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Effectiveness of Medicinal Plant-Based Therapy in the Management of Drug-Resistant Tuberculosis: Literature Review

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Abstract

Background: Tuberculosis (TB) is a deadly infectious disease with the major challenge of drug resistance, particularly in resistant Mycobacterium tuberculosis (MDR-TB). Medicinal plant therapy is a potential alternative to conventional TB treatment.

Objective: This review analyzes the antimycobacterial potential of medicinal plants and their application in the treatment of TB patients.

Methods: This study was a systematic literature review conducted according to PRISMA guidelines. A literature search was conducted in three major electronic databases: Science Direct, Wiley, and PubMed, using the keywords "Tuberculosis Treatment," "Herbal Medicine," and "Multidrug-resistant Tuberculosis (MDR-TB)". Articles included in this review were selected based on certain inclusion criteria, including publication within the last five years, quantitative research, and topic relevance. Of the 924 articles found, 4 articles met the inclusion criteria and were analyzed further.

Results: Some plants, such as Crinum asiaticum and Eucalyptus camaldulensis, showed significant antimycobacterial potential against TB, including MDR-TB. Medicinal plant therapy may reduce dependence on conventional drugs and the risk of resistance.

Conclusion: Medicinal plant therapy has great potential to be integrated in TB care. Nurses play an important role in educating and monitoring the effectiveness of this therapy.

Keywords: Complementary therapy, drug resistant tuberculosis (TB), herbal medicine, nursing practice tuberculosis

INTRODUCTION

Tuberculosis (TB) is one of the world's deadliest infectious diseases, especially in developing countries (1). Despite the availability of various antituberculosis therapies, resistance to antimycobacterial drugs, especially in multidrug-resistant Mycobacterium tuberculosis (MDR-TB), remains a major challenge in the treatment of global TB (2).

In this context, the use of medicinal plants as complementary therapy for TB has gained greater attention. Various studies have shown that medicinal plants have significant antimycobacterial activity and can be used as alternative or complementary therapeutic agents to conventional TB treatment (3). For example, plants such as Crinum asiaticum, Trachyspermum copticum, and Eucalyptus camaldulensis have been shown to have potential in overcoming TB infection, especially in drug-resistant strains (4).

This approach not only has the potential to reduce dependence on conventional drugs that are often accom-

panied by significant side effects, but also offers the opportunity to reduce the incidence of drug resistance (5). Therefore, the role of nurses is crucial in integrating medicinal plant-based therapies into clinical practice, through patient education, therapy monitoring, and assessment of the effectiveness and safety of these complementary treatments (6).

This literature review aims to analyze current research results on the antimycobacterial activity of various medicinal plants and explore how these findings can be applied in nursing practice to improve the quality of care for patients with TB. As such, this review is expected to provide greater insight into the integration of medicinal plant-based complementary therapies in the holistic and effective management of TB.

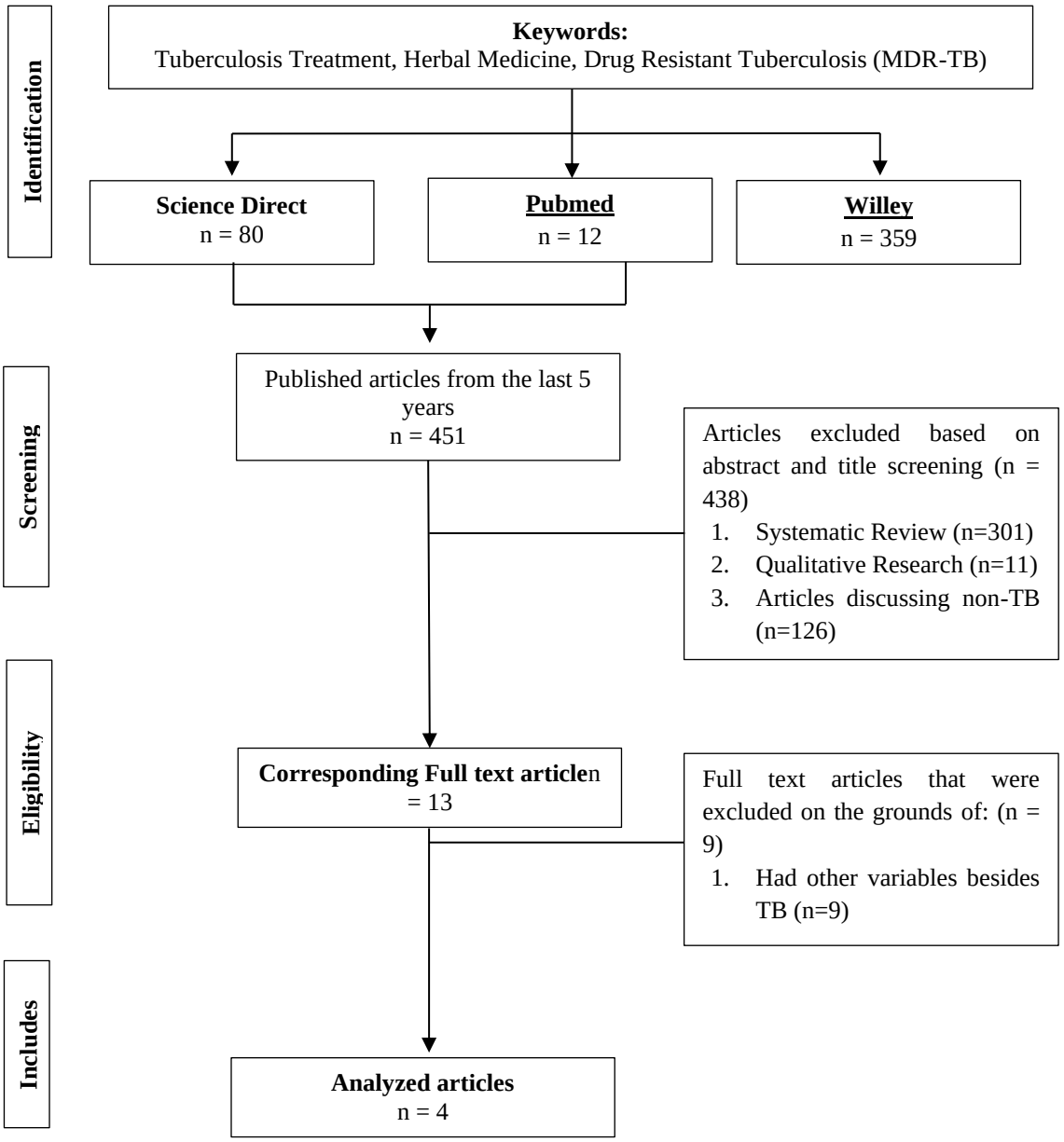
OBJECTIVE

This study aims to evaluate the effectiveness of medicinal plant-based therapy in the management of drug-resistant tuberculosis.

METHODS

This article is a literature review that summarizes and analyzes the results of related research articles. The literature search method was conducted using three major electronic databases: Science Direct, Wiley, and PubMed, using the keywords “Tuberculosis Treatment” AND “Herbal Medicine” AND “Multidrug-resistant Tuberculosis (MDR-TB)”. The search was conducted following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) protocol and involved selecting articles based on predefined inclusion criteria. The article search period lasted from January to August 2024. The inclusion criteria in the literature search were as follows: (1) freely accessible English-language articles published within the last five years (2019-2024), (2) studies involving tuberculosis patients, (3) articles using quantitative research methods, (4) articles in full text, and (5) articles that were relevant and original research. The exclusion criteria included articles that did not have a full structure, articles in the form of systematic/literature reviews, and articles with qualitative research methods**.**

From the search, a total of 924 articles were found, with 456 articles from the Science Direct database, 11 articles from the PubMed database, and 451 articles from Wiley. After initial screening of 451 articles based on the exclusion criteria, 438 articles were eliminated because they did not meet the inclusion criteria. Further screening of the remaining 13 articles resulted in 4 articles that met all inclusion criteria and were ready for further analysis.



RESULTS

Table 1. Article Extraction Results

No	Title, Author, Year	Objective	Methods	Results	Relevance to Nursing
1.	Comparative study on the antituberculous effect and mechanism of the traditional Chinese medicines NiuBeiXiaoHe	Comparing the antituberculosis effects and mechanisms of action of NiuBeiXiaoHe (NBXH) and JieHeWan (JHW) extracts, two	This study used a quasi-experimental design with JHW and NBXH treatment interventions in 6–8-week-old BALB/c mice,	NiuBeiXiaoHe (NBXH) extract has potential as a natural therapy for tuberculosis. This study shows that NBXH is as effective as JieHeWan (JHW)	The potential of NBXH as a complementary therapy can be integrated in nursing interventions to support the management of

	extract and JieHeWan Li-Yao Duan, Yan Liang, Wen-Ping Gong, Yong Xue, Jie Mi, Jie Wang, Lan Wang, Zai-Xing Jia, Hong Lei, Yu-Mei Liang, Jun Liu, Yue Zheng, dan Xue-Qiong Wu 2021	traditional Chinese medicines, on a mouse model infected with Mycobacterium tuberculosis	which were randomized into four groups: normal control, TB model, JHW treatment, and NBXH treatment, each consisting of 20 animals. Inclusion criteria were 6–8-week-old BALB/c mice with no special exclusion criteria. Instruments used included lung histopathology examination, bacterial colony count in lung and liver, ELISPOT for effector T cells secreting IFN-γ, Th1, Th2, Th17 cytokine analysis by cytometric bead array (CBA), and transcriptome sequencing. Interventions were conducted for 3 and 13 weeks, followed by evaluation of the therapeutic effect using these methods	in improving lung histopathology and reducing the number of bacterial colonies, with the added advantage of restoring the balance of gene expression disturbed by Mycobacterium tuberculosis infection	TB infection in patients, with a focus on reducing side effects and improving treatment adherence
2.	Investigation of the antimycobacterial activity of African medicinal plants combined with	Investigating the antimycobacterial properties of medicinal plants from Ghana and South Africa and	Study design: Laboratory experimental study with in vitro testing and	This study reveals the antimycobacterial properties of an African medical plant. The data	Information on the activity of Crinum asiaticum can be used by nurses in

	chemometric analysis to identify potential leads Phanankosi Moyo, Michael Ofori, Olusola S. Bodede, Madelien Wooding, Ndivhuwo Kevin Khorommbi, Lyndy J. McGaw, Cynthia A. Danquah, dan Vinesh J. Maharaj. 2024	using chemometric analysis to identify potential active compounds that could be used in the development of new drugs against tuberculosis (TB)	chemometric analysis. Intervention: Extraction and fractionation of medicinal plant compounds, followed by biological activity testing against Mycobacterium. Samples: 31 medical plant species from Ghana and South Africa, yielding one extract and seven fractions respectively. Sampling: Plants were selected based on traditional use for the treatment of TB or bacterial diseases. Criteria: Inclusion and exclusion were based on history of traditional use. Instruments: HT-SPOTi biological assay and UPLC-HRMS metabolomics analysis. Interventions: Extraction and fractionation with organic solutions, followed by activity testing	suggest the potential of Crinum asiaticum fractions as novel chemotherapeutic agents against tuberculosis, especially against evolving drug resistance	educating patients on the use of complementary therapies as part of a holistic approach to TB treatment

			against Mycobacterium		
3.	The Chemical Composition and Anti-mycobacterial Activities of Trachyspermum copticum and Pelargonium graveolens Essential Oils Jalil Kardan-Yamchi, Mohaddese Mahboubi, Hossein Kazemian, Gholamreza Hamzelou, dan Mohammad M. Feizabadi 2020	Evaluating the chemical composition and antimycobacterial activity of Trachyspermum copticum and Pelargonium graveolens essential oils against multidrug-resistant Mycobacterium strains	Research design: In vitro experimental Intervention: Essential oil test against resistant Mycobacterium strains Samples: 20 isolates of MDR Mycobacterium tuberculosis, 2 isolates of Mycobacterium fortuitum, 2 isolates of Mycobacterium kansasii, and a standard strain of Mycobacterium tuberculosis H37Rv. Sampling: Isolates from a TB reference laboratory in Tehran, Iran. Inclusion criteria: Drug-resistant Mycobacterium isolates. Exclusion criteria: Not specified Instruments: Essential oil hydro-distilled, composition analysis by GC and GC-MS, antimycobacterial test by micro-	This study reveals the potential of essential oils as an effective natural therapy against drug-resistant bacterial infections, especially resistant TB. These findings open up opportunities for the development of essential oil-based herbal medicines as an alternative or adjunct in the treatment of bacterial infections that are difficult to overcome with conventional antibiotics	Knowledge of these essential oils may assist nurses in informing patients about natural therapeutic options that may be helpful in the treatment of resistant TB infections, reducing dependence on conventional antibiotics

			broth dilution method. Intervention delivery: Essential oils were mixed in microbial media in microplates and incubated for 3 weeks at 37°C		
4.	Antimycobacterial activity and phytochemical properties of Eucalyptus camaldulensis (eucalyptus) extracted by deep eutectic solvents Ali Sami Dheyab, Abdul Jabbar Khaleel Ibrahim, Ekremah Kheun Aljumily, Mohamed Khalid AlOmar, Mohd Fadzelly Abu Bakar, Siti Fatimah Sabran 2022	Investigate the antimycobacterial activity of Eucalyptus camaldulensis extracts extracted using deep eutectic solvents (DES) against multidrug-resistant (MDR) Mycobacterium tuberculosis, and correlate phytochemical composition with antimycobacterial activity	This study uses a laboratory experimental design with interventions in the form of extraction of active components of Eucalyptus camaldulensis using deep eutectic solvents (DES) and antimycobacterial activity testing. The Eucalyptus camaldulensis used was from Ramidi, Al Anbar, Iraq. Instruments used included agar disk diffusion method, MIC and MBC measurements, and phytochemical analysis for total phenols and flavonoids. The extracts were tested against MDR Mycobacterium	Eucalyptus camaldulensis extract therapy offers potential benefits such as higher efficacy against resistant TB strains, and reduced side effects, as well as protection from oxidative stress-induced cell damage. It may also serve as a complementary treatment, reducing the dose of conventional drugs and the risk of drug resistance	Nurses may consider the use of Eucalyptus extract as part of complementary interventions in TB care, with a focus on improving patients' quality of life and reducing the dose of conventional drugs to reduce the risk of side effects

			tuberculosis strains to evaluate the zone of inhibition by agar disk diffusion method and MIC and MBC measurements using spectrophotometry		

DISCUSSION

The results of the analyzed studies demonstrate the significant potential of using medicinal plants as complementary therapy in the treatment of tuberculosis (TB), especially in the context of increasing drug resistance. The integration of these findings into nursing practice offers a more holistic and patient-centered approach, which may improve treatment effectiveness and patient quality of life. A more detailed discussion linking the research findings to nursing elements follows.

1. The Role of Education in Introducing Complementary Therapies

Research conducted by Li-Yao Duan et al. (2021) showed that NBXH has a higher effectiveness than JHW in reducing histopathological lesions and the number of bacterial colonies in a mouse model infected with Mycobacterium tuberculosis (7). In nursing practice, it provides a basis for introducing patients to complementary therapy options based on medicinal plants (8). Nurses can provide education on the benefits of this herbal therapy, explaining how NBXH can be used in conjunction with conventional TB drugs to reduce side effects and improve patient adherence to treatment regimens (9).

2. Holistic Approach to TB Management

Studies by Phanankosi Moyo et al. (2024) showed that Crinum asiaticum has potent antimycobacterial activity, thus making it a potential agent in the treatment of TB, especially in the face of drug resistance (10). The integration of medicinal plant-based therapies such as Crinum asiaticum in TB care reflects a holistic approach that combines conventional medicine with complementary therapies (11). Nurses have an important role in adopting this approach, not only as implementers of care, but also as facilitators who help patients understand and utilize additional treatment options available (12).

3. Use of Essential Oils in Nursing Interventions

Essential oils such as Trachyspermum copticum and Pelargonium graveolens studied by Jalil Kardan-Yamchi et al. (2020) showed great potential in the treatment of multidrug-resistant TB (13). In a nursing context, the use of these essential oils may be considered as part of complementary therapies, which may be more acceptable to patients seeking natural remedies (14). Nurses can play a role in monitoring the patient's response to this therapy, providing appropriate advice regarding dosage and usage, as well as ensuring that the patient understands the potential benefits and risks associated with the use of essential oils (15).

4. Drug Resistance Management with a Multimodal Approach

Research by Ali Sami Dheyab et al. (2022) highlighted the effectiveness of Eucalyptus camaldulensis extract extracts extracted using deep eutectic solvents (DES) in fighting multidrug-resistant TB strain (16).

These findings are highly relevant in the management of patients with drug resistance. Nurses can integrate the use of these herbal-based therapies into patient care plans, especially those who do not respond well to conventional treatment. In addition, nurses can also contribute to further research and the development of clinical guidelines regarding the use of these plant extracts, to ensure that the interventions applied are safe and effective (17).

Overall, the results of this study emphasize the importance of adopting a more integrative and holistic approach to TB treatment, especially amidst the growing challenge of drug resistance (18). The role of nurses in educating patients, facilitating the use of complementary therapies, and monitoring the effectiveness and safety of treatment is becoming increasingly important. The use of medicinal plants and essential oils in this context not only enriches the available treatment modalities, but also provides more diverse and adaptive options for patients (19).

In their implementation, nurses need to be equipped with adequate knowledge of these complementary therapies, as well as the ability to critically evaluate their benefits and risks (20). The development of clinical guidelines and specialized training for nursing staff on the use of medicinal plant-based therapies may also help improve the quality of care provided, thereby providing more optimal outcomes for patients suffering from TB (21).

CONCLUSION

This literature review reveals that medicinal plant-based complementary therapies have great potential in the management of tuberculosis (TB), especially for multidrug-resistant strains (MDR-TB).

CONFLICT OF INTEREST

The authors declare no potential conflicts of interest in connection with the research, authorship and/or publication of this article.

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