IOSR Journal of Applied Chemistry (IOSR-JAC)
e-ISSN: 2278-5736.Volume 12, Issue 6 Ser. I (June. 2019), PP 15-22
www.iosrjournals.org

Quantitative phytochemical analysis and Anti-tuberculosis activity of some selected medicinal plants in some Northern parts of Bauchi state, Nigeria

[1]Aska, A.S., [2]Kubmarawa, D. [3] Nkafamiya, I. A., [4]Shagal H.M., and [5]Oladosu, P.O.

[1]*Aminu Saleh College of Education, Azare Bauchi State Nigeria*
[2, 3 & 4] *Modibbo Adama University of Technology Yola Adamawa State Nigeria*
[5] *National Institute of Pharmaceutical Research and Development, Abuja Nigeria*
Corresponding Author: Aska, A.S

Abstract: *Plants based remedies have been playing a vital role in health care delivery in spite of the influence of orthodox medicines. Tuberculosis remained one of the oldest diseases in the world that caused serious health concern globally. But Tuberculosis and other respiratory diseases are among the common ailments claimed to be treated using some local plants. This research was designed to investigate Anti-tuberculosis activity of Nine (9) selected medicinal plants collected in some local communities in the Northern parts of Bauchi state, Nigeria. The quantitative phytochemical analysis was also carried out. The result indicated the highest saponins content (83.89%) in Butyrospermum paradoxum and the least saponins content (30.79%) was observed in Striga hermonthica. The arial parts of S. hermonthica have 33.60% steroids content. Butyrospermum paradoxum also recorded the highest tannin content (67%) and steroids (51.43%) while the least tannin content was found in Pilostigma reticulatum. But the least steroids content was observed in root extracts of C. mucronata. The highest percentage of phenols (70.20%) was observed in Euphorbia hirta but with lowest percentage of flavonoids. Pilostigma reticulatum has the highest percentage of alkaloids (28.31%) followed by Cissampelos mucronata with 23.67%. Waltheria indica has 65.31% saponins, 43.26% steroids and 36.30% of phenols. X. americana has 50.86% saponins, 28.41% steroids and 42.29% tannins. T. Indica has 14.40% alkaloids and 20.84% steroids. E. Senegalensis has 52.11% flavonoids, 34.84% saponins, 18.62% steroids and 27.14% tannins. The quantitative phytochemical analysis of the crude methanol extracts revealed that the plants contained significant quantity of bioactive agents in varied amounts. The phytochemicals were responsible for the utilization of these plants in traditional medicine. Micro broth dilution method was employed to investigate the anti tuberculosis activity of these plants. The result revealed that only four (4) plants out of the nine (9) tested exhibited anti tuberculosis activity with Minimum Inhibitory Concentration (MIC) range of 1.25 to 5.0mg/ml. S. hermonthica has MIC of 1.25mg/ml, E. senegalensis has MIC of 2.5mg/ml, C. mucronata and E. hirta have same MIC of 5.0mg/ml. No activity was observed for the Extracts of the following five (5) plants; W. indica, X. americana, P. reticulatum, B. paradoxum and T. indica. The active plants have shown significant anti TB activity since these MIC values are for the crude extracts of the plants. The present study indicated that the plants could be useful in anti tuberculosis drug discovery. Therefore the most active plants will be considered for further research to isolate and characterize the bioactive agents responsible for the observed ant-iTB activity.*

Key Words: *medicinal plants, quantitative analysis, phytochemicals, anti tuberculosis activity*

Date of Submission: 27-05-2019 Date of acceptance: 11-06-2019

I. Introduction

Despite the influence of orthodox medicines the use of medicinal plants has remained a very important aspect of health care delivery system especially in rural areas. It was reported that 80% of world's population relies on traditional medicines as primary source of their medication (Newman, 2006). About 25% of prescription drugs sold in USA contain active ingredients derived from plants. There were 520 new drugs approved for commercial use in USA between 1983 and 1994 but 30 were obtained from natural products and 127 were chemically modified natural products (Zambrowicz and Sands, 2003).

Medicinal plants are plants with medicinal values based on folkloric information. They are use by the local communities in the treatment of many diseases (Akinniyi and Tella, 1991). The clinical success of plant-based drugs has rekindled interest in research into medicinal plants as potential sources of new drugs. In some countries like China, India and Vietnam the research in to medicinal plants has been fully developed and plant-

based remedies have been incorporated as alternative or complementary medicines to supplement the modern drugs. However, in Nigeria like in most African countries the research into medicinal plants has not been given a desire attention as such the therapeutic potentials of these natural endowments were under-utilized (Ogundaini, 2005).

In fact, the phytochemical agents in medicinal plants work together with nutrients found in vegetables, fruits and nuts might even slow the aging process, prevent the risk of or cure many diseases such as heart diseases, diabetics, high blood pressure, cancer, tuberculosis, cataracts and urinary tract infections. There were several plant extractives that demonstrated significant inhibitory activity against microscopic pathogens like bacteria, fungi and viruses (Malcolm and Sofowora, 1969; Kone *et al.,* 2004; Sanogo, 2005; Hamza and Mbwabo, 2006; Kubmarawa *et al.,* 2007; Tanaka *et al*., 2010).

These pathogens were responsible for many deadly infectious diseases like leprosy, HIV and tuberculosis. Some medicinal plants were used in folklore medicine to treat respiratory diseases including symptoms of tuberculosis such plants may contain bioactive agents that are responsible for the observed therapeutic potentials (Uba, *et al.,* 2003; Mann *et al.,* 2007; Gupta *et al.,* 2010).

Tuberculosis is one of the oldest diseases in the world that remains a serious health concern globally. It attacks both children and adults, privileged and less privileged persons. In fact, it cut across all segment of the population (Manchester, 1984). Many plant species are widely distributed in Nigeria and are used in traditional medicine for treating of respiratory diseases such as asthma, catarrh, chronic bronchitis, cough, hay-fever, hemoptysis, pneumonia, pulmonary disorders and tuberculosis (Mann, *et al.,* 2007) and other human diseases. Some members of the family *Caesalpiniaceae, Scrophulariaceae, leguminaceae, euphorbiaceae, combretaceae, Sterculiaceae, Sapotaceae* etc have high concentrations of flavonoids, terpenoids, tannins or polyphenolic compounds. These compounds are also known to have *in vitro* antimicrobial activity (Adigun, *et al*., 2000; Sofowora, 1969; Mann, *et al*., 2008). Anti-tuberculosis activity has been reported in number of higher plants as well as in lichen species (Jimenez-Arellanes, *et al.,* 2003; Gupta, *et al.,* 2007).

In this wok, we are reporting the Anti-tuberculosis activity of some selected medicinal plants collected in some Northern parts of Bauchi state, Nigeria.

II. Materials And Methods

Nine (9) plant samples, consisting of different parts of the plants such as whole plant, root bark, stem bark, leaves and aerial parts. Clean polythene bags, pestle and mortar, UV-visible spectrophotometer, methanol, distilled water, ethanol, n-butanol, diethylether, sulphuric acid, ammonium hydroxide, Potassium hexacyanoferrate (III), soxhlet extractor ,volumetric flask, filter paper, crucible, volumetric flask, plastic bottle, oven, analytical balance, mycobacterium bovis(BCG), OADC (oleic acid, albumin, dextrose) complex, Dimethyl sulphoxide, multi-channel pipettor, 96 micro-well plates. All the reagents used were of analytical grades.

Sample collection and identification

The plants samples were collected from Three (3) Local Government Areas in Northern parts of Bauchi State, Nigeria using standard method. The freshly collected plant samples were conveyed in clean polythene bags to Biology Department, ATBU, Bauchi for identification by a taxonomist and voucher specimens were prepared and deposited in Herbarium (Abdalfatah, *et al*., 2013; Zailani, *et al*.,2010;Mann, *et al*, 2008; Kubmarawa, *et al*., 2007).

Drying and Pulverising

The samples of the plants were dried under shade inside a room. The well dried samples were pulverized to fine powder using mortar and pestle. The powder of each sample was weighed using analytical balance and kept at room temperature until use (Ibrahim, *et al*., 2012).

Extraction of plant samples

The plants samples were subjected to exhaustive extraction using soxhlet extractor. One hundred grams (100g) of each sample in 70% Methanol was used in the extraction process which lasted for 12hrs. The crude extract of each sample was filtered and concentrated in an oven at 40°c. The dried methanol extracts were then packed in glass bottles with proper labeling for future use.

Quantitative analysis

The Quantitative analysis of the extracts was carried out based on our previous work on the qualitative phytochemical analysis of the plants samples (Aska and Kubmarawa, 2016) and in accordance with standard methods as described by Edeoga, *et al*., 2005, Sutharsingh, et al., 2011, Amin, et al., 2013, Devanaboyina, *et al*., 2013 and Anand, *et al.,* 2014

Alkaloid determination

5g of the sample was weighed into a 250ml beaker and 200ml of 10% acetic acid in ethanol was added and covered. This was allowed to stand for 4hrs. The extract was filtered and concentrated on water bath to one-quarter of the original volume. Concentrated ammonium hydroxide was added drop-wise to the extract until the precipitation was completed. The whole solution was allowed to settle and the precipitate was collected and washed with dilute ammonium hydroxide and then filtered. The residue is the alkaloid, which was dried and weighed.

Flavonoids determination 10g of the plant sample was extracted repeatedly with 10ml of 80% aqueous methanol at room temperature. The whole solution was filtered using whattman filter paper No. 42(125mm). The filterate was then transferred into a crucible and evaporated into dryness over a water bath and weighed to a constant weight.

Steroids determination

1ml of methanol extract of the plant sample was transferred into 10ml volumetric flask. Sulphuric acid (4N, 2ml) and iron (III) chloride (0.5% w/v, 2ml), were added, followed by potassium hexacyanoferrate (III) solution (0.5% w/v, 0.5ml). The mixture was heated in a water-bath maintained at 70± 2°C for 30minutes with occasional shaking and diluted to the mark with distilled water. The absorbance was measured at 780nm against the reagent blank.

Saponin determination

20 g of each sample was put into a conical flask and 100cm^3 of 20% aqueous ethanol was added. The samples were heated over a hot water bath for 4hrs with continuous stirring at about 55^{o}C. The mixture was filtered and the residue was re-extracted with another 200ml 20% ethanol. The combined extracts were reduced to 40ml over water at about 90^{o}C. The concentrate was transferred into a 250ml separator funnel and 20ml of diethyl ether was then added and shaken vigorously. The aqueous layer was recovered while the ether layer was discarded. 60ml of n-butanol was added and the combined n-butanol extracts were washed twice with 10ml of 5% aqueous sodium chloride. The remaining solution was heated in a water bath. After evaporation the samples were dried in the oven to a constant weight, the saponins content was calculated as percentage.

Tannin determination

500mg of the sample was weighed into a 50ml plastic bottle. 50ml of distilled water was added and shaken for 1hr in a mechanical shaker. The mixture was filtered into a 50ml volumetric flask and made up to the mark. Then 5ml of the filtered was pipetted out into a test tube and mixed with 2ml of 0.1M ferric chloride in 0.1M HCl and 0.008M potassium ferrocynide. The absorbance was measured at 120nm within 10min.

Determination of total phenol

The Defatted sample was boiled with 50ml of ether for the extraction of the phenolic component for 15min. 5ml of the extract was pipetted into 50ml flask, then 10ml of distilled water was added. 2ml of ammonium hydroxide solution and 5ml of concentrated amyl alcohol was also added. The samples were made up to mark and left to react for 30min for color development. The total phenol was measured at 505nm.

Anti-tuberculosis Activity of the Selected Plant Extracts

The anti-tuberculosis activity of the plant extracts was carried out using the minimum inhibitory concentration determination by the broth micro-dilution as described by Aneja, 2005; Mann, *et al*., 2008 and Oladosu, *et al.,* 2013.

Extract Preparation

One hundred milligram (100mg) of each extract was dissolved in 1ml Dimethylsulphoxide (DMSO), centrifuged at 13,000xg for 15minutes. The centrifugate was further diluted 1:10 by dispensing 50µl of the extract in DMSO solution into 450µl sterile 7H9/ADC broth to give a final concentration of 10mg/ml. weighing of extracts was accurately done on mettle AB54 balance (Oladosu *et al.,* 2013).

Culture and Growth of Mycobacterium species

Mycobacterium bovis (BCG) was obtained from the Diagnostic Laboratory of National Institute for Pharmaceutical Research and Development (NIPRD), Garki – Abuja, Nigeria. The organisms were constituted in Middlebrook 7H9 broth (Difco, Detroit, Mich.) supplemented with 0.2% (vol/vol) glycerol (Sigma Chemical Co., Saint Louis, Mo.), 1.0 g of Casitone (Difco) per liter, 10% (vol/vol) OADC (oleic acid, albumin, dextrose,

catalase; Difco) and were incubated at 37°C for 7 days. The optical density of the resulting culture was measured using a UV-visible spectrophotometer at 650nm (Mann, *et al*, 2008).

Organisms Preparation

500µl of test organism *mycobacterium bovis*(BCG) freshly thawed stock was inoculated into 50ml of sterile middlebrook 7H9/ADC broth medium and incubated at 37ºC for 5-7days. The optical density of resulting culture was measured using a UV/vis spectrophotometer. The optical density (OD) of resulting culture determined at 650nm was approximately 0.2 which equal to 10^9 cfu/ml (Aneja, 2005).

Determination of Minimum inhibitory concentration (MIC)

The broth micro-dilution method (BMM) was employed for the determination of MIC of the extracts. Fifty microlitres (50µl) of sterile 7H9 broth was transferred into each of the wells of 96 micro-well plates starting from well 2 to 12. Using multi-channel pipettor, 100 µL of extract was pipetted into well 1from which 50µL was transferred to well 2 mixed thoroughly by pipetting up and down four times and 50 µL was transferred to well 3 and the process continued to well 11 from which 50µl was withdrawn and discarded that is serial dilution .Well 12 was served as organism control. Extracts were first dissolved in DMSO and then diluted in Middle brook 7H9 broth, to give a stock concentration which was diluted out across a 96-wells micro-litre plate in a two-fold serial dilution to give final testing concentrations. The same procedure was repeated for the Rifamprin as reference drug. The initial concentration of 25 µg/ml of rifamprin was diluted to the testing concentrations. The plates were then incubated for 5-7days at 37°C. The minimum inhibitory concentrations (MICs) of the extracts were recorded as the lowest extract concentration at which no mycobacterial growth was observed (Aneja, 2005; Mann *et al*., 2008, Oladosu *et al.*, 2013).

III. Results And Discussion

Table 1: Selected medicinal plants used in the study

ID number	Scientific name	Local name	Family	Part collected	Location
001	Striga hermonthica (Del.) Benth.	Makasa(H)	Scrophulariaceae	Aerial parts,	Azare
002	Ximenia Americana L.	Tsada(H)	Olacaceae	Stem	Shira
003	Tamarindus indica L.	Tsamiya(H)	Caesalpiniaceae	Stem	Shira
004	*Waltheria indica L.*	Hankufa(H)	Sterculiaceae	Leaves	Misau
005	*Pilostigma reticulatum (DC) Hochst*	Kargo(H)	Caesalpiniaceae	Leaves	Azare
006	*Cissampelos mucronata. A. rich.*	Kunnen Damisa(H)	Menispermaceae	root	Misau
007	*Euphorbia hirta L.*	Nonon kurciya(H)	Euphorbiaceae	Whole plant	Misau
008	*Erythrina senegalensis DC.*	Minjirya(H)	Fabaceae	Stem	Azare
009	*Butryospernum paradoxum (Gaertn.f.)Hepper*	Kadanya(H)	Scrophulariaceae	Leaves	Shira

***H=Hausa name**

Table 2: Result of Quantitative estimation of phytochemical constituents of the plants samples

Plants	Alkaloids %	Flavonoids %	Saponins %	Steroids %	Tannins %	Phenols %
Waltheria indica	ND	ND	65.31	43.26	ND	36.30
Ximenia americana	ND	ND	50.86	28.41	42.29	ND
Pilostigma reticulatum	28.31	40.09	61.50	ND	24.86	ND
Striga hermonthica	ND	55.17	30.79	33.60	36.25	ND
Butryospermum paradoxum	ND	62.50	83.89	51.43	67.20	45.56
Cissampelos mucronata	23.67	ND	44.67	17.38	26.33	ND
Euphorbia hirta	20.00	14.16	40.09	ND	48.18	70.20
Tamarindus indica	14.40	ND	ND	20.84	ND	ND
Erythrina senegalensis	ND	52.11	34.84	18.62	27.14	ND

ND=NOT DETECTED

Table 3: anti-tuberculosis activity of methanol extracts of selected plant samples
KEY: + = No activity − = Activity (inhibition of test organism) NB: MIC of Rifampicin=0.04µg/ml

Extracts/Doses (10mg/ml)	5	2.5	1.25	0.625	0.312	0.156	0.07	0.03	0.015	0.007	0.0035	OVC
E1	+	+	+	+	+	+	+	+	+	+	+	+
E2	+	+	+	+	+	+	+	+	+	+	+	+
E3	+	+	+	+	+	+	+	+	+	+	+	+
E4	−	−	−	+	+	+	+	+	+	+	+	+
E5	+	+	+	+	+	+	+	+	+	+	+	+
E6	−	+	+	+	+	+	+	+	+	+	+	+
E7	−	+	+	+	+	+	+	+	+	+	+	+
E8	+	+	+	+	+	+	+	+	+	+	+	+
E9	−	−	+	+	+	+	+	+	+	+	+	+
Rifampicin	−	−	−	−	−	−	−	−	−	+	+	+
Control drug(25µg/ml)	12.5	6.25	3.12	1.56	0.78	0.39	0.18	0.09	0.045	0.022	0.011	OVC
Wells	1	2	3	4	5	6	7	8	9	10	11	12

E1=Leaf extract of *Waltheria indica* **E6=**Root extract of *Cissampelos mucronata*
E2=Stem bark extract of *Ximenia Americana* **E7=**Whole plant extract of *Euphorbia hirta*
E3=Leaf extract of *Pilostigma reticulatum* **E8=**Root-bark extract of *Tamarindus indica*
E4=Aerial part extract of *Striga hermonthica* **E9=**Stem-bark extract of *Erythrina senegalensis*
E5=Leaf extract of *Vitellaria paradoxa*

Table 4: MIC value of anti-tuberculosis screening of the plant samples

Plant	Extract	MIC(mg/ml)
S. hermonthica	E4	1.25
C. mucronata	E6	5.0
E. Hirta	E7	5.0
E. senegalensis	E9	2.5

NB: MIC of Rifampicin=0.04µg/ml

IV. Discussion

The in-vitro anti-tuberculosis activity was carried out on some selected medicinal plants in some Northern parts of Bauchi State, Nigeria. The plants were used by the local communities for the treatment of tuberculosis and other respiratory diseases. The parts of the plants used and the place of collection were presented in table 1. Qualitative phytochemical screening of the methanol extracts of the plant samples was previously reported (Aska and Kubmarawa, 2016) and now we are reporting the quantitative analysis and the anti-TB activity of the plants. The result of the quantitative estimation of alkaloids, flavonoids, saponins, tannins and phenols in crude methanol extracts of the plant samples was represented in table 3. The result indicated the highest saponin content (83.89%) in *Butyrospermum paradoxum* and the least saponins content (30.79%) was observed in *Striga hermonthica.* The arial parts of S. hermonthica have 33.60% steroids content. *Butyrospermum paradoxum* also recorded the highest tannin content (67%) and steroids (51.43%) while the least tannin content was found in *Pilostigma reticulatum.* But the least steroids content was observed in root extracts of *C. mucronata*. The highest percentage of phenols (70.20%) was observed in *Euphorbia hirta* but with lowest percentage of flavonoids. *Pilostigma reticulatum* has the highest percentage of alkaloids (28.31%) followed by *Cissampelos mucronata* with 23.67%. *Waltheria indica* has 65.31% saponin, 43.26% steroids and 36.30% of phenols. *X. americana* has 50.86% saponins, 28.41% steroids and 42.29% tannins. *T. Indica* has 14.40% alkaloids and 20.84% steroids. *E. Senegalensis* has 52.11% flavonoids, 34.84% saponins, 18.62% steroids and 27.14% tannins.

Waltheria indica is used in Nigeria for the treatment of diarrhoea, infertility, skin diseases, gonorrhea and for relieving pains. The antimicrobial activity of the plant was reported by Zailani *et al,* 2010. The whole plant is locally used to treat cough, haemorrhage, fever, and malaria (Diallo, *et al*., 1999). Previous investigations showed that the constituents of *X. americana* have several biological activities such as antimicrobial, antifungal, anticancer, antineoplastic, antitripanosomal, antirheumatic, antioxidant, analgesic, moluscicide, pesticidal and also having hepatic and heamatological effects(Abdalfatah *et al*., 2013). Dosso *et al*., (2011) have reported the phytochemical screening of the stem bark of *P. reticulatum* which showed that tannins and flavonoids are the major components. But sterols, polyterpenes, saponins, alkaloids, anthraquinones, and coumarins were not detected. This genus *Pilostigma* is used by the traditional healers to treat ulcers, boils, wounds and synphilitic cancer. Other medicinal uses are against coughs, bronchitis, malaria, hepato-billary ailments, hydropsy, sterility, rachitis and kwashiorkor (Newman *et al*., 2008). *Cissampelos mucronata* (family *Menispermaceae*) is popular among traditional healers in Nigeria for its use in the treatment of anti diarrhoeal conditions (Sofowara, 1993). The morphological description of the *C. mucronata* has been documented

(Hutchinson and Dalziel, 1954). In India the root bark is used as antivenom (Selvanayahgam *et al*., 1994). In Nigeria, extracts of *E. hirta* are used as ear drops and in the treatment of boils, sore and wound healing (Ogueke, *et al.*, 2007). The plant has been used for female disorders but is now more important in treating respiratory ailments, especially cough, coryza, bronchitis and asthma. In India it is used to treat worm infestations in children and for dysentery, gonorrhoea, jaundice, pimples, digestive problems and tumours (Sandeep, *et al*., 2009).

Comparative antibacterial activity of seed extract of *Tamarindus indica* with standard Kanamycin against both gram positive (*Bacillus subtilis, Bacillus megaterium, Staphylococcus aureus* and *Sarcina lutea*) and Gram negative (*Shigella dysenteriae, Escherichia coli, Salmonella typhi* and *Salmonella paratyphi)* bacteria was also reported (Naznin and Monirul, 2009). Julia and Miami 1987 also reported that the infusion of the roots has curative value in chest complaints and as ingredient in management of leprosy. The antimicrobial activity of various extracts of *S. hermonthica* against several standard microorganisms invitro has also been studied (koua, *et al*., 2011). But no attempt has been made by previous worker to purify the compounds contained in the plant extract despite the fact that the plant crude extracts proved effectiveness against many diseases (Atawodi, *et al*., 2003). The stem bark of *Erythrina senegalensis* has shown strong analgesic and anti-inflammatory effects (Saidu *et al*., 2000), Udem *et al*., 2010 have reported low toxicity of stem bark extract of *Erythrina senegalensis* DC. *Butryspermum paradoxum (syn;Vitellaria paradoxa Gaertn.f)* is a popular tree with many applications in folkloric medicine. It is use for treating asthma, expectorant, tuberculosis and whooping cough. The decoction of seeds is use for treating catarrh condition and nasal decongestion (Gill, 1992). The antimicrobial activity of *B. paradoxum* and preliminary phytochemical constituents has been reported (Kubmarawa, *et al*., 2007; El-Mahmood, *et al*., 2008).

The result of anti-tuberculosis screening of the selected plants in this study was presented in table 3. The micro broth dilution method was used in the determination of minimum inhibitory concentration of the plant extracts against *Mycobacterium bovis* (BCG)(Antima and Sanjib, 2012). In this method several extracts were placed in different micro plate tubes containing inoculated broth (Jolaba *et al.*, 2009). The result revealed that only four (4) plants out of the nine (9) selected plants exhibited anti tuberculosis activity (5.0-1.25mg/ml) when tested for anti-mycobacterial activity (Table 3). *S. hermonthica* has minimum inhibitory concentration (MIC) of 1.25mg/ml, *E. senegalensis* has MIC of 2.5mg/ml, *C. mucronata* and *E. hirta* has same MIC of 5.0mg/ml (Table 4). No activity was observed for the Extracts of the following five (5) plants; *W. indica, X. americana, P. reticulatum, B. paradoxum* and *T. indica.* But *S. hermonthica* extract has the highest activity among the four (4) active plants. Similarly, research on the phytochemical screening for anti-TB activity was conducted by several researchers. The growth inhibition of *Mycobacterium tuberculosis* was carried out on 44 plants species selected on the basis of traditional use against tuberculosis of these, six species namely *Chelidonium majus, Pinus brutia, Palvia aethiopsis, Stachys sylvatica, Ulmus grabra, Urtica dioica* showed activity and the last three species shown activity by water extracts but the method adopted was micro-plate Alamar blue assay (Tosun *et al*., 2004). Jimenes-Arellanes, *et al*., (2003) have reported that the hexane extract of *Lantana hispida* showed good activity against mono resistant variants of *M. tuberculosis* H37Rv using micro broth techniques. Remarkably the hexane extract of *L. hispida* was also active against a group of Multi Drug Resistant (MDR)-TB clinical isolates but did not inhibit the growth of non-tuberculosis mycobacterium. When the hexane extract was fractioned by column chromatography, one of its fractions inhibited the growth of all MDR-TB clinical isolates at concentrations of 25µl/ml.

The phytochemical constituents observed in these plants make them useful for treating several ailments and the curative properties of medicinal plants are perhaps due to the presence of various secondary metabolites. The plants were selected based on ethno-botanical survey of medicinal plants used in the treating of respiratory diseases and symptom of tuberculosis. The study revealed that the crude extracts of the plants have significant anti-TB activity. Further fractionation and purification might improve the activity of the extracts. Therefore, the crude extracts will be subjected to further purification and bioactivity guided fractionation in order to isolate and characterize the anti TB agents in the plants.

Acknowledgement

The authors wish to thank the HOD chemistry, Modibbo Adama University of Technology, Yola, Nigeria and both Academic staff and non academic staff of the department for their support and contribution in this research. We are particularly grateful to the management and staff of National institute of pharmaceutical research and development (NIPRD), Abuja for their kind permission and assistance to carry out the research in the institute. We also acknowledge the support of the management of Aminu Saleh college of Education, Azare Bauchi state Nigeria.

References

[1]. Abdalfatah, A., Sajan L. S., Christina Y. I. and Saad, M. H. A. (2013). Bioassay and Phytochemical Studies on Ximenia Americana L. Bark Ethanolic Extract. J. Forest Products and Industries.2(3), 63- 68.

[2]. Adigun, J.O., Amupitan, J.O. and Kelly, D.R. (2000). Isolation and investigation of antimicrobial effect of 3, 4, 3-tri-O-methyl flavellagic acid and its glucoside from Anogeissus leiocarpus. Bull.Chem. Soc. Ethiopia. 14(2): 169-174.

[3]. Akinniyi, I. A. and Tella, U. A. (1991). Rural resources and national development(part II). A case for the recognition of African traditional medicines in Nigeria. Annals of Borno. 6/7:279-293.

[4]. Anand, D.,John, W.W., Saravanan, P. and Rajarajan, S. (2014). Phytochemical analysis of leaf extract of Eclipta alba (L.) Hassk by GC-MS method. Intern. J. Pharmacog. and Phytochem. Res. 6(3): 562-566

[5]. Aneja, K. R.(2005). Experiments in Microbiology, Plant Pathology and Biotechnology. New Age Publishers, p. 69.

[6]. Antima G. and Sanjib B.(2012) : An integrated surrogate model for screening of drugs against Mycobacterium tuberculosis. J. Antimicrob. Chemother. 67: 1380–1391.

[7]. Amin, MN, Dewan, SMR., Noor, W., Shahidud-Daula, AFM (2013). Characterization of chemical groups and determination of total phenol content and invitro antioxidant activity of ethanolic extract of Ocimum sanctum leaves growing in Bangladesh. Eur. J. Exp. Bio. 3(1):449-454.

[8]. Aska, A. S. and Kubmarawa, D. (2016). Preliminary phytochemical screening of some indigenous medicinal plants used in the treatment of tuberculosis in Bauchi state, Nigeria. IOSR- Journal of Applied Chemistry. 9:(4)1:48-52.

[9]. Atawodi, S .E., Bulus, T., Ibrahim, S., Ameh, D. A., Nok, A. J., Mamman, M. (2003). Invitro trypanocidal effect of methanolic extract of some Nigerian savannah plants. Afr. J. Biotech. 2 (9): 317-321.

[10]. Devanaboyina, N, Ramalakshmi,N. Satyanarayana, B. Sudeepthi, P. Hemachakradhar, K. and Pavankumar, RN (2013) . Preliminary phytochemical screening, Quantitative Estimation and Evaluation of Antimicrobial Activity of Alstonia macrophylla stem bark. Inter. J. Sci. Inn.Today. 2(1), 31-39.

[11]. Diallo, D., Hveem, B., Mahmoud, M.A., Berge, G., Paulsen, B.S. and Maiga, A. (1999). An ethnobotanical survey of herbal drugs of Gourma District. Mali. Pharm. Biol. 37(1):80- 91.

[12]. Dosso, K., Nguessan, B. B., Bidie, A. P., Gnangoran, B. N., Meite, S. Nguessan, D., Yapo, A. P. and Ehile, E. E.(2012) . Antidiarrhoeal Activity of an Ethanol Extract of the Stem Bark of Piliostigma Reticulatum (Caesalpiniaceae) in Rats. Afr. J. Tradit Complement Altern. Med.9(2): 242–249.

[13]. El-Mahmood, A. M, Doughari, J. H. and Ladan, N. (2008). Antimicrobial screening of stem bark extracts of Vitellaria paradoxa against some enteric pathogenic microorganisms. African J. Pharm. and Pharmacology. 2(5):089-094.

[14]. Gill, L.S. (1992). Ethnomedicinal uses of plants in Nigeria. Uniben press, Benin City, Nigeria. pp. 276.

[15]. Gupta, V.K., Darokar, M.P., Saikia, D., Pal, A., Fatima, A. and Khanuja, S.P.S. (2007). Anti-mycobacterial activity of lichens. Pharm Biol. 45: 200–204.

[16]. Gupta, V. K., Shukla, C., Bisht, G. R. S., Saikia, D., Kumar S. and Thakur, R. L.(2010). Detection of anti- tuberculosis activity in some folklore plants by radiometric BACTEC assay. Letters in Applied Microbiology 52: 33–40.

[17]. Hamza, O.J. and Mbwabo, Z.H. (2006). Antifungal activity of some tanzanian plants used in traditionally for the treatment of fungal infections. J. Ethnopharm. 108:124-134.

[18]. Hutchinson, J. and Dalziel, J.M. (1954). Flora of west tropical Africa 2nd edn. Vol 12. Crown Agent overseas Government and Administration. Millbank London SW 1. pp. 325-397.

[19]. Ibrahim, T. B., Esther, A. A., Yuehong, W. and Francis, O. S.(2012) Anti-TB Activity of Sterculia setigera Del., Leaves. J. Pharmacognosy and Phytochemist. 1(3):17-23.

[20]. Jimenez-Arellanes, A., Meckes, M., Ramirez, R., Torres, J. and Luna-Herrera, J. (2003). Activity against multidrug resistant Mycobacterium tuberculosis in Mexican plants used to treat respiratory diseases. Phytother Res. 17: 903–908.

[21]. Julia, F.M. and Miami, F. L. (1987). Tamarind fruits of the tropics. 1st edn. Univ. press Ibadan, Nigeria. Pp 115-120.

[22]. Jolaba, M., Wa'ako, D., Odyek, O. and Kirimuhuzya, C.(2009). The antimicrobial activity of Lantana camara a plant used to treat symptoms of tuberculosis in south Western Uganda. Africa Health Sci.9:40-45.

[23]. Koné, W.M., Atindehou, K.K., Terreaux, C., Hostettmann, K., Traoré, D. and Dosso M. (2004). Traditional medicine in north Côte-d'Ivoire: screening of 50 medicinal plants for antibacterial activity. J Ethnopharmacol. 93(1): 43- 49.

[24]. Koua, F. H. M., Babiker, H. A., Halfawi, A., Ibrahim, R. O., Abbas, F. M., Elgaali E.I.(2011).Phytochemical and Biological Study of Striga hermonthica(Del.)Benth callus and intact plant. Res. Pharm. Biotechnol. 3(7):85-92.

[25]. Kubmarawa, D., Ajoku, G. A., Enwerem, N. M. and Okorie, D. A. (2007). Preliminary phytochemical and antimicrobial screening of 50 medicinal plants from Nigeria. African J. Biotechnology. 6 (14): 1690- 1696.

[26]. Malcolm, S.A and Sofowora, E.A. (1969). Antimicrobial activities of selected Nigerian Folk Remedies and their Constituent plants. Lloydia, 32:512-517.

[27]. Manchester, K. (1984). Tuberculosis and leprosy in antiquity: an interpretation. Medical History. 28:162-173.

[28]. Mann, A., Amupitan, J.O., Oyewale, A.O., Okogun, J.I., Ibrahim, K. (2007). An Ethnobotanical survey of indigenous flora for treating tuberculosis and other respiratory diseases in Niger State, Nigeria.

[29]. J. Phytomed. Therap. 12: 1-12.

[30]. Mann, A., Amupitan, J.O., Oyewale, A.O.,Okogun,J.I. and Ibrahim,K. (2008). Evaluation of invitro antimycobacterial activity of Nigerian plants used for treatment of respiratory diseases.

[31]. African J. Biotech. 7(11): 1630-1636.

[32]. Naznin, A. and Monirul, M.D. I. (2009). Phytochemical Screening and In vitro antibacterial activity of Tamarindus indica Seeds ethanolic extract. Pakistan Journal of Pharmacology26(1):19-23.

[33]. Newman, N.P. (2006). Plant and human health in the twenty first century. Trends biotechnol. 10:511-531.

[34]. Newman, D., Cragg, G.M. and Sander, K.M. (2008). Natural products as a source of new drugs over the period 2002-2008. J. Nat. prod. 66:1022-1237.

[35]. Ogundaini, A. O. (2005). "From greens into Medicine taking a lead from Nature" Inaugural lecture series 176 Obafemi Awolowo University Press Ltd. Ile-Ife, Nigeria pp 1-10.

[36]. Ogueke, C. C. Jude, N. Okoli, I. C. and Anyanwu, B. N. (2007). Antibacterial Activities and Toxicological Potentials of Crude Ethanolic Extracts of Euphorbia hirta. J. American Science. 3(3):11-16

[37]. Oladosu P. O., Isu N. R., Ibrahim K.,Orishadipe A.T. and Lawson L. (2013). Antituberculosis activiy of bioactive compounds from fruit extract of Acacia nilotica. J. Microb. Res. 3(6):247-254.

[38]. Saidu, K., Onah, J., Orisadipe, A., Olusola, A., Wambebe, C. and Gamaniel, K. (2000). Antiplasmodial,analgesic, and anti-inflammatory activities of the aqueous extract of the stem bark of Erythrina senegalensis. J. Ethnopharmacol; 71(1-2): 275-280.

[39]. Sandeep, B. P., Naikwade, N. S. and Magdum C. S. (2009). Review on Phytochemistry and Pharmacological aspects of Euphorbia hirta L.JPRHC 1(1): 113-133.
[40]. Sanogo, R. (2005). Antifungal and Antioxidant Activities of 14 plants usedin the Treatment of Sexually Transmitted Infections. A paperpresented at Western Africa Network of Natural Products Research Scientists (WANNPRES), first scientific meeting August, 15-20,2004.Accra, Ghana: A report. Afr. J. Trad, Complem. Alter. Med. 2(2): 177- 205.
[41]. Selvanayahgam, Z.E., Gnanevendhan, S.G., and Balakrishna, K. (1994). Anti-snake venom botanicals from ethno-medicine. J. Herbs and Spices Med. 2 (4) 45-100.
[42]. Sofowora, A.(1993). Medicinal plants and Traditional Medicine in Africa. 2nd edn. Spectrum books Ltd, Ibadan. Pp 1-5, 50-91.
[43]. Sutharsingh, R., Kavimani, S., Uvarani, M.,Thangathirupathi, A. (2011). Quantitative Phytochemical Estimation and Antioxidant studies on aerial parts of Naravelia zeylanica DC. Intern. J. Pharm. Stud. and Res. 2(2):52-56.
[44]. Tanaka, H., Sudo, M., Kawamura, T., Sato, M., Yamaguchi, R., Fukai, T. (2010). Antibacterial constituents from the roots of Erythrina herbacea against methicillin-resistant Staphylococcus aureus. Planta Med. 76(9): 916-919.
[45]. Tosun, F., Kizilay, C.A., Sener, B., Vural, M. and Palittapongarnpim, P. (2004). Antimycobacterial Screening of some Turkish plants. J. Ethnopharmacol., 95: 273-275.
[46]. Uba, A., Ibrahim, K., Agbo, E. B. and Makinde, A. A. (2003). In vitro inhibition of Mycobacterium smegmatis ATCC607 and a clinical isolate of Mycobacterium tuberculosisby some Nigerian Medicinal Plants. Science Forum: Journal Pure and Applied Science, 6:226-231.
[47]. Udem, S.C., Obidoa, O. and Asuzu, I.U.(2010). Acute and chronic toxicity studies of Erythrina senegalensis DC stem bark extract in mice. Comp. Clin. Pathol. 19(3): 275-282.
[48]. Zailani, A. H., Jada, S. M. and Wurochekke, U. A.(2010). Antimicrobial Activity of Waltheria Indica . Journal of American Science. 6 (12):1591-1594.
[49]. Zambrowicz, B.P. and Sands, A.T. (2003). Knockouts model the 100 best-selling drugs–will they model the next 100? Nat. Rev. Drug Discov. 2:38-51.
[50]. Zumla, A., Hafner, R., Lienhardt, C., Hoelscher, M. and Nunn, A. (2012). Advancing the development of tuberculosis therapy. Nature reviews. Drug discover. 11 (3): 171–172.

IOSR Journal of Applied Chemistry (IOSR-JAC) is UGC approved Journal with Sl. No. 4031, Journal no. 44190.

Aska, A.S " Quantitative phytochemical analysis and Anti-tuberculosis activity of some selected medicinal plants in some Northern parts of Bauchi state, Nigeria." IOSR Journal of Applied Chemistry (IOSR-JAC) 12.6 (2019): 15-22.