

Study on the Clinical Effects and Mechanisms of Traditional Chinese Medicine in Treating Chronic Diseases

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Abstract: Traditional Chinese medicine has a history of thousands of years in treating chronic diseases. Relying on the theories of "holistic view" and "treatment based on syndrome differentiation", it has accumulated rich clinical experience. Due to their chronic and insidious nature, chronic diseases often cannot be cured by a single treatment method. In recent years, with the development of biology and pharmacology, the therapeutic effects of traditional Chinese medicine have been further verified. Through mechanisms such as immune regulation, anti-inflammation, and anti-oxidation, traditional Chinese medicine effectively slows the progression of chronic diseases and improves quality of life. This study explores the multi-target effects of active ingredients in traditional Chinese medicine, analyzes the integration and complementarity of traditional Chinese medicine with modern treatment methods, and emphasizes the promotion of modern technology in the research of traditional Chinese medicine mechanisms. Through a comprehensive analysis of the clinical effects and mechanisms of traditional Chinese medicine in treating chronic diseases, this study aims to provide theoretical support for the modernization of traditional Chinese medicine and promote its application in the global health field.

Key Words: traditional Chinese medicine treatment; chronic diseases; clinical effects; mechanism research; immune regulation

Introduction

The high incidence of chronic diseases is closely associated with the global trend of population aging, presenting a significant challenge in the field of global health. Although conventional Western medical treatments can provide symptomatic relief in the short term, they often fail to fundamentally regulate the patient's overall health status, particularly exhibiting numerous issues in long-term management. The treatment of chronic diseases with traditional Chinese medicine, characterized by its comprehensive regulatory approach, has gradually gained attention in modern medical research. The theoretical foundation of traditional Chinese medicine is long-standing and profound, emphasizing individualized and holistic treatment strategies, and demonstrating significant effects in immune regulation, inflammation reduction, and anti-oxidation.

However, how to scientifically elucidate the mechanisms of traditional Chinese medicine and validate its clinical efficacy through modern technological methods has become a crucial focus in current research. Based on this, our study concentrates on the clinical effects and mechanisms of traditional Chinese medicine in treating chronic diseases, aiming to employ modern molecular biology techniques to investigate its biological mechanisms, analyze its advantages and potential in chronic disease treatment, and provide a theoretical basis for the modernization of traditional Chinese medicine.

1. Theoretical Basis and Current Status of Traditional Chinese Medicine in Treating Chronic Diseases

1.1 Historical Application and Theoretical Development of Traditional Chinese Medicine in Chronic Disease Treatment

The application of traditional Chinese medicine in treating chronic diseases has a long history, and

it has accumulated rich experience, especially in regulating physical weakness and chronic symptoms. According to ancient medical classics such as "*Huangdi Neijing*" and "*Shanghan Lun*", chronic diseases are often regarded as long-term health problems caused by various factors including dysfunction of internal organs, deficiency of qi and blood, and imbalance of yin and yang. Traditional Chinese medicine theory emphasizes achieving the goal of alleviating or curing chronic diseases by adjusting the overall state of the body and restoring the balance of yin and yang. Since ancient times, traditional Chinese medicine has used the method of "treatment based on syndrome differentiation" to achieve long-term regulation and curative effects by adopting combinations of various herbs according to the patient's different constitutions, causes of disease, and symptoms, thereby harmonizing the internal organs, qi, and blood.

The theoretical system of traditional Chinese medicine in treating chronic diseases is deeply influenced by the guiding ideologies of "holistic view" and "treatment based on syndrome differentiation". Its unique treatment approach not only focuses on local treatment of symptoms but also emphasizes regulating the body's overall condition, strengthening immune system function, and improving the circulation of qi and blood, thereby preventing disease recurrence. In the process of treating chronic diseases, the main treatment methods of traditional Chinese medicine include promoting blood circulation and removing blood stasis, tonifying the spleen and stomach, and clearing heat and detoxifying, among others. In recent years, with the development of modern Chinese medicine and combined with research achievements in modern biology, many traditional theories and practices of Chinese medicine have been further verified and refined, leading to their wider application and recognition in the treatment of chronic diseases ^[1].

1.2 Definition and Classification of Chronic Diseases

Chronic diseases refer to conditions that persist over an extended period and progress gradually. Their onset is typically slow without noticeable subjective symptoms, making them difficult for patients to detect until the disease has advanced to a certain stage. Chronic diseases are characterized by their prolonged duration, recurrent nature, and insidious onset. Common chronic diseases include cardiovascular diseases, diabetes, chronic respiratory diseases, liver diseases, and kidney diseases. These conditions generally do not manifest rapid clinical symptoms, yet they significantly impact patients' quality of life, consequently making their threat increasingly severe in modern society.

Based on differences in etiology, clinical manifestations, and pathological mechanisms, chronic diseases can be classified into several types. For example, metabolic diseases such as diabetes and hypertension are primarily associated with imbalances in the endocrine system's regulation and metabolic disorders; cardiovascular and cerebrovascular diseases such as coronary heart disease and stroke are usually closely related to factors like arteriosclerosis and dyslipidemia; chronic respiratory diseases such as chronic obstructive pulmonary disease (COPD) are closely associated with environmental factors like long-term smoking and air pollution. The clinical manifestations, treatment strategies, and management approaches of each chronic disease vary; however, their commonality lies in the need for long-term adherence to treatment, which often requires a combination of symptomatic treatment and holistic regulation.

1.3 Current Research Status and Development Trends of Traditional Chinese Medicine in Treating Chronic Diseases

Research on traditional Chinese medicine for chronic diseases has achieved remarkable progress in recent years. Particularly with the support of modern medical technology, the clinical efficacy of many traditional Chinese medicines has been empirically validated. The pharmacological effects of traditional Chinese medicines, such as astragalus, angelica, goji berries, and salvia, including immune regulation, anti-inflammatory, and antioxidant properties, have been substantiated through experimental and clinical studies. With in-depth research in biology and pharmacology, the mechanisms of action of these medicines have been gradually clarified, providing a theoretical foundation for their broader application in the treatment of chronic diseases.

Advances in modern molecular biology technologies, particularly breakthroughs in genomics, proteomics, and metabolomics, have enabled more precise analysis of the mechanisms underlying traditional Chinese medicine's therapeutic effects on chronic diseases. Through these advanced technologies, researchers can accurately identify the targets of active components in traditional Chinese medicine and elucidate their molecular-level actions, establishing a solid foundation for its

modernization and international integration. In the future, with the application of big data and artificial intelligence, traditional Chinese medicine treatment will evolve toward precision medicine and personalized therapy by optimizing formulation compatibility. Integrated with modern biopharmaceutical technologies, the combination of traditional Chinese medicine and modern drugs is expected to expand its application scope in chronic disease treatment. As clinical data and mechanistic research deepen, the therapeutic efficacy and mechanisms of traditional Chinese medicine will gain broader recognition, promoting its modernization and contributing to global health management [2].

2. Clinical Efficacy Analysis of Traditional Chinese Medicine in Treating Chronic Diseases

2.1 Evaluation Criteria and Methods for Clinical Efficacy of Traditional Chinese Medicine in Chronic Disease Treatment

2.1.1 Changes in Clinical Symptoms and Quality Assessment

Changes in clinical symptoms serve as the most direct indicators for evaluating therapeutic efficacy in chronic diseases. By regularly monitoring patients' primary symptoms, such as pain, fatigue, dyspnea, weight changes, and blood glucose fluctuations, and combining these observations with quality of life scores (e.g., SF-36, EQ-5D, etc.), a preliminary assessment of treatment effectiveness can be conducted. These scales systematically evaluate changes in patients' symptoms, daily activity capacity, and overall health status, thereby providing quantitative evidence for the therapeutic effects of traditional Chinese medicine.

2.1.2 Biomarkers and Laboratory Examinations

The efficacy of traditional Chinese medicine in treating chronic diseases is not only reflected in symptom improvement but also requires validation through biomarkers and laboratory examinations. For instance, in diabetes treatment, indicators such as blood glucose levels and glycated hemoglobin (HbA1c) can effectively reflect the therapeutic outcomes; in hypertension management, changes in blood pressure serve as crucial indicators. Additionally, the detection of chronic inflammation markers (such as C-reactive protein and cytokines) and oxidative stress levels contributes to evaluating the role of traditional Chinese medicine in slowing the pathological progression of chronic diseases.

2.1.3 Imaging and Histological Changes

The advancement of imaging technologies has established examination methods such as CT and MRI as crucial tools for evaluating the therapeutic effects of traditional Chinese medicine. In the treatment of cardiovascular and cerebrovascular diseases, these imaging modalities can clearly observe indicators including vascular patency and the degree of arteriosclerosis, thereby enabling the assessment of traditional Chinese medicine's therapeutic outcomes. Through histological examinations, such as pathological tissue section analysis of the liver and kidneys, the mechanisms through which traditional Chinese medicine influences chronic diseases can be directly observed [3].

2.2 Clinical Efficacy Evaluation of Traditional Chinese Medicine in Treating Common Chronic Diseases

2.2.1 Clinical Effects of Traditional Chinese Medicine in Diabetes Treatment

As a typical metabolic disease, the core objectives of diabetes treatment are controlling blood glucose levels and reducing diabetes-related complications. In recent years, a growing number of studies have demonstrated that traditional Chinese medicines such as astragalus, goji berries, and codonopsis play significant roles in regulating insulin secretion, improving pancreatic β -cell function, providing antioxidant effects, and exerting anti-inflammatory actions. In clinical research, the application of these traditional Chinese medicine compounds can effectively lower blood glucose levels, improve glucose metabolism, and mitigate chronic complications of diabetes—such as diabetic retinopathy and diabetic nephropathy—through the regulation of immune responses.

2.2.2 Clinical Effects of Traditional Chinese Medicine in Hypertension Treatment

Hypertension, as a prevalent chronic disease worldwide, imposes a sustained burden on patients' cardiovascular and cerebrovascular systems. Traditional Chinese medicine demonstrates unique advantages in lowering blood pressure, with commonly used herbs such as *Gastrodia Rhizome*, hawthorn, and *Salvia* exhibiting effects in regulating blood pressure, improving vascular elasticity, and

promoting blood circulation. Clinical studies indicate that traditional Chinese medicine treatment based on the principle of "treatment based on syndrome differentiation" can achieve better antihypertensive effects through personalized regulation according to patients' different symptom patterns. Particularly among elderly hypertensive patients with multiple comorbidities, traditional Chinese medicine treatment demonstrates higher safety and fewer side effects.

2.2.3 Clinical Effects of Traditional Chinese Medicine in Treating Chronic Obstructive Pulmonary Disease (COPD)

Chronic Obstructive Pulmonary Disease (COPD) represents a common chronic respiratory condition where long-term airflow limitation and chronic inflammation lead to symptoms including dyspnea, shortness of breath, and sputum production. Traditional Chinese medicines such as almond, adenophora root, lily bulb, and fritillaria bulb possess functions of moistening the lungs and relieving cough, as well as clearing lung heat and resolving phlegm. Clinical studies demonstrate that compound prescriptions of traditional Chinese medicine can significantly alleviate patients' respiratory symptoms, improve pulmonary function, while concurrently reducing the frequency of acute exacerbations. Traditional Chinese medicine treatment effectively regulates immune system function, alleviates airway inflammation, and delays disease progression.

2.3 Comparative Analysis of Traditional Chinese Medicine and Modern Treatment Methods

2.3.1 Complementarity Between Traditional Chinese Medicine and Western Medicine in Chronic Disease Treatment

Western medicine typically relies on single mechanisms—such as lowering blood sugar, reducing blood pressure, or countering inflammation—to directly target diseases themselves. In contrast, traditional Chinese medicine employs compound formulations to regulate multiple physiological processes, repair organ system functions, and enhance immunity, thereby delaying disease progression. The integration of Chinese and Western medicine can leverage their respective advantages: mitigating side effects of Western drugs while improving therapeutic outcomes. For instance, in hypertension treatment, Western medicine can rapidly control blood pressure, while traditional Chinese medicine contributes to long-term management by regulating constitutional health, enhancing drug tolerance, and alleviating complications.

2.3.2 Integration of Traditional Chinese Medicine and Modern Technology in Chronic Disease Treatment

With the rapid development of molecular biology and big data technologies, modern medicine enables more precise targeted therapies for chronic diseases, while traditional Chinese medicine offers treatment approaches that holistically regulate bodily functions. Modern technologies can facilitate better understanding of the mechanisms underlying traditional Chinese medicine compounds, utilizing methods such as genomics and metabolomics to identify potential biomarkers, thereby enabling personalized treatment plans. By integrating modern technologies with the holistic regulatory advantages of traditional Chinese medicine, more precise and comprehensive treatment options can be provided for patients with chronic diseases ^[4].

2.3.3 Comprehensive Efficacy and Safety in Clinical Research

When evaluating comprehensive treatment, attention must be given not only to therapeutic effectiveness but also to medication safety. Compared with Western medicine, traditional Chinese medicine generally demonstrates lower side effects, particularly during long-term administration, thereby better safeguarding patient health. By integrating traditional Chinese medicine with modern treatment methods, it becomes possible to avoid issues of drug dependency and resistance associated with prolonged use of Western medicine, while simultaneously maximizing therapeutic outcomes and reducing the recurrence of chronic diseases and associated complications.

3. Mechanisms of Action and Research Progress in Traditional Chinese Medicine for Chronic Diseases

3.1 Biological Mechanisms of Traditional Chinese Medicine in Chronic Disease Treatment

3.1.1 Anti-inflammatory Effects and Immune Regulation

Chronic diseases are often accompanied by low-grade inflammatory responses, where persistent activation of the immune system serves as a critical factor in disease progression. Studies have shown that many traditional Chinese medicines possess significant anti-inflammatory properties. They can regulate the immune system by inhibiting the secretion of inflammatory factors such as TNF- α and IL-6, suppress the overactivation of immune cells, thereby alleviating inflammatory responses and improving pathological conditions. For instance, active components of traditional Chinese medicines such as astragalus, salvia, and goji berries enhance anti-inflammatory cytokines, inhibit oxidative stress, significantly improve immune function, and reduce both the incidence and recurrence rates of diseases.

3.1.2 Antioxidant Effects and Free Radical Scavenging

Oxidative stress serves as a critical pathological factor in the development of chronic diseases. Excessive free radicals can damage cells, leading to oxidative injury of proteins, lipids, and DNA, thereby accelerating disease progression. Components in traditional Chinese medicine, such as flavonoids and saponins, demonstrate significant antioxidant effects. They can scavenge free radicals, inhibit the formation of lipid peroxides, and repair damaged cells, consequently slowing the progression of chronic diseases. Traditional Chinese medicines including *Salvia miltiorrhiza*, goji berries, and *Ganoderma lucidum* have shown potential in antioxidant research by enhancing antioxidant enzyme activity and reducing oxidative stress damage, thereby contributing to the prevention and treatment of chronic diseases ^[5].

3.1.3 Cellular Repair and Tissue Reconstruction

Another crucial mechanism of traditional Chinese medicine involves promoting cellular repair and tissue regeneration. In chronic diseases, long-term pathological damage leads to varying degrees of structural changes in tissues. Traditional Chinese medicine activates endogenous cellular repair mechanisms to facilitate the regeneration and restoration of damaged tissues. For instance, components of traditional Chinese medicines such as goji berries and angelica can promote cell proliferation and differentiation while enhancing tissue repair capacity. Particularly in clinical treatments for chronic conditions like diabetes and liver diseases, multiple studies have confirmed their significant effects in promoting tissue healing and reducing tissue fibrosis.

3.2 Effects of Active Ingredients in Traditional Chinese Medicine on Key Targets in Chronic Diseases

3.2.1 Regulatory Effects on Metabolic Pathways

Chronic metabolic diseases, such as diabetes and obesity, are often accompanied by glucose metabolism disorders and fat accumulation. Active ingredients in traditional Chinese medicine can alleviate the occurrence and progression of these diseases by regulating key metabolic pathways. For instance, active components in traditional Chinese medicines like astragalus and goji berries can activate the AMP-activated protein kinase (AMPK) signaling pathway, promote fatty acid oxidation and energy metabolism, improve insulin resistance, and regulate blood glucose levels. Furthermore, these active ingredients can mitigate diabetes and its complications by modulating key biological processes in the liver, including glucose metabolism and lipid metabolism.

3.2.2 Intervention in Cardiovascular Pathology

The mechanisms of traditional Chinese medicine in treating cardiovascular diseases are manifested not only through direct blood pressure and lipid-lowering effects, but also through comprehensive regulation of the cardiovascular system to slow pathological progression. For instance, tanshinones from *Salvia miltiorrhiza* demonstrate significant protective effects on vascular endothelial function, inhibiting the development of atherosclerosis and improving blood circulation. By regulating the expression of signaling molecules such as angiotensin II (Ang II) and endothelin (ET), traditional Chinese medicine suppresses the proliferation and migration of vascular smooth muscle cells, thereby delaying the progression of cardiovascular diseases including hypertension and coronary heart disease.

3.2.3 Regulatory Effects on Immune Responses

Chronic diseases are frequently accompanied by immune dysfunction, where aberrant activation or suppression of immune responses can lead to exacerbation or persistence of diseases. Active components in traditional Chinese medicine exert immunomodulatory effects by regulating the activity of immune cells and the secretion of cytokines. Research indicates that polysaccharides from *Ganoderma lucidum*, flavonoids from *Astragalus*, and polysaccharide components from goji berries all demonstrate significant immunoregulatory properties. These components enhance the body's immune defense capabilities by activating immune cells such as T cells and macrophages, thereby reducing immune imbalances induced by chronic diseases [6].

3.3 Application of Modern Technological Methods in Traditional Chinese Medicine Mechanism Research

3.3.1 Application of Genomics and Proteomics

Genomics and proteomics provide powerful tools for investigating the mechanisms of traditional Chinese medicine. Through high-throughput gene expression analysis, researchers can identify how components of traditional Chinese medicine regulate gene expression and uncover potential therapeutic targets. For instance, medicinal materials such as astragalus and goji berries intervene in conditions like diabetes and cardiovascular diseases by modulating the expression of metabolism-related genes. Proteomics further elucidates the effects of traditional Chinese medicine on specific proteins, particularly those involved in cellular signaling pathways and immune regulation.

3.3.2 Integration of Metabolomics and Systems Biology

Metabolomics, as an emerging research methodology, analyzes changes in endogenous metabolites to reveal metabolic disorders in chronic diseases and the interventional effects of traditional Chinese medicine. The multi-target and multi-pathway effects of traditional Chinese medicine typically constitute the primary reason for its efficacy in treating chronic diseases, and the application of metabolomics precisely provides an explanatory framework for this complex mechanism. By integrating metabolomics with systems biology approaches, researchers can construct multi-level networks of traditional Chinese medicine treatment for chronic diseases, further investigate its mechanisms of action, and provide scientific basis for optimizing clinical efficacy.

3.3.3 Application of Big Data and Artificial Intelligence Technologies

With the rapid development of big data analytics and artificial intelligence (AI) technologies, modern science holds immense potential for application in traditional Chinese medicine research. Big data technology can integrate clinical, laboratory, and biomedical literature data to precisely analyze the components of traditional Chinese medicine and their mechanisms of action. AI, particularly deep learning algorithms, can automatically identify potential targets of compound formulations of traditional Chinese medicine, providing new insights for new drug development. AI-assisted drug screening technologies are being widely applied in the research and development of new traditional Chinese medicines, accelerating both the scientific validation and clinical application of traditional Chinese medicine in treating chronic diseases.

Conclusion

With the rapid advancement of modern technologies, particularly the application of genomics, metabolomics, and artificial intelligence, the mechanisms of traditional Chinese medicine in treating chronic diseases have been elucidated with greater precision. By integrating traditional Chinese medicine with modern biological technologies, the potential of compound formulations of traditional Chinese medicine can be further explored, promoting the development of personalized treatment approaches. Future research will increasingly focus on the integrated application of traditional Chinese medicine and modern therapeutic methods, investigating the advantageous complementarity between compound formulations of traditional Chinese medicine and Western drugs to provide more comprehensive and precise treatment solutions for patients with chronic diseases. Meanwhile, with the accumulation of clinical data and technological progress, the scientific validity and safety of traditional Chinese medicine in treating chronic diseases will be further validated, advancing its global integration and contributing to the future development of worldwide health initiatives.

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