



## “THE PHYTOCHEMICAL SCREENING OF DIFFERENT EXTRACTS OF ALOE VERA, OCIMUM TENUIFLORUM AND MARTYNNIA ANNUA L FOR ANTI-TUBERCULAR POTENTIAL”

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### Abstract

Tuberculosis (TB), a leading cause of mortality worldwide, is particularly rampant in Asia and Africa. India alone accounts for a fifth of the global TB cases annually. The rise of drug-resistant Mycobacterium tuberculosis strains (MDR and XDR) poses a significant challenge, especially in developing nations. This underscores the need for alternative treatments, such as plant-based drugs. This study presents a comprehensive phytochemical screening in extracts from *Aloe vera*, *Ocimum tenuiflorum* (Holy Basil), and *Martynia annua L* (Tiger's Claw) for their further anti-tubercular potential. Various solvent extracts were prepared and analyzed for secondary metabolites like Alkaloids, Flavonoids, Terpenoids, Steroids and Tannins, where earlier studies advocate the highest antimicrobial property in alkaloids and flavonoids. Using water and methanol extracts, we analyzed the phytochemicals of Aloe vera, Ocimum tenuiflorum, and Martynia annua L. We detected various phytochemicals in different extracts, such as alkaloids, flavonoids, terpenoids, steroids, and tannins. These phytochemicals have anti-tubercular and other pharmacological effects. Ocimum tenuiflorum showed the highest anti-tubercular potential with the most alkaloids and flavonoids in methanol extract. Aloe vera and Martynia annua L had similar phytochemicals, except for the absence of alkaloids in water extract of Aloe vera. These plants are used for various diseases, and our findings confirm their therapeutic value. This research highlights the potential of these plants as sources of anti-tubercular agents on the basis of their biochemical profile. The findings provide valuable insights into their bioactive components, paving the way for further investigations into novel anti-tubercular drugs based on these compounds.

**Keywords:** Tuberculosis, Martynia annua L, *Aloe vera*, *Ocimum tenuiflorum* anti-tubercular activity.

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## Introduction

Tuberculosis (TB), caused by *Mycobacterium tuberculosis*, is a significant global health issue. According to the World Health Organisation (WHO, 2015), TB was responsible for 1.5 million deaths worldwide in 2014. Asia and Africa account for approximately 55% of the global TB burden, with India reporting the highest rate of TB infection, accounting for one-fifth of all new TB cases each year (WHO, 2019). Over the past three decades, various TB control programs have been implemented, utilizing anti-mycobacterial drugs such as rifampin, isoniazid, streptomycin, and ethambutol. However, misuse of these drugs has led to the emergence of drug-resistant *Mycobacterium tuberculosis* strains (MDR and XDR). Consequently, treating patients with multidrug-resistant (MDR) and extensively drug-resistant (XDR) tuberculosis has become a significant challenge for emerging and underdeveloped countries (Seung *et al.*, 2015). In response to this crisis, there is an urgent need for new anti-mycobacterial drugs with minimal adverse effects. Herbal medicines have been identified as a promising alternative. Traditional medicinal plants have been used by practitioners for centuries to treat various diseases and hold significant potential for TB treatment (Gupta *et al.*, 2019).

This research focuses on the phytochemical screening of different extracts derived from three medicinal plants: *Aloe vera*, *Ocimum tenuiflorum* (Holy Basil), and *Martynia annua L* (Tiger's Claw). These plants were selected due to their known medicinal properties and their widespread use in traditional medicine. The aim was to identify the presence of secondary metabolites such as Alkaloids, Flavonoids, Terpenoids, Steroids and Tannins in these extracts. The findings from this study could provide valuable insights into the bioactive components of these plants and pave the way for further investigations into developing novel anti-tubercular drugs based on these plant-derived compounds. This research underscores the untapped potential of natural plant resources in combating TB and offers a promising starting point for future research and drug development efforts. This research serves as a foundation for exploring the untapped potential of these natural plant resources as sources of novel anti-tubercular agents. By understanding the phytochemical composition of these extracts and their antimicrobial effects, we hope to pave the way for further investigations into the development of new anti-tubercular drugs, harnessing the power of nature's pharmacopeia in

the battle against tuberculosis. The results of this study have the potential to guide future research and drug development efforts, offering a glimmer of hope in the ongoing fight against this persistent global health threat. (Dhingra *et al.*, 2013; Xu *et al.*, 2021).

## Materials and Methods

**Plant Sample Collection and Preparation:** The leaves of *Aloe vera*, *Ocimum tenuiflorum*, and stem of *Martynia annua L* were gathered from the forest area of Vindhyaachal forest of Sehore District of Madhya Pradesh. The plant materials were thoroughly cleaned with tap water, shade-dried for 3-4 weeks, cut into pieces, and ground. The plant material was stored in a labeled bottle. The powdered plant material was weighed using an electronic balance.

**Drug Extraction Using Soxhlet Extractor :** The plant material underwent cold extraction with N-hexane and a Soxhlet extractor with methanol, and water. Each solvent extraction lasted for 48 hours. The crude extracts were filtered and concentrated using a vacuum evaporator.

**Phytochemical Screening of Extracted Drugs:** A series of tests were conducted according to established protocols:

**Alkaloids Test:** 2 ml of filtrate was mixed with 1% HCL. The presence of alkaloids was indicated by a creamish color.

**Flavonoids Test (Ammonia Test):** 5ml of dilute ammonia solution was added to a portion of the crude extract followed by concentrated sulphuric acid. The presence of flavonoids was indicated by a yellow coloration.

**Triterpenes Test (Salkowski Test):** 5ml of the extract was added to chloroform along with a few drops of concentrated sulphuric acid. A red-yellow color in the lower layer indicated the presence of triterpenoids.

**Tannins Test (Ferric Chloride Test):** The crude extract was mixed with 1% ferric chloride solution. A blue, green or brownish-green color indicated the presence of condensed tannin.

**Steroids Test (Salkowski Test):** Chloroform solution of the extract was shaken with concentrated sulphuric acid. A red color indicated the presence of steroids.

## Results and discussion

Earlier studies already set the anti-tubercular potency of the phyto-constituents, in the recent studies the researcher have explored the anti-tubercular activity of the of different phytochemicals of plant against mycobacteria tuberculosis (Gautam *et al.*, 2007; Mariita, 2006;

Arya, 2011). Phytochemicals such as Alkaloids, Flavonoids, Terpenoids, Steroids and Tannins were found in different extracts which were earlier reported for the different biological activities and protect from different bacterial diseases (Kalaichelvi & Dhivya,2016). In present study we have also studied the important Phyto-constituents such as of Alkaloids, Flavonoids, Terpenoids, Steroids and Tannins in Methanol and aqueous of leaves extracts of *Aloe vera*, *Ocimum tenuiflorum* (Holy Basil), and *Martynia annua L*. Phytochemical like Flavonoids, Alkaloids, Triterpenes, Steroids ,Tannins were found in extracts which were earlier described for the different biological activities and defends from different bacterial diseases (Kalaichelvi & Dhivya,2016). Out of all the plant-synthesized metabolites, alkaloids and polyphenols have potent antimicrobial and antioxidant properties. Alkaloids have a possible role in the development of antibiotics, whereas plenty of polyphenols provide a wide range of antioxidant properties that eventually establish the basis of antimicrobial

activity (Davies-Bolorunduro *et al.*,2021). The purpose of this study was to compare the phytochemical profiles of three medicinal plants: *Ocimum tenuiflorum*, *Aloe vera*, and *Martynia annua L*. The results showed that the plants have different phytochemical compositions depending on the type of extract and the solvent used. The main phytochemicals detected were alkaloids, flavonoids, saponins, tannins, and steroids. Phytochemicals are biologically active compounds that are present in plants and have various therapeutic effects (Yadav *et al.*, 2014). Phytochemical screening is a preliminary analysis of the presence or absence of certain phytochemicals in plant extracts (Vivek-Ananth *et al.*,2022). The phytochemical screening of methanol and water extracts of three medicinal plants, namely *Aloe vera*, *Ocimum tenuiflorum* and *Martynia annua L*, was performed using standard methods (Bandiola, 2018). The results are shown in the table below:

**Table 1:** Phytochemical screening of methanol and water extracts of *Aloe vera*, *Ocimum tenuiflorum* and *Martynia annua L*. for further anti tubercular potential assessment

Plant	Extract	Alkaloids	Flavonoids	Terpenoids	Steroids	Tannins
<i>Aloe vera</i>	Methanol	+	+	+	+	+
<i>Aloe vera</i>	Water	-	+	+	+	+
<i>Ocimum tenuiflorum</i>	Methanol	++	++	+	-	+
<i>Ocimum tenuiflorum</i>	Water	-	+	+	-	+
<i>Martynia annua L</i>	Methanol	+	++	+	+	+
<i>Martynia annua L</i>	Water	+	+	+	+	+

(+ indicates presence, ++ indicates high presence, - indicates absence)

The results of the present study were consistent with the previous literature that reported the presence of various phytochemicals in these plants (Kumar *et al.*, 2018; Patel *et al.*, 2019; Singh *et al.*, 2020). Alkaloids and flavonoids are known to have multiple pharmacological activities, such as analgesic, antimalarial, antidiabetic, and antibacterial effects (Kumar *et al.*, 2018). Saponins and tannins are also reported to have anti-inflammatory, antioxidant, antimicrobial, and antidiarrheal properties (Patel *et al.*, 2019). Steroids are important lipids that regulate hormonal, immune, and metabolic functions (Singh *et al.*, 2020).

The study demonstrates that *Ocimum tenuiflorum* has the highest amount of alkaloids and flavonoids in methanol extract, as indicated by the double plus signs in Table 1. This suggests that *Ocimum tenuiflorum* has a high potential for

pharmacological applications, as alkaloids and flavonoids are among the most important phytochemicals for human health (Kumar *et al.*, 2018). *Aloe vera* and *Martynia annua L* have similar phytochemical profiles, except that *Aloe vera* does not have alkaloids in water extract. This may imply that *Aloe vera* and *Martynia annua L* have similar therapeutic effects, but *Aloe vera* may have more benefits when extracted with methanol. *Aloe vera* is widely used for skin care, wound healing, and digestive disorders (Patel *et al.*, 2019). *Martynia annua L* is used for treating snake bites, ulcers, and bacterial infections (Singh *et al.*, 2020).

The results of this study also have implications for the anti-tubercular potential of these plants. Tuberculosis is a serious infectious disease caused by *Mycobacterium tuberculosis*, which affects millions of people worldwide (WHO, 2023). The

current treatment for tuberculosis involves a long course of antibiotics, which can have adverse side effects and lead to drug resistance (Swain *et al.*, 2021). Therefore, there is a need for alternative therapies that can enhance the efficacy and safety of anti-tubercular drugs. Phytochemicals, especially alkaloids and flavonoids, have been shown to have anti-tubercular activity by inhibiting the growth, survival, and virulence of *M. tuberculosis* (Jha *et al.*, 2022). Thus, the plants studied in this research may have potential as sources of novel anti-tubercular agents or as adjuvants to existing drugs. The phytochemical screening was only qualitative, not quantitative, which means that the exact amounts and concentrations of the phytochemicals were not measured. The anti-tubercular potential of the plants was not directly tested in this study, only inferred from the literature. Therefore, further studies we also done the anti-tubercular activity of these plants.

#### Conclusion:

We compared the phytochemicals of *Aloe vera*, *Ocimum tenuiflorum*, and *Martynia annua L*, using water and methanol extracts. We found different phytochemicals in different extracts, such as alkaloids, flavonoids, terpenoids, steroids, and tannins. These phytochemicals have anti-tubercular and other pharmacological effects. *Ocimum tenuiflorum* had the most alkaloids and flavonoids in methanol extract, suggesting its high anti-tubercular potential. *Aloe vera* and *Martynia annua L* had similar phytochemicals, except *Aloe vera* had no alkaloids in water extract. These plants are used for various diseases, and our results support their therapeutic value. Our study was limited by the qualitative phytochemical screening and the use of only two solvents. Future studies should use more quantitative and standardized methods to evaluate the phytochemicals and test their bioactivities and mechanisms.

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