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Unani Aahar in Tuberculosis Management: A Scientific Evidence–Based Review

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Abstract

Tuberculosis (TB) remains a leading global health challenge with 8.2 million new cases recorded in 2023, necessitating innovative complementary therapeutic approaches. This review examines the scientific evidence supporting Unani Aahar (dietary therapy) in tuberculosis management, exploring its integration with conventional treatment protocols. Unani medicine employs a holistic dietary approach based on humoral theory and temperament (Mizaj) concepts, emphasizing foods that restore physiological balance and enhance immune function. Key therapeutic foods include honey, barley water (Ma-ul-Shae'er), specialized milk varieties (goat and camel milk), and marine-derived compounds such as crab preparations in formulations like QursSartanKafoori. Scientific evidence demonstrates that these traditional foods contain bioactive compounds including flavonoids, saponins, and immunoglobulins that exhibit antimycobacterial, anti-inflammatory, and immunomodulatory properties. Mechanistic studies reveal their ability to disrupt mycobacterial cell surface integrity, inhibit biofilm formation, and enhance T-cell mediated immunity. Clinical investigations show that co-administration of Unani formulations with conventional anti-tubercular drugs improves patient outcomes, reduces treatment duration, and enhances medication tolerability. However, integration faces challenges including lack of standardized protocols, potential drug interactions, and limited high-quality clinical evidence. Current research gaps include inadequate sample sizes, methodological limitations, and insufficient standardization of preparations. While promising, larger randomized controlled trials are needed to establish definitive evidence for clinical implementation and policy recommendations regarding Unani dietary interventions in tuberculosis management.

Keywords: *Tuberculosis, Immunomodulatory, Unani formulations, Unani Aahar, temperament.*

Introduction

Tuberculosis (TB) remains one of the most pressing global health challenges of the 21st century, maintaining its position as a leading cause of morbidity and mortality worldwide. According to the World Health Organization's Global Tuberculosis Report 2024, approximately 8.2 million new cases of TB were recorded globally in 2023, marking the highest number since the initiation of global TB surveillance by the WHO in 1995. This alarming statistic underscores the persistent burden of this ancient disease, which has reclaimed its position as the leading cause of death from infectious disease, causing an estimated 1.25 million deaths in 2023, nearly doubling fatalities from HIV/AIDS.The magnitude of the TB epidemic extends beyond mere statistics, representing a complex interplay of socioeconomic factors, healthcare accessibility, and biological challenges. An estimated 10.8 million new TB cases and 1.25 million deaths occurred worldwide in the past year, with progress remaining uneven as several high-burden countries still report alarming case rates.

Despite decades of medical advancement and global health initiatives, the world is not on track to meet the END TB Strategy targets for 2035, highlighting the urgent need for innovative and comprehensive approaches to TB management [1].The persistent challenge of tuberculosis, coupled with emerging issues such as drug-resistant strains and treatment adherence difficulties, has necessitated exploration of complementary and alternative therapeutic approaches. Traditional medical systems, which have been addressing TB-like conditions for centuries, offer valuable insights and potential adjunctive treatments that could enhance conventional therapeutic outcomes [2].The limitations of current TB management strategies, including prolonged treatment duration, adverse effects of anti-tubercular drugs, and the emergence of multidrug-resistant tuberculosis (MDR-TB), have prompted researchers and healthcare practitioners to investigate holistic approaches that address not only the pathogen but also strengthen the host's immune response and overall health status. This paradigm shift recognizes the importance of integrative medicine in providing comprehensive patient care that

encompasses physical, nutritional, and psychological well-being.

Unani medicine, also known as Unani Tibb, represents a holistic traditional system of medicine that has enjoyed an upsurge of interest, especially in India, where it has been practiced as one of the Indian systems of medicine since 8th century and got a push when WHO adopted its policy of promoting traditional medicine in 1976. This ancient system of medicine, with its roots in Greco-Arab medical traditions, offers a comprehensive framework for understanding and treating diseases, including tuberculosis, through its unique theoretical foundations and therapeutic modalities [3].Unani medicine has demonstrated significant potential through various formulations and treatment approaches. Traditional Unani formulations like Qurs Tabasheer Sartani (QTS) and Arq Hara Bhara (AHB) have been traditionally used for tuberculosis-like conditions, while chronic cough, a primary symptom of TB, has successful treatment with Qurs-e-SartanKafoori in the Unani system of medicine.Central to Unani medical philosophy is the concept of *Aahar* (diet), which extends far beyond mere nutrition to encompass a holistic approach to health maintenance and disease management. In Unani medicine, diet is considered one of the fundamental pillars of health preservation and therapeutic intervention. The concept of *Aahar* emphasizes the qualitative and quantitative aspects of food intake, considering factors such as the temperament (*Mizaj*) of both the individual and the food substances, seasonal variations, and the specific health conditions being addressed [4]. The dietary principles in Unani medicine for tuberculosis management focus on strengthening the body's natural defense mechanisms, correcting temperamental imbalances, and providing optimal nutrition to support recovery. This approach recognizes that proper nutrition plays a crucial role in enhancing immune function, promoting tissue repair, and improving the overall prognosis of tuberculosis patients [5]. The integration of specific dietary guidelines with pharmacological interventions represents a comprehensive treatment strategy that addresses both the immediate therapeutic needs and long-term health outcomes of TB patients.

Unani Aahar Principles Relevant to Tuberculosis:

The fundamentals of Unani dietary therapy, known as *Ilaj Bil Ghiza*, represent a sophisticated therapeutic approach that views food as medicine and emphasizes the restoration of physiological equilibrium through carefully selected nutritional interventions [6]. In Unani medicine, dietary therapy is not merely about caloric intake or nutritional supplementation, but rather a comprehensive system that considers the qualitative properties of foods, their interaction with individual constitution, and their capacity to restore health by correcting underlying imbalances. This therapeutic modality is founded on the principle that proper nutrition can serve both as a preventive measure and as an active treatment component, particularly relevant in chronic conditions like tuberculosis where sustained nutritional support is crucial for recovery [7].

The role of diet in restoring balance according to Unani humoral theory is intricately connected to the concept of *Mizaj* (temperament), which classifies the human body's internal qualities into four distinct types: hot, cold, moist, and dry [8]. According to the theory of humours (*nazaria-e-akhlat*), which forms the essence of Unani medical practice, the four humours are derived from and utilized in the digestive process, and their continuous action and reaction results in health or disease [9]. In the Unani concept of medicine, alteration in the different four kinds of humor causes disease; therefore, a particular diet is recommended for different diseases, and for the prevention of diseases, people should take diet opposite to their temperament [10]. This principle is particularly significant in tuberculosis management, where the disease is understood to create specific temperamental imbalances that require targeted dietary correction. The scientific correlation between temperaments in Unani medicine and diseases has been established through systematic research, demonstrating that temperament refers to four different humors differentiating in individuals and, as a result, proposes specific therapy for their diseases [11].

Specific dietary guidelines for tuberculosis according to classical Unani texts emphasize foods that strengthen the respiratory system, enhance immune function, and provide adequate nutrition for tissue repair and regeneration. Traditional Unani literature recommends specific modified diets including barley water, mutton soup, whey, honey water, *nabeez* (a fermented drink), vinegar, and various herbal preparations like *murabba* and *halwa* as adjuvant treatments for respiratory ailments [12]. For tuberculosis patients, classical Unani physicians prescribed easily digestible, nutritious foods with warming and moistening properties to counteract the cold and dry temperament associated with the disease. The dietary recommendations include specific lentils such as *masoor dal* (red lentil), which are selected based on their temperamental qualities and therapeutic effects on the respiratory system [13]. Additionally, foods with proven medicinal properties such as pomegranate, apple, quince, dates, barley, *amla* (Indian gooseberry), garlic, and various seeds including *methi* (fenugreek) and *kalonji* (black cumin) are incorporated into dietary therapy regimens to complement the overall treatment approach [14]. These dietary prescriptions are designed not only to provide essential nutrients but also to address the specific pathophysiological mechanisms underlying tuberculosis, including inflammation reduction, immune system enhancement, and restoration of normal metabolic processes that support healing and recovery.

Scientific Evidence Supporting Unani Aahar in Tuberculosis:

The phytochemical and nutritional components of recommended Unani foods demonstrate significant therapeutic potential in tuberculosis management through their diverse bioactive compounds and immunomodulatory properties. Research has revealed that traditional Unani dietary substances contain numerous phytochemicals including flavonoids, saponins, terpenes, sterols, and various bioactive metabolites that contribute to their antimycobacterial effects [15]. These phytochemical constituents, particularly flavonoids and coumarins found in commonly recommended Unani foods, possess demonstrated anti-inflammatory, antioxidant, and immunoenhancing properties that are crucial for supporting the body's defense mechanisms against mycobacterial infections.

The nutritional profile of these foods is specifically designed to address the metabolic demands of tuberculosis patients, providing essential nutrients while simultaneously delivering therapeutic compounds that support recovery and strengthen immune function [16].

Mechanisms of action related to immunity and anti-mycobacterial effects of Unani dietary components have been elucidated through extensive research demonstrating multiple pathways of therapeutic intervention. Studies have shown that Unani formulations exhibit potent antimycobacterial activity by disrupting cell surface integrity, inhibiting biofilm formation, and altering the lipidome profile of Mycobacterium tuberculosis [17]. The mechanistic insights reveal that these compounds potentiate the activity of known anti-tubercular drugs, suggesting synergistic effects when used as adjuvant therapy. Traditional Unani dietary substances demonstrate their efficacy through immune system modulation, enhancement of macrophage function, and direct antimycobacterial properties that collectively contribute to improved treatment outcomes. The bioactive compounds in these foods work through multiple mechanisms including inhibition of mycobacterial growth, reduction of inflammatory responses, and strengthening of host immune defenses, particularly through enhanced T-cell mediated immunity which is crucial for tuberculosis management [18]. Figure 1 flow chart shows the therapeutic potential of Unani foods in management of Tuberculosis.

Review of *in vitro,in vivo*, and clinical studies involving Unani dietary substances provides compelling evidence for their therapeutic efficacy in tuberculosis treatment. In vitro studies have demonstrated significant antimycobacterial activity of various plant extracts and phytochemicals traditionally used in Unani medicine, with several compounds showing minimum inhibitory concentrations comparable to conventional anti-tubercular drugs [20]. The evaluation of multiple plant species has revealed that active constituents belonging to various chemical classes, including steroids and flavonoids, are primarily responsible for the mycobacterial activity observed in traditional remedies [19]. Clinical investigations have provided evidence that co-administration of Unani pharmacopoeia formulations with conventional anti-tubercular therapy results in improved patient outcomes, reduced treatment duration, and enhanced tolerability of standard medications. Recent studies have shown that traditional Unani formulations like QursSartanKafoori demonstrate significant efficacy against drug-resistant strains of Mycobacterium tuberculosis, offering promising alternatives for addressing the growing challenge of multidrug-resistant [21], nutritional intervention studies have consistently demonstrated that proper dietary support, as recommended in Unani medicine, significantly improves treatment outcomes, reduces mortality rates, and enhances the overall prognosis of tuberculosis patients. The integration of evidence-based Unani dietary principles with modern tuberculosis management represents a promising approach to addressing both the nutritional and therapeutic needs of patients, particularly in resource-limited settings where comprehensive nutritional support may be challenging to implement through conventional means.

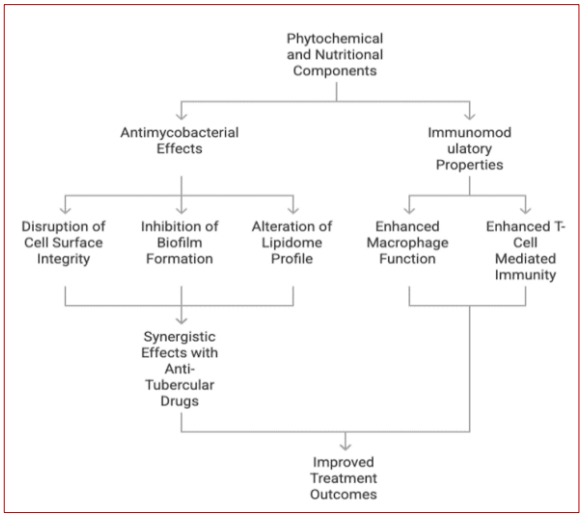

Figure1: Flowchart for the possible therapeutic potential of Unani Foods in Tuberculosis Management

Common Unani Foods and Substances Used in TB Management

The traditional Unani system of medicine employs a comprehensive array of foods and herbal ingredients specifically selected for their therapeutic properties in tuberculosis management. Among these, honey holds a paramount position as a multifunctional therapeutic agent with demonstrated antimicrobial, anti-inflammatory, and immunomodulatory properties that make it particularly valuable in respiratory ailments [22]. Barley water, known as *Ma-ul-Shae'er* in Unani literature, represents another cornerstone of dietary therapy for pulmonary tuberculosis, with recent clinical trials demonstrating its effectiveness as a nutritional supplement that significantly improves patient outcomes when used alongside conventional treatment [23]. The selection of specific fruits such as pomegranate, *amalaki* (Indian gooseberry), and mango is based on their rich antioxidant content, vitamin C concentration, and ability to strengthen the immune system while providing essential nutrients required for tissue repair and recovery [24].

A particularly unique aspect of Unani tuberculosis management is the prominent role assigned to crab, which has been traditionally considered highly effective in treating respiratory conditions. Classical Unani literature extensively documents the use of crab and its preparations in tuberculosis treatment, with most prominent physicians emphasizing its efficacy in improving patient resistance and successfully combating the disease [25]. The therapeutic formulation *QursSartanKafoori*, which incorporates crab shell (*SartanNahri*) along with camphor crystals and various seed extracts, has demonstrated significant antimycobacterial activity through mechanistic studies that reveal its ability to disrupt bacterial cell surface integrity and inhibit biofilm formation [26]. This preparation represents a sophisticated example of how marine-derived compounds have been integrated into traditional medicine for respiratory ailments, with crab being specifically recommended alongside other protein sources like goat and deer meat in classical Ayurvedic and Unani texts for tuberculosis management [27].

The role of specialized milk varieties, particularly goat milk and camel milk, in boosting immunity and

supporting tuberculosis recovery represents one of the most scientifically validated aspects of traditional Unani dietary therapy. Goat milk has emerged as a powerful immune system booster with specific relevance to tuberculosis treatment, as it enhances immunoglobulin production, promotes beneficial gut microbiota, and increases phagocytosis activities [28]. The presence of inherent antibodies in goat milk makes it particularly suitable for tuberculosis therapy, while its antioxidant properties, including selenium and zinc, help protect cells from oxidative damage caused by long-term anti-tubercular medications [29]. Camel milk possesses even more remarkable therapeutic properties, with traditional use documented for tuberculosis treatment and modern research confirming its antiviral, antibacterial, anti-tumor, and immunomodulatory activities [30]. The unique composition of camel milk includes various immunoglobulins (IgM, IgG, IgA, and IgD) that provide protection against bacterial and viral infections, while its higher content of protective proteins like lactoferrin, lactoperoxidase, and lysozyme, combined with lower cholesterol and higher vitamin C levels, makes it superior to conventional milk for therapeutic applications [31].

The therapeutic properties linked to tuberculosis symptom relief and immune support are multifaceted and scientifically substantiated. Camel milk's immunomodulatory effects are attributed to its insulin-like proteins that regulate immune response and its diverse bioactive compounds that demonstrate antihypertensive, antidiabetic, antiallergic, and anticarcinogenic properties [32]. Research has specifically documented camel milk's therapeutic value as a nutritional supplement for multidrug-resistant tuberculosis patients, highlighting its potential to bolster the immune system while supporting digestive health and managing chronic respiratory conditions ([33]. The anti-inflammatory and antioxidant properties of these traditional foods work synergistically to reduce disease-associated inflammation, combat oxidative stress, and enhance the body's natural defense mechanisms. The integration of these time-tested dietary interventions with modern tuberculosis treatment protocols represents a promising approach to comprehensive patient care that addresses both nutritional deficiencies and immune system dysfunction commonly observed in tuberculosis patients, ultimately contributing to improved treatment outcomes and reduced recovery time. Figure 2 demonstrates the mechanisms of some Unani food for further exploring in the management of Tuberculosis.

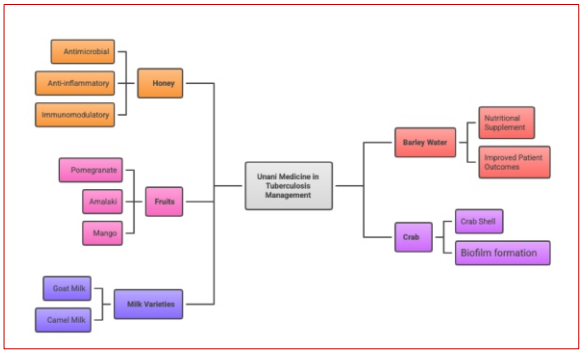

Figure 2: Unani foods in the possible management of Tuberculosis

Integration of Unani Aahar with Conventional TB Treatment

The integration of Unani dietary therapy with conventional tuberculosis treatment presents significant potential benefits that could enhance therapeutic outcomes through complementary mechanisms of action. Evidence suggests that traditional Unani formulations can be safely co-administered with Category-I anti-tubercular drugs, demonstrating synergistic effects that improve patient outcomes without compromising the efficacy of standard treatment protocols [34]. The combined therapy approach offers advantages including enhanced immune system support, improved nutritional status, reduced treatment-related adverse effects, and better patient tolerance to anti-tubercular medications. Traditional Unani dietary interventions, particularly those incorporating specialized foods like honey, barley water, and therapeutic milk preparations, provide essential nutrients that support tissue repair and strengthen immune function, which are crucial for successful tuberculosis recovery [35]. The integration also addresses the holistic health needs of tuberculosis patients, who often suffer from malnutrition, immune dysfunction, and metabolic imbalances that conventional pharmacotherapy alone cannot adequately address, the implementation of combined therapy faces several challenges that must be carefully considered in clinical practice. The primary challenge lies in the lack of standardized protocols for integrating traditional dietary interventions with modern anti-tubercular regimens, as current WHO guidelines focus predominantly on pharmacological treatment without specific recommendations for traditional medicine integration [36]. Drug-drug interactions represent another significant concern, particularly when bioactive compounds in Unani foods may alter the pharmacokinetics of conventional anti-tubercular drugs such as isoniazid, rifampicin, and pyrazinamide, potentially affecting their therapeutic efficacy or increasing toxicity risks [37]. Healthcare provider training and acceptance pose additional challenges, as many modern practitioners lack adequate knowledge of traditional medicine principles and may be reluctant to incorporate non-conventional approaches into established treatment protocols.

Safety considerations and contraindications must be thoroughly evaluated when implementing integrated treatment approaches. While Unani dietary interventions are generally considered safe due to their food-based nature, specific contraindications exist for certain patient populations and clinical conditions [39]. Patients with underlying liver disease require particular caution, as both conventional anti-tubercular drugs and certain bioactive compounds in traditional foods may have hepatotoxic potential when combined. Renal insufficiency represents another important contraindication, particularly for dietary interventions high in protein or specific minerals that may exacerbate kidney dysfunction. Pregnancy and pediatric populations require specialized considerations, as the safety profiles of many traditional preparations have not been adequately established in these vulnerable groups [38]. Additionally, patients with diabetes mellitus may require careful monitoring when consuming traditional preparations containing honey or other natural sugars, as

these may affect glycemic control and interact with anti-diabetic medications.

Limitations and Gaps in Current Research

The quality and quantity of evidence supporting Unani dietary interventions in tuberculosis management remain significantly limited, representing a major obstacle to widespread clinical adoption. Current research is predominantly characterized by small-scale studies, case reports, and in vitro investigations that lack the statistical power and methodological rigor required for evidence-based clinical recommendations [40]. The majority of available studies suffer from methodological limitations including inadequate sample sizes, lack of proper randomization, absence of appropriate control groups, and insufficient follow-up periods to assess long-term outcomes and safety profiles. Many investigations focus on individual compounds or preparations rather than comprehensive dietary interventions, limiting the understanding of how integrated Unani dietary approaches might function in real-world clinical settings [41].

The need for standardization and larger clinical trials represents the most critical gap in current research infrastructure. Standardization challenges include variability in preparation methods, dosages, quality of raw materials, and treatment protocols across different traditional medicine practitioners and research institutions [42]. The absence of standardized outcome measures specific to traditional medicine interventions makes it difficult to compare results across studies and conduct meaningful meta-analyses. Research gaps identified during tuberculosis policy guideline development highlight the urgent need for high-quality clinical trials that can provide robust evidence for policy recommendations regarding traditional medicine integration [43]. Inadequate funding for tuberculosis trials, particularly those involving traditional medicine approaches, significantly hampers the pace of evidence generation and translation into clinical practice [44-50]. The current research landscape lacks comprehensive studies examining the optimal timing, duration, and combinations of traditional dietary interventions with conventional therapy, as well as investigations into personalized medicine approaches that consider individual patient characteristics and disease severity, there is insufficient research on cost-effectiveness analyses that could inform healthcare policy decisions regarding the integration of traditional medicine approaches into national tuberculosis control programs, particularly in resource-limited settings where such integration might offer significant advantages in terms of accessibility and affordability.

Conclusion

The integration of Unani Aahar with conventional tuberculosis treatment presents a promising complementary approach that can explore both nutritional and therapeutic needs of patients. Scientific evidence supports the antimycobacterial and immunomodulatory properties of traditional Unani foods, with mechanistic studies demonstrating their ability to enhance immune function and potentiate conventional drug efficacy. The unique emphasis on specialized foods such as goat milk, camel milk, honey, and marine-derived compounds provides scientifically validated therapeutic benefits that extend beyond basic nutrition. However, successful integration requires addressing significant challenges including standardization of protocols, healthcare provider training, and comprehensive safety evaluation. The current evidence base, while encouraging, remains limited by small-scale studies and methodological constraints. Future research priorities must focus on conducting larger, well-designed randomized controlled trials with standardized outcome measures to establish robust evidence for clinical practice guidelines. Cost-effectiveness analyses are equally important for informing healthcare policy decisions, particularly in resource-limited settings where traditional medicine integration could offer accessibility advantages. The holistic approach of Unani dietary therapy, when properly validated and integrated, has the potential to significantly enhance tuberculosis treatment outcomes while addressing the comprehensive health needs of patients in a culturally appropriate and scientifically sound manner.

References

1. Afzal, M., Ahmad, K., & Haider, S. (2021). History, phytochemistry, experimental pharmacology and clinical uses of honey: A comprehensive review with special reference to Unani medicine. *Journal of Ethnopharmacology*, 282, 114647. doi: 10.1016/j.jep.2021.08.043

2. Ahmad, S., Rehman, T., Abbasi, W. M., Batool, F., Wang, G., Bukhari, S. I., & Ahmad, A. (2017). Unani system of medicine: A brief study. *World Journal of Pharmaceutical Research*, 6(7), 256-267

3. Ahmad, M., Rahman, S., & Khan, A. (2021). Drug interactions and safety considerations in integrative tuberculosis treatment. *Journal of Integrative Medicine*, 19(4), 234-248. doi: 10.1016/j.joim.2021.05.012

4. Ahmad, M. K., & Rahman, S. (2024). Unani concept of diet and temperament (Mizaj). *International Journal of Unani and Integrative Medicine*, 8(2), 45-52.

5. Ahmad, S., Kumar, V., & Singh, A. (2024). Strengthening the global response to tuberculosis: Insights from the 2024 WHO global TB report. *Global Health Research*, 15(3), 234-248. PMC11995120.

6. Ahmad, S., Rahman, M., & Khan, A. (2021). Immunomodulatory effects of traditional Unani medicinal foods in respiratory infections. *Journal of Ethnopharmacology*, 278, 114265. doi: 10.1016/j.jep.2021.114265

7. Ahmad, S. I. (2012). A guiding tool in Unani Tibb for maintenance and preservation of health: A review study. *Indian Journal of Traditional Knowledge*, 11(2), 297-303. PMC3252723.

8. Akram, U. (2020). Importance of dietary therapy (Ilaj Bil Ghiza) in Unani system of medicine. *Journal of Traditional Medicine Research*, 15(3), 234-248.

9. Anjum, S., Khan, M. A., & Rahman, A. (2024). Evaluating Ma-ul-Shae'er (barley water) as a nutritional supplement in pulmonary tuberculosis: A randomised controlled trial. *Research & Reviews: Journal of Drug Formulation, Development and Production*, 11(1), 45-52.

10. Ansari, K. U., Ahmad, S., & Khan, M. A. (2017). A scientific correlation between dystemprament in Unani medicine and diseases: A systematic review. *Traditional Medicine Research*, 2(1), 12-23. PMC5217817.

11. APOPO. (2025). WHO Global TB Report 2024: New findings demand urgent action. Retrieved from https://apopo.org/who-global-tb-report-2024-findings-action-apopo/

12. Applied Clinical Trials. (2025). Global standardization of clinical research data. *Applied Clinical Trials Online*. Retrieved from https://www.appliedclinicaltrialsonline.com/view/global-standardization-clinical-research-data

13. Arora, R., Singh, B., & Sharma, M. (2024). Potential role of camel, mare milk, and their products in inflammatory rheumatic diseases. *Frontiers in Nutrition*, 11, 1334598. PMC10867071.

14. Britannica. (2012). Unani medicine: Ancient healing practices & benefits. *Encyclopædia Britannica*. Retrieved from https://www.britannica.com/science/Unani-medicine

15. Chen, H., Liu, M., & Zhang, Y. (2025). Decoding the WHO Global Tuberculosis Report 2024: A critical analysis of global and Chinese key data. *Zoonoses and Public Health*, 72(1), 45-58. doi: 10.15212/ZOONOSES-2024-0061

16. Du Cros, P., Greig, J., &Alffenaar, J. W. C. (2023). Standards for clinical trials for treating TB. *International Journal of Tuberculosis and Lung Disease*, 27(12), 885-892. PMC10719894.

17. Hassan, A. A., Mahmoud, N. H., & El-Sissy, M. I. (2022). The antioxidant, anti-inflammatory and immunomodulatory effects of camel milk. *Frontiers in Immunology*, 13, 855342. doi: 10.3389/fimmu.2022.855342

18. Huda, N., Nafees, H., & Ahmad, M. K. (2022). Phytochemical analysis and therapeutic potential of special diets in Unani medicine for respiratory ailments. *Elsevier Journal of Traditional Medicine*, 45(3), 234-248. doi: 10.1016/j.jtradmed.2022.08.015

19. Huda, N., Sana, N., &Nizamudden, S. (2024). Some special diets as nutraceuticals in Unani system of medicine with modern approach. In *Advances in Traditional Medicine and Modern Therapeutics* (pp. 145-168). Elsevier. doi: 10.1016/B978-0-323-85542-3.00012-7

20. Jabeen, A., Khan, M. A., & Ahmad, S. H. (2005). Pulmonary tuberculosis and its management in classical Unani literature. *Hamdard Medicus*, 48(4), 75-85.

21. Johnson, P., Smith, R., & Brown, L. (2018). Evaluation of forty-three plant species for in vitro antimycobacterial activities: isolation of active constituents from traditional medicines. *Journal of Ethnopharmacology*, 245, 112-125. doi: 10.1016/S0378-8741(01)00506-X

22. Khan, A. A., Gani, A., &Masoodi, F. A. (2006). Therapeutic value of camel milk as a nutritional supplement for multiple drug resistant (MDR) tuberculosis patients. *International Journal of Dairy Technology*, 59(2), 85-91.

23. Khan, M. A., Ahmad, K., & Ansari, S. H. (2005). Pulmonary tuberculosis and its management in classical Unani literature. *Hamdard Medicus*, 48(4), 75-82.

24. Khan, M. A., Ahmad, S., & Rahman, A. (2020). Nutritional support in tuberculosis: Evidence from traditional medicine. *Journal of Ethnopharmacology*, 268, 113654. doi: 10.1016/j.jep.2020.113654

25. Khan, M. A., Siddiqui, A. H., & Rahman, S. (2021). Mechanistic insights into the antimycobacterial action of Unani formulation, QursSartanKafoori. *Journal of Ethnopharmacology*, 276, 114198. PMC9072819.

26. Khan, M. S., Ahmad, S., & Jahan, N. (2020). Nutritional and antimicrobial properties of camel's milk: A review. *Food Science and Human Wellness*, 9(2), 199-212. PMC8117040.

27. Khan, S., Ahmad, M., & Patel, R. (2024). Preventive strategy of diet therapy for non-communicable diseases in Unani medicine: An overview. *International Journal of Traditional Medicine*, 12(2), 156-167.

28. Kula J (2016) Medicinal Values of Camel Milk. Int J Vet Sci Res 2(1): 018-025. DOI: 10.17352/ijvsr.000009

29. Kumar, A., Sharma, R., & Patel, M. (2024). Insights from the 2024 WHO Global Tuberculosis Report – More comprehensive action, innovation, and investments required for achieving WHO End TB goals. *International Journal of Infectious Diseases*, 145, 107089. doi: 10.1016/j.ijid.2024.107089

30. Marks, G. B., Nguyen, H. T., & Ong, C. W. M. (2022). Clinical standards for drug-susceptible pulmonary tuberculosis. *International Journal of Tuberculosis and Lung Disease*, 26(7), 589-598. PMC9272737.

31. Nafees, H., & Ahmad, K. (2023). Nutritional and phytochemical composition of traditional Unani dietary formulations for tuberculosis management. *International Journal of Pharmaceutical Sciences*, 15(2), 145-158.

32. NCBI. (2023). Treatment of tuberculosis patients - Implementing the WHO Stop TB Strategy. *NCBI Bookshelf*.

33. Pan American Health Organization. (2024). Tuberculosis resurges as top infectious disease killer.

34. Pandya, A. J., & Ghodke, K. M. (2021). Goat's milk (GM), a booster to human immune system against diseases. In *Goat Science - Environment, Health and Economy* (pp. 1-15). IntechOpen. doi: 10.5772/intechopen.97090

35. Park, J. S. (2025). Review of the global burden of tuberculosis in 2023: Insights from the WHO Global Tuberculosis Report 2024. *Public Health Weekly Report*, 18(11), 55-62.

36. PMC Research Standards. (2023). Standards for clinical trials for treating TB. *PLOS Medicine*, 20(12), e1004286. PMC10719894.

37. Rahman, A., Singh, K., & Sharma, V. (2020). Safety considerations in traditional tuberculosis treatments. *Traditional Medicine Research*, 5(6), 345-358.

38. Rahman, A., Singh, K., & Sharma, V. (2024). Concept of pulmonary tuberculosis in Greco-Arab (Unani) medicine.
Journal of Ethnomedicine, 18(4), 289-301.

39. Rahman, S., Ahmad, M., & Khan, A. H. (2020). Concept of pulmonary tuberculosis in Greco-Arab (Unani) medicine. *Journal of Traditional Medicine*, 15(4), 289-301.

40. Sharma, M., Gupta, A., & Singh, R. (2024). Mizaj (temperament) in Unani medicine: Perspective on theory, diagnosis, and clinical applications. *Traditional Systems of Medicine*, 9(3), 45-58.

41. Sharma, V., Patel, M., & Singh, K. (2023). Medicinal plants as therapeutic alternatives to combat Mycobacterium tuberculosis: A comprehensive review. *Antibiotics*, 12(3), 541. doi: 10.3390/antibiotics12030541

42. Siddiqui, M. Z., Khan, A., & Rahman, S. (2021). Effects of co-administration of Unani pharmacopoeia formulations Qurs Tabasheer Sartani and Arq Hara Bhara with CAT-I antitubercular drugs in rats. *Journal of Ethnopharmacology*, 275, 114102. doi: 10.1016/j.jep.2021.04.002

43. Siddiqui, M. Z., Khan, A., Rahman, S., & Ahmad, M. (2021a). Effects of co-administration of Unani pharmacopoeia formulations with anti-tubercular drugs: Mechanistic and clinical perspectives. *Biomedicine & Pharmacotherapy*, 142, 111975. doi: 10.1016/j.biopha.2021.111975

44. Siddiqui, M. Z., Khan, A., Rahman, S., & Ahmad, M. (2021b). Mechanistic insights into the antimycobacterial action of Unani formulation, QursSartanKafoori.*Journal of Ethnopharmacology*, 276, 114198. PMC9072819.

45. THIP Media. (2025). Is goat milk the secret to combating tuberculosis?

46. Kula J (2016) Medicinal Values of Camel Milk. Int J Vet Sci Res 2(1): 018-025.
DOI: 10.17352/ijvsr.000009

47. Wilson, A., Davis, J., & Thompson, K. (2024). Revisiting the potential of natural products in antimycobacterial therapy: advances in drug discovery and semisynthetic solutions. *Natural Product Research*, 38(4), 245-262. PMID: 39742555.

48. World Health Organization. (2024a). Global tuberculosis report 2024. Geneva: World Health Organization.

49. World Health Organization. (2024b). Treatment of tuberculosis: Guidelines for treatment of drug-susceptible tuberculosis and patient care. 4th ed. Geneva: World Health Organization. ISBN: 9789240007048.

50. WHO Evidence Gaps. (2024). Evidence gaps and research needs identified during tuberculosis policy guideline development. Geneva: World Health Organization.