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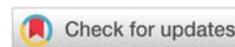
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*Corresponding author: Amjad Hussain, Lecturer, Department of Eastern Medicine, Faculty of Pharmacy and Health Sciences, University of Balochistan Quetta, Pakistan, Email: aadilamirali@hotmail.com

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Review Article

Anti-tuberculosis effects of different medicinal plants: A narrative review

Amjad Hussain^{1*}, Aadil Ameer Ali², Sultan Ayaz³,
Wahidullah⁴, Pervez Mehar⁵, Ahmad Ali⁵, Zakir Ullah⁵ and
Ramsha Baig¹

¹Lecturer, Department of Eastern Medicine, Faculty of Pharmacy and Health Sciences, University of Balochistan Quetta, Pakistan

²Institute of Physiotherapy & Rehabilitation Sciences, Shaheed Mohtarma Benazir Bhutto Medical University, Larkana, Pakistan

³Department of Eastern Medicine, Government College University, Faisalabad, Pakistan

⁴Wilson Pharmaceuticals, Islamabad, Pakistan

⁵Faculty of pharmacy, Gomal University, Dera Ismail Khan, Pakistan

Abstract

The medicinal plants contain various chemical constituents which play an important role in the treatment of various diseases. The current review explained the scattered information on medicinal plants used in the treatment of tuberculosis. The review contains four medicinal plants (*Allium sativum* (L), *Aloe vera* (L), *Acalypha indica* (L) and *Allium cepa* (L)) having anti-tuberculosis effects. Moreover, six medicinal plants (*Acorus calamus* (L), *Curcuma longa* (L), *Ephedra gerardiana*, *Glycyrrhiza glabra* (L), *Hygrophila auriculata*, *Papaver somniferum* (L)) have been checked for their toxicological impacts in the treatment of tuberculosis.

Introduction

Mycobacterium Tuberculosis (MBT) is a pathogenic bacteria which causes tuberculosis. Primarily it effects the respiratory system but it may effects the other systems like urogenital system (painless hematuria (it would be painful if the clots occurred), hematospermia, Gastrointestinal system (abdominal pain and intestinal obstruction [1-6]. The signs and symptoms of tuberculosis are cough, fever, night sweating, haemoptysis, dyspnoea, tachycardia, anaemia, chest pain and weight loss [4]. In the developing countries, tuberculosis is a dreadful infection. Annually It infects almost 9 million people, more than 2 million deaths occur annually due to this infection [7,8]. The deaths may be increase in the future because of increase spread of multidrug-resistant bacterial strains [9]. Furthermore human immunodeficiency virus is another risk factor which has significantly increased the new cases of tuberculosis [10-12]. Finding of the new compound is one of the tough tasks but research efforts at the National Institute

of Allergy and Infectious Diseases has recognize a screening program, to find out the new compounds that are actively used against *M. tuberculosis* [13]. The purpose of this review is to gather the literature as well as to know the phytochemical and pharmacological effects of medicinal plants which may be helpful in the treatment of tuberculosis.

Methodology

The current review contains the published data of medicinal plants having antibacterial (antituberculosis) activity. Information of medicinal plants were collected by using various search engines (Google scholar, PubMed and scopus).

Discussion

Medicinal plants are used from the ancient times in the treatment of various diseases. These plants are wild or cultivated which contain various therapeutic agents having various pharmacological activities [16]. Table 1 consist of

botanical name, family, parts used, plant extracts, pathogens, minimum inhibitory concentration (MIC) (mg/ml), zone of inhibition (mm), traditional uses and the methods used for determination of antibacterial activity. These study explained medicinal plants used for treating tuberculosis. While Table 2 comprises the vernacular name, family, concentration, parts used, extracts and toxic effects on the tested animals.

The antibacterial activity (antituberculosis) of these plants are due to their metabolites such as phenol, glycosides, alkaloids, steroids, tannins, terpenes, trepenoids, saponins and flavonoids.

Medicinal plants are used in the different dosage form like decoction, concoction, tablets, capsule and syrup. Decoction and extract of the plants are the common technique used due to easy intake [17].

Antibacterial effects of some medicinal plants used in the treatment of tuberculosis

Incidence of tuberculosis increases due to multiple drug

resistance and HIV infected patients [18]. Traditionally, many plants has been used for the treatment of tuberculosis. These plants contain active biomolecules having antimycobacterial activity. Furthermore, these plants decreased the adverse effects as well as multi-drug resistance [19].

There are four plants such as *Allium sativum* L. and *Aloe vera* (L.) Burm.f., *Acalypha indica* L., and *Allium cepa* L., leaves and bulbs have antibacterial activity against *M. tuberculosis*. The extracts of the plants were taken in concentration from 0.02–0.04 mg/ml. The zone of inhibition against the MBT were between 2.5 and 17.3 mm. *A. indica* showed strong inhibiting activity (17.3mm) against H37Rv strain of *M. tuberculosis* by using L-J proportion method [20].

Traditionally *P. granatum* (L.), *Artemisia afra* Jacq. Ex Willd, *Abutilon indicum* (L.), *Carica papaya* (L.), *Bombax ceiba* (L.), *Linum usitatissimum* L., *Aegle marmelos* (L.), and *Bauhinia variegata* (L.) are used against tuberculosis. However, few medicinal plants have been investigated properly for their therapeutic effects against tuberculosis.

Table 1: *In-vitro* activity of some medicinal plants having antituberculosis effects.

Plant name	Reference	Part used	Extract	Pathogenic agent	Concentration (mg/ml)	Inhibition (mm)	MIC (mg/ml)	Traditional uses	Method
<i>Allium sativum</i> (L)	Amaryllidaceae	Bulb	Water, Crude extract	<i>Mycobacterium tuberculosis</i> (H37Rv strain)c	0.02 0.04	10.92 16.0	N/A	Tuberculosis	Lowenstein Jensen proportion method.
<i>Aloe vera</i> (L)	Asphodelaceae	Leave, Leave gel	Pure gel, Ethanol acetone	<i>Mycobacterium tuberculosis</i> (H37Rv strain)	0.02 0.04	2.54 10.41	N/A	Tuberculosis	L-J proportion method
<i>Acalypha indica</i> (L)	Euphorbiaceae	Leaves	Water extract,	<i>Mycobacterium tuberculosis</i> (H37Rv strain)	0.020 0.040	12.7 17.3	N/A	TB	L-J proportion method
<i>Allium cepa</i> (L)	Liliaceae	Bulb	Aqueous	<i>Mycobacterium tuberculosis</i>	0.02 0.04	9.9 8.9	N/A	Tuberculosis	L-J proportion method

Table 2: Toxicity of medicinal plants used traditionally for the treatment of tuberculosis.

S.No	Plant Name/ Rf.no	Family	Concentration	Part used	Extract	Toxic effect	Test Animal
1	<i>Acorus calamus</i> (L) [30]	Acoraceae	100	Rhizome	Acetone	Haemolysis	Sheep
2	<i>Curcuma longa</i> (L) [27,28]	Zingiberaceae	1000 0.1	Rhizome Root	Hydro alcohol Root extract	Mild depression, reduced respiration, dullness Apoptosis, To stop the development of embryo at the morula stage.	Rat Rabbit
3	<i>Ephedra gerardiana</i> [29]	Ephedraceae	Excess amount	Herb	Alkaloid	High blood pressure, heart problem and liver damage,	Human
4	<i>Glycyrrhiza glabra</i> (L) [26]	Fabaceae	Excess amount 760-2,280	Root Dried root	Glycyrrhizinic Acid Glycyrrhizinic Acid	Blood pressure, kidney, edema and hypertension. Hypokalemia, edema.	Human Human
5	<i>Hygrophila auriculata</i> [32-33]	Acanthaceae	80 1.1-1.6 0.22 2000	Seed Leaves	Gentamicin Methanol Aqueous Methanolic extract	Cytotoxicity Dehydration	Human cancer cell lines (Breast, Colon) Albino rat
6	<i>Papaver somniferum</i> (L) [31]	Papaveraceae	150	Stem Root	Ethyl acetate	Necrotic effect	African green monkey kidney, human colorectal adenocarcinoma, rat brain tumour cells and human cervix carcinoma.



Toxicity of some medicinal plants used in the treatment of tuberculosis

Medicinal plants contain primary and secondary metabolite called bioactive natural products. These metabolites have various pharmacological activities and used for the treatment of different diseases. However toxic effects may be observed in the use of various plants [21-24].

It is believed that herbal medicines are safe, but this review reported seven medicinal plants having toxic effects in human beings and animals [25].

It has been reported that *G. glabra* contain glycyrrhizin and glycyrrhizinic acid. These chemical constituents stimulate the excretion of adrenal cortex hormones (Mineralocorticoid). The increase level of mineralocorticoid decreases renin level, sodium retention, hypokalemia, hypervolemia, edema and hypertension. Furthermore, it has been observed that glycyrrhiza *glabra* is harmful for the people having high blood pressure, heart and kidney diseases [26].

1000 mg/kg of hydroalcoholic extract of *C. longa* induces depression and decreased respiration. Furthermore, root extract of *C. longa* (0.1 µg/ml) stops the growth of embryo in rabbit at morula stage [27,28].

George P conducted a study in 2011, which explained that excessive amount of *Ephedra Gerardiana* causes liver damage, heart problem, high blood pressure [29].

Ahmad et al., explained a study that acetone extract of *Acorus calamus* causes hemolysis [30]. *Papaver somniferum* is a good source of different bioactive molecules and used for many diseases but it has necrotic effects at concentration of 150 µg/ml [31]. Seeds and leaves extract of *Hygrophila auriculata* in various solvents exhibit cytotoxicity and dehydration effects in albino rat [32,33] Table 2.

Conclusions

Medicinal plants contain most of the bioactive natural compounds that exhibit various pharmacological activities. The current study explained that some of medicinal plants are traditionally used in the treatment of TB. Leaves and bulbs are the common parts used in the form of extract and decoction. While some of the plants have potential effects against tuberculosis but they produce toxic effects in the body.

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