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Review Article On Herbal remedies can be used to cure tuberculosis instead of modern medications.

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Abstract :

Tuberculosis (TB), caused by Mycobacterium tuberculosis, remains one of the most significant global health challenges, especially with rising cases of drug-resistant TB strains. Traditional TB treatment relies heavily on a combination of synthetic antibiotics, including isoniazid, rifampicin, ethambutol, and pyrazinamide. While effective, these drugs are associated with several limitations, such as severe side effects, high costs, and a growing prevalence of multidrug-resistant TB (MDR-TB) and extensively drug-resistant TB (XDR-TB). The emergence of these resistant strains underscores an urgent need for alternative therapies that are both effective and accessible, with fewer adverse effects and lower chances of developing resistance.

In recent years, herbal medicines have attracted considerable interest due to their broad pharmacological potential, natural origins, and historical use in traditional medicine for treating infectious diseases, including TB.This review explores the potential of medicinal herbs as an alternative or complementary treatment for TB, focusing on bioactive compounds that exhibit promising anti-mycobacterial properties. Numerous studies have identified plants and phytochemicals with demonstrated efficacy against M. tuberculosis.

In conclusion, while herbal therapies alone may not entirely replace synthetic drugs for TB treatment, they hold substantial promise as complementary or alternative approaches that may reduce side effects, lower treatment costs, and enhance patient adherence.

Keywords :

Mycobacterium tuberculosis (M. TB), Herbal medicines, Synthetic drugs, Phytochemicals, Alternative therapies, Anti-mycobacterial activity, Herbal anti-infective, Pulmonary tuberculosis,

Introduction :

The second leading cause of death worldwide is tuberculosis, a nasty bacterial disease that spreads easily. In 1882, German microbiologist Robert Koch identified the causative agent of tuberculosis as Mycobacterium tuberculosis, a bacterium belonging to the Mycobacterium genus. Initially, it was believed that TB was a minor illness that could be treated with medications. The first antibiotic was launched in 1944 and proved to be quite effective. However, streptomycin monotherapy soon ceased working because of drug resistance, and it taught us to develop a new therapy that uses various medication systems to block the bacteria from becoming even more resistant. [1,2]

The disease known as tuberculosis (TB) is extremely contagious, and the rising death rate from TB remains a concern. Since the beginning of time, people have been afflicted by this illness. Between 33 and 35 percent of people worldwide and 40 percent of people in India are infected with some kind of tuberculosis. [3] The bacterium Mycobacterium tuberculosis is the cause of tuberculosis, an airborne bacterial disease. Although it may potentially affect other organs and tissues, it primarily affects the lungs. The Greco-Roman and Egyptian civilizations were in existence at the period, when spinal TB was first identified and confirmed around 3400 BC. Indian doctrine from antiquity had noted this illness.[4]

TB has occasionally been treated with a variety of medications, each of which has a unique mode of action that influences bacteria differently. Since the 1940s, streptomycin has been used to treat tuberculosis; since the 1960s, isoniazid has been used to treat tuberculosis; Rifampin was released at the start of the 1970s [5]; and in 1961, ethambutol was introduced as a bacteriostatic first-line medication [6]. Approximately 8 million people are infected with Mycobacterium TB annually, and sadly, 2–3 million of those infected die as a result of the disease [7]. With approximately 33% of the population, 40% of whom are from India alone, tuberculosis is an incredibly contagious disease that is thought to be polluted [8]

The use of therapeutic herbs is crucial in improving people's health. When taken from the plant, it generates a physiological activity that is crucial for the treatment of tuberculosis in humans [9]. One country that has a unique richness of healing plants and a wealth of traditional knowledge about using medicine and home remedies to treat various ailments is India [10, 11]. The treatment of the ailment has become progressively entangled in view of the crisis of medication-safe Mycobacterium tuberculosis strains. As a result of the declining accomplishment of the normal and modest TB prescriptions, there is a pressing need to recognize new medications with which to treat TB. Plants are a decent wellspring of new medications, and people look for new prescriptions from plants [12, 13].

General pathophysiology:

An intrapulmonary hypersensitive immune response triggered by tuberculosis kills the invading microbe while causing lung tissue damage. Cavitations and casketing granuloma are pathologic symptoms of tuberculosis that arise from hypersensitivity that coexists with the host immunological response. The main cells that M. tuberculosis infects are macrophages [14].

Anti-tuberculosis plant-derived drugs:

Additionally, herbal items are a promising source of antimycobacterial mixtures that may also be quite effective in the treatment of tuberculosis and other respiratory illnesses. Extra specific restorative floras are created in each place based on the climatic and geographic conditions, and a vitally large variety of them have excellent beneficial properties [15]. Due to the harmful effects of modern pills and drugs, plants have long been a common and valuable source of remedies used to treat a variety of illnesses [16, 17]. For a very long time, beneficial vegetation was used, which was a great chance to treat many illnesses, including tuberculosis. As a result, customized medicinal items were provided by Vegetablefill as a discrete and secure option [18]. For a very long time, nearby people and others employed infusions, macerations, tinctures, and decoctions of medicinal plant components, such as leaves, roots, stem bark, stem, bloom, and natural objects, as traditional TB prescriptions [19, 20]. Standard plant data is becoming a significant tool for developing increasingly innovative and superior medications [21].

Artemisia annua [Chinese traditional medicine] :

A study found that artemisinin can both treat and improve the effectiveness of the conventional medications used to treat tuberculosis. By keeping the bacteria from going dormant, it works as an anti-TB agent. Bacteria in dormancy are difficult to eradicate because they shield themselves from low oxygen levels. The immune system typically produces dormancy to regulate bacterial development and avoid infection. Conversely, the latent bacteria develop a high level of drug tolerance. In order to stop bacteria from sensing

oxygen levels and going into dormancy and dying, artemisinin attacks the heme molecule of bacteria. This could help to shorten the length of treatment and slow the evolution of medication resistance [22].

Tridax procumbens Linn. [Compositae]:

As a direct result of blooms, it is frequently referred to as "coat buttons" and has been used extensively in Ayurveda for liver ailments [23]. A microplate alamar blue test (MABA) against M. tuberculosis (H37Rv strain) was used to assess the extracts' antimicrobial properties. Depolarization of the film and inhibition of DNA, RNA, and protein combinations are two possible mechanisms by which flavonoids work. It may have triggered lysis and rapidly reduced the thickness of the bacterial cells [24].

For extended periods of time, tannin is utilized as an antimicrobial growth-promoting factor (AGP) at subtherapeutic doses, which is especially advantageous for the selection of bacteria that are resistant to antibiotics [25].

Calophyllum lanigerum:

Being an anti-HIV-1 drug, it is a non-nucleoside reverse transcriptase inhibitor (NNRTI). It was examined and found to be effective against all strains of Mycobacterium TB, including resistant strains, according to a study. (-)-calanolide A inhibits the production of proteins, RNA, and DNA quickly [26].

Capparis mooniiwight (Rudanti):

It has anti-inflammatory and anti-oxidant qualities. enhances resistance and strengthens the body's SS-guarded instrument. At the tubercular sites, stimulation of the Reticulo Endothelial System (RES) enacts the mesenchyme and speeds up recovery. Thus, new solid tissue is arranged and executioner cells are decimated during this process [27]. Rudanti powder provides hepatoprotection when added to DOTS [28]. because of the presence of rutin and β-sitosterol, as well as substances with antimicrobial and antitussive qualities, such as gallotannins, chebulinic acid derivatives, and stachyhydrin [29].

Natural products as anti-TB Agents :

Minerals, plants, and animals are examples of natural goods that have been used to treat human illnesses. Almost as long as human civilization has been, medicine has existed. Allopathy, or modern medicine as it is currently recognized, has evolved progressively throughout time as a result of scientific and observational efforts by scientists [30]. Throughout many centuries of practical experience, mankind have chosen natural items as raw ingredients that are effective against a variety of ailments. Sometimes undervalued, this experiential assessment differs from the scientific assessment of western medications. However, natural ingredients were used to create a number of successful medications, such as digitoxin, ephedrine, morphine, aspirin, atropine, and reserpine [31].

Since the beginning of time, medicinal plants have been utilized as a source of medicine in almost every society. The existence of natural goods with therapeutic qualities has been linked to the popularity of herbal treatments and healthcare preparations, such as those found in ancient writings like the Bible and the Vedas and made from widely used traditional herbs and medicinal plants [32]. Ayurveda, which translates to "Science of life and longevity" in ancient Sanskrit, is one of India's oldest medical systems and is centered on diet, lifestyle, and herbal remedies [33]. Ayurvedic terms for tuberculosis include Rajayakshma, Yakshma, Shosha, and Kshaya [34].

Current Treatment Regimen for Drug-Sensitive (DS) TB :

Bring this four-drug combination under directly observed treatment (DOT) for at least six months. Two phases make up the treatment: the first consists of giving the four medications indicated above for two

months, and the second consists of using INH and RIF for the final four months to eradicate the dormant germs.[35]
The four medications target M. tb through distinct mechanisms of action. To summarize, RIF binds to the _-subunit of the bacterial RNA polymerase and exerts its bactericidal activity by inhibiting the early steps of gene transcription [37, 38].

INH is a prodrug that, upon activation, inhibits the enoyl-acyl carrier protein reductase (InhA), a crucial enzyme in the biosynthesis of MAs [36]. Like INH, PZA is a prodrug that is activated when the pyrazinamidase enzyme diffuses into the TB granuloma and converts it to pyrazinoic acid (POA), which kills the M. tb bacteria within the granuloma [39]. Nevertheless, PZA's mode of action remains mysterious. EMB is a bacteriostatic medication that targets the three arabinosyltransferases EmbA, EmbB, and EmbC to prevent the production of arabinogalactan and lipoarabinomannan, two crucial elements of the mycobacterial cell wall [40].

Although the four front-line anti-TB agents are effective against DS-TB, this regimen is linked to a number of negative side effects, such as skin rash, liver dysfunction, peripheral neuropathy, erythromelalgia, ocular toxicity, central nervous system (CNS) toxicity, and gastrointestinal (GI) intolerance [41]. In addition to the overuse or misuse of antibiotics, the formation of DR M. tb strains was facilitated by poor patient compliance brought on by these undesirable side effects, a high pill count, and a prolonged course of treatment [41].

Up to 20% of patients on isoniazid, either alone or in combination, experience a brief, asymptomatic increase in liver enzymes, which goes away as long as the medication is taken [42, 43]. Hepatotoxicity caused by anti-TB drugs might present as anything from fulminant liver failure to asymptomatic increases in liver enzymes.[44, 45] Hepatocellular patterns are typically taken using DILI. The burden of hepatotoxicity associated with anti-TB drugs is determined by its severity and result in addition to its prevalence or frequency. The median time between starting a medication and experiencing clinical symptoms is 16 weeks (range: 6 weeks–6 month When compared to acute viral hepatitis, anti-TB drug-induced fulminant liver failure seems to have a worse prognosis, with a case fatality rate ranging from 0.042 to 0.07 per 1000 persons at any point during therapy [49–53] When compared to acute viral hepatitis, anti-TB drug-induced fulminant liver failure seems to have a worse prognosis, with a case fatality rate ranging from 0.042 to 0.07 per 1000 persons at any point during therapy [49–53].

Since most patients are on a combination of drugs during anti-TB therapy, it is challenging to estimate the incidence of hepatotoxicity caused by individual agents. Ethambutol and streptomycin are not thought to be hepatotoxic, however isoniazid, rifampicin, and pyrazinamide are known to be hepatotoxic. Details about the hepatotoxicity of pyrazinamide [55,56], rifampicin [54], and isoniazid (INH) are based on observations collected when these treatments were used alone to treat latent TB or in combination with other medications that didn't seem to have any negative effects on the liver. When used to treat pruritus in patients with primary biliary cirrhosis, rifampicin has been shown to induce DILI.[57] . This may be an overestimate, though, and the underlying liver condition may be connected to the higher risk. Rifampicin has been shown to have a relatively low incidence of DILI in other studies where it has been administered alone as a prophylactic therapy for latent TB.[58,59].

Conclusion :

This study has revealed that polyherbal remedies have thepotential to cure tuberculosis. This is the first researchwork on the anti-tuberculosis activity of polyherbal medicinesused for the treatment of tuberculosis in South Africa.The remedies might be potential sources of new anti-mycobacterialagents as they all showed activity againstM. tuberculosis. However, the activity of these remediesand their active principles still require in vivo study in orderto validate their potential as anti-tuberculosis agents.

Tuberculosis (TB) is an infectious disease caused by the bacillus Mycobacterium tuberculosis (Mtb). Tuberculosis is a chronic granulomatous infectious disease. Infection occurs via aerosol, and inhalation of a few droplets containing M. tuberculosis bacilli. Most cases of TB are pulmonary and acquired by person to person transmission of air-borne droplets of organisms. It can be diagnosed by PPD, IGRA, Sputum studies, X-rays and Biopsies.

Some antibiotics such as

•Isoniazid(INH),Rifampin,Pyrazinamide(PZA),Ethambutol are therapeutically used.

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