dc had anti-mycobacterial activities as well as antibacterial (Akinpelu and Obuotor, 2000; Djoukeng *et al*, 2005). Also literatures have shown that most of the plants in these studies have anti bacterial activities (Medicinal plants of Nigeria, North central Zone, 2006).

MATERIALS AND METHODS

Plants material were collected in February 2009 in the central zone of plateau (Nigeria) and identified by the herbarium staff of the department of medicinal plant research and traditional medicine. The voucher specimens were deposited in the herbarium for future reference. Fourteen species were studied, the plants were collected and air dried immediately. A list of the plants part tested is presented in Table 1.

Extractions of plants parts: The powdered plant materials (10g) were extracted in 100ml of 70% aqueous methanol, on a mechanical shaker for 24 hours at room temperature. The extracts were filtered and the filtrates evaporated at a reduced temperature

under vacuum. The residual aqueous solution were thereafter, lyophilized on a bench top freeze dryer. The weight of the extracts obtained and screened against BCG are as indicated in Table 2.

Determination of MIC:Determination of antitubercular activity against *Mvcobacterium tuberculosis* (H₃₇Rv) was carried out as described by Clifton Barry III laboratory, TRS, NIAID, USA (9). This was accomplished using the micro well serial dilution method. A 1/10 dilution of the test extract/compound in DMSO was made in the media: 50µl of media was introduced into wells 2-12. 100ul of the extract/compound was delivered into well 1, 50µl was taken from well 1 and delivered into well 2 after through mixing 50µl was transferred from well 2 to 3 and the procedure was repeated through to well 12 and from well was 50µl discarded. Thereafter, 50µl of inoculums was added to all wells and it was incubated for 7days. DMSO and ethambutol were use as control and standard drug respectively.

BOTANICAL NAME OF PLANT	FAMILY	PART USED	TRADITIONAL THERAPEUTIC USES
Pavetta corymbosa (DC) F.N. Williams	Rubiaceae	Leaves and twist	antimicrobial, wound,Fever,Respiratory disorder
Pavetta owariensis P. Beav.	Rubiaceae	Stem bark.	Fever, Cough, Mental disorder.
Canarium schweinfurthii Engl.	Burseraceae	Leaves	Wound, Cough, Stimulant, Sexual infection
Cassia mimosides.	caesalpinioideae	Whole plant	Fever, Cough, diarrhea, rheumatism
Piliostigma thonningii Schum.	caesalpinioideae	Seed Pods	Dysentery, Respiratory problem, Wound
Gardenia erubescens Stapf and Hutch	Rubiaceae	Root bark	Antiviral ,syphilis ,fever, Cough
Syzygium guineense (Willd.)Dc	Mytaceae	Root bark	Amenorrhea, Abdominal pain, Cough
Vitex dononia	Verbenaceae	Stem bark	Cough, Sedative, trypasonomiasis, leprosy
Parkia biglobosa (Jacq.) R.Br.exG.Don	Mimosaceae	Stem bark	Leprosy, Cough, Gonorrhea.
Erythrina senegalensis	leguminosae	Leaves	Diuretics, convulsion, cough, toothaches
Terminalia glaucescens Planch.ex.Benth	Combretceae	Leaves	Cough, fever, Stomach pain
Maytenus senegalensis(lam).Exell	Celastrceae	Roots	Cough, Infection, Fever
Boswellia dalziellii Hutch	Burseraceae	Stem Bark	Dermatitis, eczema Cough
Carissa edulis Vahl	Apocynaceae	Roots	Tonic, Stimulant, Cough

BOTANICAL NAME OF PLANT	WEIGTH OF MINIMUM INHIBITIR
BOTANICAL NAME OF FLANT	
	EXTRACTS (g) CONCENTRATION
Pavetta corymbosa (DC) F.N. Williams	1.20 800
Pavetta owariensis P. Beav.	1.40 1800
Canarium schweinfurthii Engl.	1.50 1000
Cassia mimosides	1.25 1200
Piliostigma thonningii Schum.	1.03 2000
Gardenia erubescens Stapf and Hutch	1.20 3850
Syzygium guineense (Willd.)Dc	1.20 1200
Vitex dononia	1.40 1500
Parkia biglobosa (Jacq.) R.Br.exG.Don	1.35 2450
Erythrina senegalensis	1.10 1200
Terminalia glaucescens Planch.ex.Benth	1.25 1300
Maytenus senegalensis(lam).Exell	1.00 3800
Boswellia dalziellii Hutch	1.80 5000
Carissa edulis Vahl	0.60 3650

Table 2. Minimum inhibitory concentration and yield of the plant extracts from the 10g

RESULTS AND DISCUSSION

The profile of the medicinal plants used in this study is shown in table 1. The choice of the solvent system used in the extraction was deliberate, since this is the closest solvents to what is used by most traditional healers. The result of the anti- mycobacterium activity of the crude extracts revealed that only Nine plants (Pavetta Corymbosa, Canarium schweinfurthii Engl, Piliostigma thonningii Schum, Syzygium guineense, Vitex dononia, Erythrina senegalensis, Pavetta owariensis P.Beav, Terminalia glaucescens Planch. Ex Benth, Cassia mimosides) inhibited the growth of the bacterium with minimum inhibitory concentration within the range of 800µg/ml to 2000µg/ml. The other five plants (Gardenia erubescens Stapf and Hutch, Pirinari centrifiolium, Maytenus senegalensis Boswellia dalziellii Hutch, (lam).Exell, Parkia biglobosa (Jacq.)R.Br.exG Don. and Cassia mimosides) had MICs above 2500µg/ml.

This study substantiates the claim/use of the evaluated plant materials by traditional healers for the treatment of tuberculosis. The bioassay screening showed over 64% of the plant extracts had activity ≤2000µg/ml. Those with higher MICs cannot equally be ruled out as these may be sources of prodrugs that may produce better activity *in vivo* or if screened by other technique may equally give better results. Further work is in progress on some of these plants that had MIC less than 1500µg/ml with the aim of isolating the active components via bioassay guided isolation.

ACKNOWLEDGMENT

The authors are grateful to the National Institute for Pharmaceutical Research and Development Abuja for providing some of the material and equipment for this work. We would like to appreciate the ethno botanist of the Department of Medicinal Plants research and Traditional medicine, NIPRD, Abuja for identified the plants used in this work

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