Innovat International Journal of Medical & Pharmaceutical Sciences, 2022; 7[2]

www.innovatpublisher.com

ISSN - 2456-8694
Review Article

# AYURVEDIC REMEDIES OF TUBERCULOSIS

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**Received 2021.12.21-Accepted 2022.02.02**

**ABSTRACT**

Tuberculosis is a contagious infectious disease caused by Mycobacterium tuberculosis or other members of the family. It has been a global health crisis and has affected many civilizations which makes it one of the top 10 causes of death all around the globe. More than 25 % of the world's T.B cases are found in India. Despite the availability and treatment using anti-TB drugs, the disease has not been yet eradicated with the drugs used have been found to cause side effects. Ayurveda helps people to remain healthy by treatment using universal principles and maintaining a proper lifestyle. Therefore, it is necessary to study the uses of Ayurveda in the treatment of Tuberculosis. This article is a review carried out by studying the research and review works worldwide to present the role of Ayurvedic remedies in managing Tuberculosis. Also, this review is to make the readers and researchers aware and familiar with the topic so that they take the initiative and perform more research on this disease and its treatment. It has been found that there are several ayurvedic remedies available for the treatment and are quite reliable. Some remedies are reported to completely cure Tuberculosis and reduce its symptoms whereas some are good to be used as an adjunct or supportive treatment to anti-TB drugs to fight the side effects. However, there isn't much awareness and research done about the ayurvedic treatment of the disease due to which it is less preferred by the patients.

**Key words**: Tuberculosis, Ayurvedic remedies, *Adhatodavasica,* Mahakanakasundurarasa

## INTRODUCTION

Tuberculosis (TB) is one of the oldest diseases and a leading cause of death globally. [1] Tuberculosis (TB) is a bacterial infection that affects the lungs [pneumonia]. It is caused by the bacteria Mycobacterium tuberculosis. [2] Tuberculosis (TB) is a contagious disease that is a major source of illness and one of the leading causes of mortality around the world. TB was the biggest cause of death from a single infectious agent until the coronavirus [COVID-19] pandemic, ranking ahead of HIV/AIDS. [3] It mostly affects the lungs, but it can also damage other organs in up to one-third of cases. [1] Tuberculosis is a contagious respiratory disease spread by inhaling infected air while nearby or coughing and sneezing over a long time in filthy surroundings and also if there isn't enough ventilation in the system [3] Tuberculosis can be dormant for years without presenting symptoms or spreading to others. When a patient's immune system is weakened, dormant tuberculosis can become active and cause infection. [4] Close contact settings, alcohol IV drug misuse, certain disorders [diabetes, cancer, and HIV], and certain professions are also risk factors for TB [healthcare workers] Mild fever, headache, chills, night sweats, exhaustion, lack of appetite, weight loss, cough with or without mucus and pus, coughing up blood, chest pain from lungs inflammation, difficulty breathing, swollen glands, and sore throat are common symptoms of tuberculosis bacteria growing in the lungs. [2] Tuberculosis is the primary cause of death among HIV-positive patients (PLHIV). [3] Tuberculosis (TB) is a disease that has afflicted humans since the dawn of humanity Tuberculosis (TB) is still a major public health issue around the world. Every year, over 2 million people die from this disease and 9 million people become sick around the world. (WHO 2006) [3]. In roughly 5-15 percent of individuals, once infected, the active disease develops during their lifetime [6] On India's health and wellbeing scale, tuberculosis is still one of the most prevalent diseases. When compared to the worldwide picture, India continues to have the largest tuberculosis (TB) burden. (WHO 2012). [3] Anti-TB allopathic drugs are administered to control the disease's symptoms, however, can cause side effects. [3] Hepatotoxicity produced by anti-TB medications is one of the leading causes of patient discontinuation of therapy and the emergence of MDR TB. [7] GIT symptoms, hepatotoxicity, ototoxicity, nephrotoxicity, skin rashes, fever, peripheral neuritis, and rarely psychotic alterations are all side effects of anti-TB medications. [8]

## DIAGNOSIS

When evaluating patients with symptoms, doctors do not usually evaluate the potential of tuberculosis. As a result, the diagnosis of tuberculosis (TB) disease may be delayed or even missed, and the patient may stay unwell and potentially contagious for an extended length of time. Although not all people with tuberculosis have symptoms, the majority of people with the disease do have one or more symptoms that prompt them to seek medical help. All people who have symptoms of tuberculosis or have a positive TST or IGRA test that indicates M. tuberculosis infection should be medically assessed to rule out tuberculosis.

The five components of a thorough medical evaluation for tuberculosis disease are as follows:

- Medical history of the patient
- Physical examination
- Test for M. tuberculosis infection
- Chest radiograph
- Bacteriologic examination of clinical specimens

### Medical History of the patient

A physician should inquire if there are any signs of tuberculosis and if so, then how long while taking note about the medical history of the patient as well as if there has been any known exposure to someone with infectious tuberculosis disease may recur and become drug-resistant if the previous treatment regimen for TB disease was insufficient or if the patient did not comply with medication. Consider demographic characteristics [such as the patient's place of origin, age, ethnicity, occupation, or racial group] that may raise the patient's risk of catching tuberculosis.

Clinicians should check for other underlying diseases like HIV or diabetes as it enhances the likelihood of patients who are infected with Mycobacterium tuberculosis

Extrapulmonary tuberculosis can induce symptoms in the affected area of the body. Back discomfort, for example, can be caused by tuberculosis of the spine; blood in the urine can be caused by tuberculosis of the kidney, and TB meningitis can induce headaches and confusion. Extrapulmonary tuberculosis should be evaluated in the differential diagnosis of sick people with systemic symptoms and a high risk of contracting tuberculosis.

**Physical Examination** A physical examination is an important aspect of any patient's evaluation. It cannot be used to confirm or rule out

tuberculosis, but it can disclose additional factors that may alter TB disease therapy if it is confirmed.

**Test for M. tuberculosis Infection**

The most appropriate tests for detecting M. tuberculosis infection should be chosen depending on the reasons and context for testing, as well as test availability and overall cost-effectiveness.

TST and QFT tests assist clinicians to distinguish between persons who are infected with M. tuberculosis and those who are not. A negative result to any of the tests, however, does not rule out the possibility of TB illness or LTBI.

**Chest Radiograph**

A chest radiograph is useful for TB disease diagnosis. Chest anomalies may indicate pulmonary tuberculosis. The usual view for detecting TB-related chest abnormalities is a posterior-anterior radiograph of the chest. A lateral view may be beneficial in some circumstances, particularly with children. Chest radiograph abnormalities may be suggestive of TB illness, although they are never diagnostic. Chest radiographs can be used to rule out pulmonary tuberculosis in people with a healthy immune system who have a positive TST or IGRA but no symptoms or indications of the disease.

**Bacteriologic Examination of Clinical Specimens**

Clinical specimen examinations [e.g., sputum, urine, or cerebrospinal fluid] are crucial diagnostic tools. The samples should be inspected and cultured in a lab that specializes in tuberculosis testing.

Sputum should be collected for TB culture from all people suspected of having TB disease at any location for diagnostic purposes. At least three sputum specimens must be collected at 8-to 24-hour intervals, with at least one being taken early in the morning. [9]

**PATHOPHYSIOLOGY OF TUBERCULOSIS**

Airborne illness is another name for tuberculosis which is caused due to Mycobacterium tuberculosis. The particle, also known as Droplet Nuclei, is created by Airborne. The nuclei of droplets range are in size from 1 to 5 microns in diameter. Tuberculosis is an infectious disease that occurs when a person inhales tubercle bacilli-containing droplet nuclei [fig 1. a]. Then the tubercle bacilli penetrate the alveoli of the lung [fig 1. b]. Bacilli present in the alveoli of the lung is covered with a special immune cell called Macrophages which acts as a barrier to prevent further infection which is latent TB Stage [fig 1. b]. However, the bacilli continue to multiply, and the barrier is broken, resulting in the active TB stage [fig 1. c]. The bacilli continue to multiply until a cell-mediated immune [CMI] response is established, which takes two to six weeks after infection. The lung is gradually destroyed due to the host's failure to mount an adequate CMI response and tissue repair. Unchecked bacterial development can result in the spread of bacilli via the bloodstream, resulting in disseminated tuberculosis. [10, 11] Tuberculosis is a granulomatous infectious disease that lasts for a long time. M. tuberculosis pathogenesis occurs in two stages after infection. The first stage, known as latent TB, is an asymptomatic state that can last for years in the host. [12]

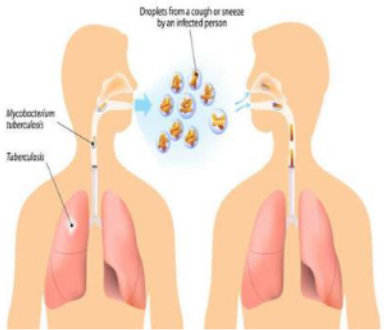


**Fig. 1.a**

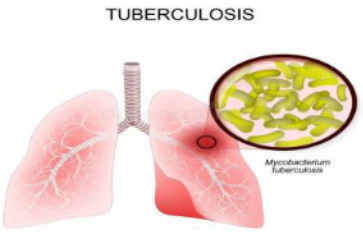


**Fig. 1.b**

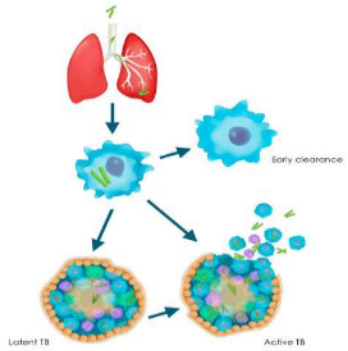


**Fig. 1. c**

Inhaling Mycobacterium TB can result in one of four outcomes:

- The organism is cleared right away.
- Latent Infection
- The beginning of the active phase of the disease [primary disease]
- Active disease many years later [reactivation disease].

Primary Disease-

About half of the about 10% of infected people who acquire active disease do so within the first two to three years, and this is referred to as quickly progressing or primary disease.

Reactivation disease-

Reactivation of tuberculosis is caused by the multiplication of a previously dormant bacterium that was seeded during the first infection. Reactivation disease affects 5 to 10% of people with latent infection who have no underlying medical concerns. [13] Reactivation of disease is risked by immunological compromising diseases, malnutrition, tobacco smoke, indoor air pollution, malignancy, and immune suppressive medication. [14]

**Etiology** [15]

Tuberculosis is also known as Rajyakshama. There are 4 Causes for Tuberculosis according to Ayurveda- Rajyakshamaare sahasa, vegsandharana, kshaya, and vishamasana. [16]

TB caused by Mycobacterium tuberculosis is the most common cause.

Apart from TB, it also contains-

- M.kanasasi
- M.ulcerence
- -M.fortuitum
- -M.marinum, etc. [17]

Sites involved: 85% of all TB cases are Pulmonary TB cases, others include Extrapulmonary sites, Genito-urinary tract, Bones & joints, Skin, Lymph node, Intestine, Meninges, etc [18]

Characteristics of M. TB-

- Rod shape with a diameter of 0.2-0.5 and a length of 2-4.
- My colic acid, which is contained in its cell wall, causes it to become acidic quickly.

- As a result, it is resistant to acid and alcohol decolorization.
- non-motile and aerobic.
- Multiplies at a sluggish rate.
- Can go dormant for decades. [17]

**Symptoms of tuberculosis**

Consider a patient a 'Tuberculosis Suspect' if he has any of the following symptoms:

- A cough that has lasted more than three weeks.
- Haemoptysis [blood loss].
- Chest pain that has lasted more than three weeks.
- All of these symptoms could be caused by different diseases, but if any of them are present, sputum should be examined. Coughing and sputum are fairly prevalent throughout the world. A lot of it is caused by acute respiratory infections that only last a week or two. [19]

## ALLOPATHIC REMEDIES

The summary of the anti-tubercular agents is given in table 1.

**Table 1: Antitubercular agents**

| Drug Classes | Anti-TB Drugs | Comments |
|---|---|---|
| First-line drugs | Rifabutin[RBT]<br>Rifapentine[RPT]<br>Isoniazid [INH]<br>Rifampin[RIF]<br>Pyrazinamide [PZA]<br>Ethambutol [EMB] | It can be used instead of RIF to treat any kind of tuberculosis caused by organisms that are known or suspected to be susceptible to this drug.<br>In HIV-negative individuals with noncavitary, drug-susceptible pulmonary TB who have negative sputum smears at the end of the initial phase of treatment, it may be taken once weekly with INH in the continuation phase of treatment.<br>The core of the original therapy regimen includes INH, RIF, PZA, and EMB. |
| Second-line drugs | Streptomycin [SM]<br>Cycloserine<br>Capreomycin<br>p-Aminosalicylic acid<br>Levofloxacin<br>Moxifloxacin<br>Gatifloxacin<br>Amikacin/Kanamycin<br>Ethionamide | *SM was once regarded as the first-line medicine, and it is still utilized in the early stages of treatment in some cases.<br>*Resistance to SM is becoming more common in many parts of the world, reducing its overall effectiveness.<br>These medications are only used in specific circumstances, such as drug intolerance or resistance. |

## COMMON ANTI-TUBERCULAR PLANTS FROM AYURVEDA

*Adhatodavasica*

It belongs to the *Acanthaceae* family of plants. Justice *adhatoda* is another name for it.

Anti-tubercular Activity

The oil extracted from the leaves, flowers, and roots of *vasica*plants has a substantial anti-tubercle bacilli action. According to the "Indian Materia Medica," alkyl halides from quinazoline present in the plant under phase-transfer catalysis synthesize compounds with antimycobacterial activity against Mycobacterium tuberculosis, Mycobacterium avium,and 4-[S-Butylthio] quinazoline [3c] was even more active against atypical mycobacterial strains. **[2]**

*Allium cepa* [Onion]

The onion is also called bulb onion or common onion.

Anti-tubercular Activity

According to one study, onion juice's antibacterial effect is due to the presence of flavonoids and polyphenols, which have been shown to have a broad spectrum of antibacterial activity. Herbal preparations have several advantages over synthetic ones, including the fact that they do not act directly on bacteria, but rather create an unfavorable environment for them, threatening their survival, and they have also been shown to impede the development of resistant strains of microorganisms such as Mycobacterium tuberculosis. **[2]**

Guduchi

It can be used in form of powder or extracts.

Guduchi mainly acts on the digestive & circulatory systems.

It is an immune-boosting herb that can balance all three doshas effectively.

It is also used for the treatment of fever, reduces pain & inflammation & also clears ama [toxic substances] from the body. [20]

*Allium sativum* [Garlic]

Garlic [Allium sativum], a Liliaceae family member, is a popular cultivated food all over the world.

Anti-tubercular Activity

S-allyl cysteine [SAC main garlic ingredient] is a stable, effective, and safe organosulfur molecule found in garlic that protects against oxidation, free radicals, and bacteria growth suppression [Mycobacterium tuberculosis]**[2]**

Garlic is known to contain high amounts of sulphuric acid that can destroy germs responsible for TB & its indications.

Thus, including garlic as a part of daily diet can help fight TB.

One of the best ways to consume garlic for fighting TB includes chopping a few cloves of raw garlic & boiling them in 250 ml of milk. Eating the boiled garlic pieces first and then drinking the milk has been reported to be beneficial in TB patients **[20]**

*Aloe Vera*

Aloe Vera is also known as Aloe, burn plant, lily of the desert, elephant's gall.

Anti-tubercular Activity

Aloe vera leaf extracts contain chemical components that suppress the growth of *Mycobacterium tuberculosis*. Cathartic anthraquinone glycosides are active components in the leaves. Glucose, galactose, mannose, and galacturonic acid are all found in the mucilage of leaves. These characteristics aid in the fight against bacteria. **[2]**

*Acalypha indica*

*Acalypha Indica* L. is a plant that grows in India [family: *Euphorbiaceae*], sometimes known as Indian nettle, is a weed that may be found throughout India's plains.

Anti-tubercular Activity

Quinone derivatives have a "tuberculostatic" effect. This plant's quinone derivative is used to treat Mycobacterium tuberculosis. **[2]**

Yashthimadhu

It is most commonly administered in form of powder. It efficiently balances the tridoshas- Vatta, pitta &kapha& also aids in the eradication of excess Kapha from the body. Yashthimadhu improves Longevity, has healing properties & strengthens the body which makes it quite considerable for the treatment of Rajyakshma or T.B. It can cause hypertension due to sodium water retention if administered for more than 6 weeks. [20]

*Morindacitrifolia*

Morindacitrifolia is a coffee tree belonging to the *Rubiaceae* family. Its natural range includes Southeast Asia and Australia.

Anti-tubercular Activity

*Morindacitrofolia* shows antimicrobial action against tuberculosis bacteria, according to a study titled "Anti-tuberculosis activity of selected medicinal plants against multi-drug resistant *Mycobacterium tuberculosis* isolates."

The compounds found in plants like Noni may be able to kill the bacteria that cause tuberculosis.

Extracts from the Noni plant may kill 89 percent of tuberculosis bacteria, which compares favorably to rifampicin, a commonly prescribed tuberculosis treatment.

Plant steroids, or phytosterols, are the active components in the Noni plant. Antibiotic-resistant tuberculosis, and increasingly, multi-drug-resistant tuberculosis, may be helped by phytosterols in the Noni plant, which target bacteria through a different mechanism than antibiotics. **[2]**

Brahmi

Brahmi is quite helpful in cleansing & nourishing the immune system, purification of blood & thus this helps in the treatment of bronchitis, cough & fever which are the very common symptoms of T.B. Large doses of Brahmi may lead to headache and itching. **[20]**

*Mimosa pudica*

Touch me not, live and die, shame plant, and humble plant are all names for *Mimosa pudica L. [Mimosaceae]*, a prostrate or semi-erect subshrub native to tropical America and Australia.

Bentham Science Publishers Ltd. released a study. The antimicrobial activity of successive whole plant extracts in petroleum ether, chloroform, ethyl acetate, methanol, and water against various Gram-positive and Gram-negative bacterial strains was explained by the phytochemical and pharmacological profile, which revealed a large zone of inhibition. *Mimosa pudica* ethanolic extract showed anti-tuberculosis effectiveness against virulent and non-virulent *M. tuberculosis* strains. **[2]**

Vidarikand

Vidarikand can be consumed in form of powder, decoction, confection & milk decoction.

It is a tonic, rejuvenating, nutritive & anti-inflammatory agent. It primarily acts on the reproductive and digestive systems.

It helps in gaining weight in the weak&debillatated people.

The major indication of TB is weight loss.

Thus, this herb is quite useful in improving health in TB patients. **[20]**

Ashwagandha

It is used as add-on therapy in addition to conventional medicine as it efficiently helps in reducing the symptoms of tuberculosis.

It is the main ingredient of Chyavanaprashavleha which is used in the treatment of cold, cough & TB. **[20]**

Pineapple

Pineapple can dissolve mucus and clear nasal blockage & also makes the recovery process rapid which makes it a very efficient home remedy for T.B.

Thus, a glass of pineapple juice every day can help a person get rid of Tb & its consequences. **[20]**

Indian Gooseberry

Indian Gooseberry is mostly known to be helpful for hair fall treatment.

But in addition to that, it can very efficiently reduce the symptoms of TB & helps bring back the overall health in a short duration of time. Extracting the fruit's juice and mixing a spoonful of it with honey is the best approach to procure the benefits of the fruit in treating the disease.

This combination, when taken first thing in the morning on an empty stomach, can successfully relieve TB and associated symptoms. **[202**

Mint

It loosens the mucus & helps decongest the nasal blockages quite instantly. It aids in the nourishment of the lungs &also boosts the body's overall resistance against infections. Fresh mint juice should be combined with honey and malt vinegar in a 1:2:2 ratio. Any fruit or vegetable juice can be mixed with the resulting mixture. This combination should be consumed at least twice a day for best results. **[20]**

Milk

Regularly drinking milk would give the abode with the calcium needed to treat tuberculosis. Some people are even advised to go on a milk-only diet. Thus, at least two glasses of hot milk should be consumed every day to effectively treat tuberculosis and its symptoms. **[20]**

Drumstick leaves

Drinking soup made up of drumstick leaves is a potential home remedy for tuberculosis. For around 15 minutes, boil a handful of drumstick leaves in about 250ml of water. Allow the resulting solution to cool before straining it. For best benefits, season the soup with pepper and salt, as well as a few drops of lime juice, and consume a glass of it every morning. **[20]**

Bottle gourd

Consuming bottle gourd daily & regularly can help to increase the body's resistance to the germs of TB & boosts the body's immune quite a lot which makes it easier for the body to eradicate the symptoms & the germs causing the disease in one go. **[20]**

Banana

Bananas are known to cure severe cases of TB. Individuals suffering from severe symptoms such as frequent cough [with blood] and high fever can get immediate relief by drinking banana juice or eating raw bananas daily. **[20]**

Celery

Celery is known to be quite useful as a remedy for TB.

To some extent, TB can be controlled by grinding a few dried leaves, extracting their juice, and taking at least 5 tablespoons of it at regular intervals throughout the day. **[20]**

Exposure to sunlight

The Tuberculin bacilli, which causes tuberculosis, can be killed by the sun's rays. Therefore, standing in the sun, ideally early in the morning, can aid in the elimination of bacteria causing tuberculosis and significantly reduce the symptoms of the disease. **[20]**

**Ayurvedic formulations for Tuberculosis-**

Mahakanakasundurarasa:

A] Ingredients: -

*1. Swarnabhasma*

*2. Suddha Parada,*

*3. SuddhaGandhaka,*

*4. Nagabhasma,*

*5. SuddhaKaphari,*

*6. Hema Makshikabhasma,*

*7. Abhrakabhasma [sataputa],*

*8. Kanthalohabhasma,*

*9. Pravalabhasma,*

*10. Vangabhasma,*

*11. Mouktikabhasma,*

*12. SuddhaHaritala.*

B] Uses: -

Used for the treatment of chronic consumption (TB) with severe side effects such as anemia, jaundice, chronic fever, swasa and Kasa, and so on. It is the only treatment for tuberculosis that is guaranteed to work at all stages. Longevity, vitality, and vigor are all benefits of this herb. It also

Improves the appearance of the skin. Along with this, Chyavanaprasa and *Draksharishta* are strongly recommended.

C] Dose: -

1g = 10 doses

To be taken twice daily with honey or as directed by the physician. **[21]**

Eladichurna:

It is composed of cinnamon, cardamon, bark &leaves,nagakesara, maricha[ black pepper],pipalli [long pepper] &shunthi [dried ginger].

It is helpful in the treatment of indigestion, cough, bronchitis, inflammation of the throat &chest & loss of appetite. As these symptoms are also indicated by TB eladichurna proves to be quite helpful in the management of the disease. **[22]**

ChitrakaHaritaki

This consists of chitraka[leadwort], Amalaki [Indian Gooseberry], Guduchi, haritaki, dashmoola, jaggery, trikatu [mixture of pippali, maricha&shunthi], honey, cinnamon &cardamon. This medicine increases appetite & is used in the treatment of T.B . It has digestive, carminative & most importantly expectorant properties. **[12]**

Swarnamalinivasanta

It is composed of swarnabhasma, maricha, mauktikbhasma& lime juice.

It works efficiently in the treatment of tuberculosis, cough & chronic fever. **[22]**

DhanvantaraGutika

It mainly consists of shunthi, cumin, chirayata, cardamon, Haritaki& Indian nightshade root. It is mainly an expectorant & a cardiac tonic and therefore is used in the management of tuberculosis, pneumonia, bronchitis &cough**. [22]**

Draksharishta

It is composed of cinnamon [tak], cardamon [ela] , Indian bay leaf[ tejpatra] , clove,pippali , honey, sugar & raisins. As Draksharishta has digestive & appetizing properties, it is useful for the management of loss of appetite in TB patients. It is a cardiac tonic, restorative & mild laxative. **[22]**

Sitopladichurna

The main Ingredients of Sitopladichurna are vanslochan [bamboo resin], cinnamon, cardamon& long pepper. It is an anti-inflammatory, expectorant, sedative, digestive, carminative & anti-infective agent due to which it is helpful in the treatment of Tuberculosis. It is usually administered with honey or ghee for curing bronchitis &cough. **[22]**

Madhumalinivasanta

It is composed of cinnabar, black pepper, white pepper & lime juice.

It is used in the treatment of tuberculosis, cough & chronic fever. **[22]**

Vasantakusumakar

It is mainly composed of decoctions of Haridra, bhasmas [ raupya, suvarna, mauktik, vanga, naga&abhraka], vasa &Chandan. It is mainly helpful in the treatment of disorders of Vata, tuberculosis & diabetes. **[22]**

Bhringrajasava

The ingredients of Bhringrajasava are bhringraj, haritaki, clove, cardamon, jahiphal, nutmeg & jaggery. This medicine can correct & replenish the digestive & Metabolic fire in Tissues. Moreover, it has antibacterial, tonic, nutritive & rejuvenating properties which are very useful in the management of the disease, tuberculosis.

According to a clinical study, Bhringrajasava was reported to be a valuable adjunct to DOTS [Directly observed treatment, short-course chemotherapy].

It is an efficient immune booster & protects the body against foreign pathogens.

It also works efficiently to protect the liver from the adverse & toxic effects of DOTS.

The conclusion of the study revealed that Bhringrajasava as an adjunctive treatment together with DOTS shows a marked improvement in the condition of Tuberculosis patients **[22]**

Cow's Urine Therapy-

One more effective remedy for Tuberculosis and its allergies is Ayurvedic Jain's Cow Urine Therapy. It is known to be helpful in all Respiratory disorders like Tuberculosis, Bronchitis, allergies, COPD, Lung Fibroid, etc. It effectively helps to reduce TB & its symptoms, also helps to prevent further growth of the disease. It enhances lung function and increases the immunity of the body & thus increasing the quality of life. Regular treatment helps in reducing & even discontinuing drug/inhaler dependency. **[23]**

Curcumin capsules

They are a 100 percent extract-based composition that acts as an antiseptic, antioxidant, and anti-microbial, as well as strengthening the body, detoxifying the blood, and balancing the Kapha in the body-mind system. **[24]**

Swasani herbal capsules

They work wonders in conditions including colds, coughs, dyspnea, chest pain, and other respiratory issues. It helps to unblock clogged passages and allows people to breathe freely again**. [24]**

Giloy capsule-

It's an antioxidant powerhouse that helps to neutralize free radicals and reduce inflammation. It's a 100 percent extract-based formulation that's great for boosting immunity, blood purification, and tracking respiratory issues. **[24]**

Adulsa [Justicia vasica]

The common names include Malabar nut, adulsa, adhatoda, vasa, vasaka. It consists of chemical constituents such as sicinolone, Vasicine, vasicinone,

It is employed to treat chronic bronchitis, asthma, and, all kinds of coughs. The fruits are used to relieve cold, bronchitis, and antispasmodic conditions. [25]

Tulsi [Ocimum tenuiflorum]

Tulsi mostly consists of eugenol [~70%] β-elemene, isothymusin, and germacrene and, β-caryophyllene. Medicinal uses: Tulsi is one of the oldest herbs prescribed by Ayurveda which consists of Antispasmodic, Carminative, anti-asthmatic, stomachic, expectorant, hepatoprotective, and, antirheumatic properties. [25]

Praanrakshak Churna

Ingredients present in Plant Ayurveda's Praanrakshak churna have Dalchini, Mulethi, Vaasa, Shirish, and many more drug combinations consisting of Tonic and Immunomodulator actions. Which is useful against Tuberculosis. [26]

Kass-Har Churna

Plant Ayurveda Kass-Har Churna is a good remedy for cough, chronic bronchitis, and bronchial asthma useful for tuberculosis. The ingredient present in this churna are Mishri, Pilppali, Dalchini, etc.[26]

Tubespot

Its planted ayurvedic capsules consist of Extract of Adusa, Amla, Arjun, Ashwagandha, Beheda, Neem, pippli, Shatavari, Tulsi. These capsules are useful to treat Tuberculosis. [27]

Rudanti Forte

This capsule is offered to treat Tuberculosis and enhance metabolism consists of Rudhati Phal, Chhotipipal, Dalchini, Harad, Shring bhasma, and many more. [28]

TB care Tablets

Guru prasadam TB care tablets are useful in Tuberculosis and prevent the infection of TB.[29]

**Table 2: Some Other Ayurvedic Formulations for Tuberculosis [30]**

| Dosage Form | Name of the Formulations |
|---|---|
| Churna /KwathaChurna | VidaryadiKwathaChurna, KarpuradiChurna, YavandyadiChurna, AgnimukhaChurna, AshwagandhadiChurna, MahatalisadiChurna, LavangadiCurna, YogarajaRasayana. |
| Vati /Tablet /Guggul | MahayogarajGuggulu, Saptavimshatik Guggulu, DhanvantarGutika, SanshamaniVati |
| Asava /Arishta | KanakasavaKumaryasava-A, Kumaryasava-B, Dantadyarishta, Dashmoolarishta, Draksharishta, Pippalyadyasava, Vasakarishta. Babbularishta |
| Avleha /Paka /Khanda | AgastyaharitakiRasayana, KushmandakaRasayana, GuduchyadiModaka, ChitrakHaritaki, Chyavanprasha, Narikela Khanda, GuduchyadiModaka, Pugakhsnda, Vasavleha, ShatavariGuda, ArdrakakhandaAvleha, VyaghriHaritaki |
| Sneha /Taila /Ghrita | IndukanataGhrita, EladiGhrita, ChagaladyaGhrita, NirgundiGhrita, PanchatiktagugguluGhrita, PippalyadiGhrita, VidaryadiGhrita, ChandanadiTaila, ChandanbalalakshadiTaila, BalaTaila, BalashwagandhalakshadiTaila, VasachandanadiTaila, Madhyam Narayan Taila, VisnuTaila, Brihat Ashwagandha Ghrita |

**Traditional Herbs possessing Anti-tubercular potential :**

- In bio-activity research of the methanol extract of Artocarpus integrifolia, MR Hema et al. discovered that it has anti-tuberculosis action even at low concentrations [less than 1mg], leading to the isolation of two recognized components cycloheterophyllin and homopterocarpin. [31]
- Mahesh AR et al. discovered that the water-soluble part of the methanolic extract of Citrus sinensis dried peels has greater antitubercular efficacy at 50µg/ml. [32]
- In their study, Ehsanifar et al. used the proportional method on one reference sample with six concentrations and, seven clinical samples as well as the effects of plant extracts in combination with rifampicin, to discover that the Methanolic extract of Capparis spinosa plant had anti-mycobacterial properties. [33]
- Using Microplate Almar Blue Assay [MABA], Shivakumar BS et al. discovered that an ethanol extract of the stem and leaves of Barlaria Buxifolia Linn was active at minimum inhibitory concentrations [MIC] of 25 and 50 g/ml, indicating that it could be used to create new antituberculous therapies. [34]
- Villaflores et al. investigated the phytochemical elements of Alpinia purpurata, or red ginger, on Philippine Zingiberaceae plants for antimycobacterial activity. This study reveals the potential of this plant as a source of anti-TB phytomedicines. [35]
- Kumar JK et al. studied crude extracts of five medicinal plants: Humboldtia brunonis, Kingiodendron pinnatum, Indigoferra cassiodes, Derris scandens, and, Caesalpinia Mimosoideae. They discovered that leaf extracts from these medicinal legumes have anti-tubercular action, which opens up the possibility of developing anti-tubercular crude medicines. [36]

**Case Studies**

Vyas et al. carried out a single-blind controlled trial to evaluate the adjunct properties of Rasayana compound in a capsule form among 133 T.B patients who were undergoing Cat-1 therapy under RNTCP classification with age > 13 years at opd level in three hospitals [one of which was Ayurveda Hospital and the other two were modern hospitals]. With significant statistical significance [P<0.001], the compound was found to reduce cough [83 percent], fever [93 percent], dyspnea [71.3 percent], hemoptysis [87 percent], and increase body weight [7.7%]. [AYU Journal/2012]

A study was performed by Dornala&Dornala to determine the clinical efficacy of Bhrinrarajasava as NaimittikaRasayana in PTB at the State TB Training and Demonstration Centre's Out Patient Department [OPD], S.R. Nagar, Hyderabad, Andhra Pradesh, India, on 60 PTB patients with sputum positive cases [cat-1], sputum negative [cat -2], failure, relapse & default cases [cat-2] as per RNTCP at the time of study 99 patients undergoing anti TB treatment. In Cat-I, Cat-II, and Cat-III patients, the medication response is marked [P<0.05], moderate [P>0.05], and marked [P< 0.01], respectively.

Debnath et al. conducted a clinical trial to evaluate the use of Ayurvedic medicine [Ashwagandha and Chhyawanprash] as an adjuvant therapy to anti-tubercular medications in the treatment of PTB, at Patipukur TB hospital annexed to JB Roy State Ayurvedic Medical College and Hospital, Kolkata, India. At the end of the trial, it was found that the symptoms subsided, bodyweight improved, ESR values were normal, IgA and IgM patterns changed, and isoniazid and pyrazinamide bioavailability rose dramatically.

Sharma et al. performed a clinical trial for investigating the hepato-protective benefits of Ayurvedic medicines in individuals receiving anti-TB therapy which lasted for 90 days the PG department of Kayachikitsa, Rajiv Gandhi PG Ayurveda College and Hospital, Paprola, HP, India. The trial included three groups of subjects, each with ten participants aged 15 to 70, with normal liver anatomy and physiology. Group 1 was administered Liv-600 capsule, group 2 was given a freshly prepared decoction of Bhumyamalaki [Phyllanthus fraternus] and group 3 was administered 600 mg of starch powder as a placebo. The results of the clinical trial showed that both of these formulations showed hepatoprotective characteristics when compared to the placebo after 12 weeks of treatment.

Vertebral tuberculosis (TB) is the most frequent type of spine infection, accounting for half of all musculoskeletal TB infections. It affects more children and young adults. If treatment is neglected, it may result in serious neurologic consequences.

Pott's spine is the common name for the condition in conventional medicine. Sir Percival Pott described tuberculous inflammation of the spine in his monograph in1779, which gave rise to the name.

The patient was reported to have an infection of Mycobacterium tuberculosis revealed from the culture of a drained abscess. The patient's MRI of the thoracolumbar spine revealed discitis of the D12-L1 discs, as well as osteomyelitis involving vertebral bodies from D8 to L1.

Based on the recommendations made in various Ayurvedic literature, the patient was put on regular therapy of Mahalaxmi Vilasras [Ayurvedic Formulary of India, Part- I, Tripathi, 2010] 250 mg per day in the morning an empty stomach followed by mild purification [samshodhan]. The patient was given ghrita of sheep and goat processed in the decoction of sthiradi group of herbs internally and externally both ways for four days. Mild fomentation of his body was also allowed on the fourth day. On the fifth day, he was recommended powder of Piper longum 3g in honey and Terminalia chebula 6g with lukewarm water in the morning empty stomach separately at the interval of nearly one hour. The powder of Piper longum induced 2-3 times mild emesis and the powder of Terminalia chebula ensured 3-4 times clear motion. Thus, the purification process was completed within five days. Though he had no neurological symptoms, given the extension of abscess, both orthopedic and neurosurgery specialists were consulted for surgical drainage of abscess and underwent paraspinal abscess drainage through paravertebral muscles. Following the procedure patient. Briefly treated by cleaning and local dressing with

panchwalkal decoction and jatyaditaila as per instructions. Four weeks later culture from drained abscess revealed Mycobacterium tuberculosis. He was discharged after two weeks of hospitalization and outpatient treatment continued. The effect of the drug was assessed from time to time through hematological, biochemical, radiological investigations and urine analysis. After 12 months of the treatment, on follow-up MRI dated May 27, 2014, revealed complete resolution of vertebral bodies and healed abscess. Now the patient has no back pain and no fever. His appetite is good. He gained 16 kg of weight during treatment. No adverse effects of the drug were reported by the patient during therapy. His quality of life is good.

The Ayurvedic treatment of tuberculosis is built on a set of principles that include nutritional assistance, palliative care, and detoxification therapy. Detoxification, which includes oleation, fomentation, moderate emesis, and laxation, is the most effective treatment for this condition. The major goal of this technique is to remove disease-causing substances from the body while maintaining the patient's immunity.

The most efficient remedy in the treatment of Vata disease is oleation, which involves applying ghrita of sheep and goat topically and giving it orally [Singh, 2004]. The administration of ghrita, which is made from the decoction of the sthiradi group of plants, causes the patient's alimentary canal to secrete enzymes. It promotes appetite and corrects digestion.

Analgesics, improved circulation, and reduced inflammation are all benefits of fomentation. The accumulated waste materials/toxins that clog the channels and cause sickness are removed from the body either through the emesis process or through the purgation process.

*Detoxification clears the channels, enhances absorption, and ensures that nutrients are transported smoothly throughout the body. Palliative care administered following detoxification [Samshodhan] therapy is said to be more effective, with the disease not relapsing once the patient has been cured.

Mild emetics are advised for patients with TB who have low bodily strength. Piper longum powder, in a 3 g. Doseacted as mild emetics. When it was given to the patient with honey on an empty stomach, a response of two or three vomits was elicited within half an hour.

When given to the patient in a 6 g. Dose with lukewarm water on an empty stomach in the morning, Terminalia chebula acted as a soft bowel evacuator, ensuring 3-4 times clear motion. The role of detoxification therapy in numerous disorders has been investigated.

These procedures increased body weight, improved serum immunoglobulin, elevated hemoglobin levels, and restored liver functions, according to the study

Conclusion: - Mahalaxmi Vilas Ras is a very useful medicine for the treatment of tuberculosis, according to the results of the treatment. The drug is just as effective as R H E & Z, which is used in conventional medicine to treat tuberculosis. It is risk-free, cost-efficient, and effective in eradicating the condition. **[37]**

6] A clinical trial was conducted which was divided into phases, with 99 newly diagnosed pulmonary tuberculosis patients of both sexes aged 10 to 65 years being randomly assigned to one of two groups, regardless of age, sex, or religion.

The trial was conducted at Southern Health Improvement Samity [Pioneer and Peer NGO, WHO affiliated, devoted to Tuberculosis Eradication, Implementing DOTs], Bhangar, 24 Parganas [South], Rural hospital in Sundarban area, 30 km away from Kolkata and Patipukur T B Hospital annexed to J B Roy State Ayurvedic Medical College and Hospital, Department of Health and Family Welfare, Government of West Bengal, Kolkata and Southern Health Improvement

Patients with pulmonary tuberculosis who met the inclusion and exclusion criteria were formally notified about the trial. One of the criteria was that the patient does not have any persistent infections of HIV for instance and no previous exposure to ATDs also there wasn't any history of a concomitant major illness to the brain, heart, kidneys, liver, and other organs, or hormonal imbalances.

The major objective of the trial was to assess the reduction of toxicity and early restoration of Ayurvedic medications by enhancing the bioavailability of ATDs as an additional therapy.

The treatment response of 99 patients treated with ATD in combination with *Aswagandha (Withaniasomnifera)* and a multi herbal formulation mentioned in CharakaSamhita's Chikitsa-sthana, i.e., Chyawanprash, was explored in this study.

Aside from blood isoniazid and pyrazinamide, hematological parameters, sputum bacterial load count, immunoglobulin IgA and IgM, blood sugar, liver function test, and serum creatinine were examined parameters, which were repeated after 28 days of treatment.

The treatment showed that Symptoms improved, body weight increased, ESR values were normal, IgA and IgM patterns changed, and isoniazid and pyrazinamide bioavailability increased significantly. This novel clinical investigation, combined with empowered research, may prove to be fruitful in the hunt for a cure for PTB. **[38]**

In this research study, a 37-year-old male patient who had pulmonary tuberculosis was seen in the National Institute of Ayurveda's outpatient department [OPD] by the director. The patient had a history of pulmonary tuberculosis, and ATT had been performed by a medical practitioner for four months. Since using ATDs, the patient has also complained of a burning feeling, weakness, and nausea.

Along with ATDs, the patient received the following treatment: Medications were continued for 7 days, and the patient experienced relief from cough, dyspnea, chest pain, anorexia, dark stool, and hemoptysis.

- Combination of 250mg Bol parpati, 250mg KaharawaPishti, and 500mg of PippaliChurna 2 times a day with Honey as an adjuvant.
- 1/2tsp ofVasalehatwo times a day.
- 30ml of Dashamool Kashaya 2 times a day
- 30ml Draksharishta 2 times a day after meal.
- 30ml of Bhrangarajasava 2 times a day after an hour of taking food with an equal amount of water.

The first medicine [*Bol Parpati + KaharawaPishti + PippaliChurana*] and the fifth medicine *[Bharanarajasava*] were stopped and 10ml *VidaryadiGhrita*2 times after having food was inserted after the stoppage. The medications were continued for the next 15 days. Body aches, general weakness, and insomnia were relieved for the patient.20ml *Vidaryadi Kashaya*2 times a day after meal and 1/2tps of *AjaashwagandhadiLehya*2 times a day after a meal were given after 15 days of the above treatment.

Vidaryadi Kashaya and AjaashwagandhadiLehya were given after 15 days of the above treatment. The patient's body weight increased after 7 days of taking these medications. Vidaryadi Kashaya was then discontinued after 7 days, however, VidaryadiGhrita and AjaaswagandhadiLehya were continued. Gradually, the patient's symptoms subsided. For the next three months, the patient was followed up every fifteen days.

His symptoms gradually improved over for four months. After 15 days of treatment, the patient experienced mild relief, which improved after two months.

*Pippali*

Cough, asthma, bronchitis, pulmonary TB, persistent fever, and other respiratory illnesses are treated with *Pippali*. *Pippali* has anti-aging properties. It's commonly used to treat liver problems, anemia, anorexia, loss of appetite, and general malaise. *Pippali* has antibacterial, anti-inflammatory, anti-tubercular, cough suppressant, immunological stimulant, and hepatoprotective properties.

Most of the formulations that were given to the patient contained pippali. Because pippali is a Kapha-VataSamaka, Rasayana, and Balya, the patient had alleviation in Swasha, Kasha, Kshaya, Yakshama, Jwara, and other areas.

Because *AjaashwagandhadiLehya, Draksharishta, VidaryadiGrita*, and *Bhrangarajasava*are *Balya, Brahangan*, and *Rasayana* alleviated symptoms such as generalized weakness, weight loss, *Dhatukshaya*, and anorexia.

These formulations were useful in treating recurring chest infections by increasing the patient's immunity as well as lowering cough, suppressing hemoptysis, and sputum generation. In this case, significant results were produced. As a result, a combination of herbs-mineral medicines showed great efficacy in the treatment of pulmonary tuberculosis and the negative effects of ATDs. **[7]**

8]Because the pathogen that causes this disease has become multi-drug resistant, there has been an increase in worry. The current study was conducted in Central India among the Gond, Korku, and Bhatra tribes.443[63.2%] of the 700 people polled were found to be sick.Muskdana*[Abelmoschus esculentus]* leaf or root powder was chosen by Gond tribes, Adusa*[Adhatodavasica]* leaf or root powder was liked by Korku tribes, while full plant of Vanva was preferred by Bhatra tribes *[Ocimumbasilium]*

Gond Tribes

Muskdana Leaf or Root Powder, Abelmoschus esculentus [Linn.] Moech was given to the patients as a supplement. The plant was harvested from the forest during the rainy season, cleaned and dried, powdered, and kept in a cool spot. For 5–6 months, about 3–5 gms of powdered leaf/root was orally supplied empty stomach 5–6 times a day, depending on availability. The dose is even suggested for 2–3 months after the infection has been cured, as bacteria may be dormant. The patients' health state was assessed using a chest X-ray and a sputum test, and a record was kept. About 78.94 percent [n=105] of sick people were reported to be healed after five months of continuous therapy.

Korku tribes

When it comes to the health status of Korku tribes who were screened for tuberculosis [n=250] in Hoshangabad district in localities in clusters of villages at Kesla, Tawa Nagar, Sohagpur, and Bankhedi, the infestation was found to be 63.2 percent of respondents [N=158] infested with tuberculosis ranging from 8–27.6 percent.AdhatodavasicaNees Leaf or Fruits were given to these patients as a supplement. For 5–6 months [n=91], about 4–5 gms of a leaf or fruit powder was orally supplied twice a day, first on an empty stomach before lunch with warm water, and then 5 hours after meals and before dinner. With the addition of herbal medicine, 56.1 percent of respondents [n=91] were determined to be healed after five months of continuous medication. The patients' health state was checked using a chest X-ray and a sputum test, and a record was kept.

Bhatra tribes

In contrast, the health status of Bhatra tribes in Chhattisgarh who were screened for Tuberculosis [n=250] in Bastar district in areas of clusters of villages in Kondagaon, Kolebeda, Makdi, and Keshkal, the infestation was found to range from 5.2–26.4 percent [n=162]. The full plant of Van Tulsi, Ocimumbasilium Linn, was given to these patients as a supplement.1–2 gms of leaves, twigs, blossoms, and fruits [whole plant] are collected and cooked for 15–20 minutes in 200 ml of water. After that, the plant is mashed, and the juice is removed, filtered, and stored in a cool location. For 5–6 months, patients are given this decoction orally 5–6 times a day. The patients' health state was checked using a chest X-ray and a sputum test, and a record was kept. About 67.2 percent [n=109] of the sick people were reported to be healed after five months of continuous therapy. **[5]**

9] In a case study by Deshpande Vaishali et al., a 58-year-old female patient receiving anti-tubercular treatment was given a Combination [Swarna Malini Vasanta 60mg + Abhrak Bhasma 120mg + Chausasti Pippali 250 mg] BD, Kaishora Guggulu 500mg TDS AF with warm water and, Samshamani Vati 1gm TDS AF with warm water. Complete recovery in low back pain, tingling, numbness, body soreness, and loss of appetite was reported after completing 55 Basti and 85 days of oral medication. Muscle power and weight gain were improved which were caused due to TB and ATT.[39]

In a randomized controlled trial conducted by Narayana, D.BA, et al., 90 patients with pulmonary tuberculosis receiving ATD were divided into three groups: Group I: 10g of Chyavanprash [CP] twice a day as an adjunct therapy in addition to ATD; Group II [Combine therapy]: Combination of anabolic steroid [25mg once a week IM], protein supplement [2 teaspoonfuls or 4g thrice a day] and vitamins [one cap/day] along with ATD and, Group-III: only ATDs without an adjuvant Therapy.

In comparison to group III, symptoms such as cough, expectoration, weakness, lack of appetite, weight loss, fever, edema pains, and hemoptysis nearly totally disappeared in the CP and combined therapy group. In comparison to the other groups, the CP group had a better average weight gain and serum protein. Hb levels improved in the CP and combination treatment groups. In comparison to the observations in group III, X-ray chest before and after treatment demonstrated effective recovery in the CP and combination therapy groups. [40]

## CONCLUSION

Herbal home remedies have been discovered and studied to be particularly effective in the treatment of tuberculosis, a respiratory disease that has spread around the world and kills a huge number of patients each year in both acute and sub-acute cases. As a result, the World Health Organization [WHO] has lately acknowledged herbal medications as being capable of, and likely desirable for, replacing herbal home treatments with modern medicines in any situation. Because allopathic treatments have more negative effects, there has been a surge in demand for phytopharmaceuticals all over the world. This review attempts to gather a list of anti-tubercular herbs from Ayurveda as well as from other countries to provide a scientific overview of their use. It has been also found that research works on Ayurvedic remedies for diseases are a bit lesser in numbers which is why there is a much-needed requirement for more research and reviews on this topic.

## ACKNOWLEDGEMENT-

The authors are grateful to the Principal and faculty of G.E.S. Sir M.S. Gosavi College of Pharmaceutical Education and Research, Nashik, Maharashtra, India for providing the facility to carry out the review.

**CONFLICTS OF INTERESTS**- No conflicts of interest.

**AUTHORS CONTRIBUTION**-

The authors confirm the contribution to the paper as follows:

Madhura Tiwari: Data collection and Grammatical corrections

Atharva Hastekar: Framing Data and Referencing, Draft manuscript preparation;

Mohit Sharma: Case studies and Interpretation;

Dr. Dhanashri R. Mali: Overall reframing and Conclusion.

**AUTHORS FUNDING**- Not applicable.

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