

Meta-Analysis of TCM Emotional Regulation Combined with Fiber Fabric Intervention for Kidney Disease Depression

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ABSTRACT This meta-analysis systematically evaluates the clinical effectiveness and safety of traditional Chinese medicine (TCM) emotional regulation combined with functional fiber-fabric interventions for depression in patients with nephrotic syndrome. Relevant randomized controlled trials were identified through comprehensive searches of major domestic and international databases, followed by qualitative and quantitative evidence synthesis. The intervention model integrates TCM emotional regulation approaches, including psychological guidance, breathing exercises, and mind-body practices, with functional textile materials such as far-infrared and negative-ion fiber fabrics. The available evidence indicates that the combined intervention demonstrates favorable effects in alleviating depressive symptoms, improving sleep quality, enhancing quality of life, and maintaining a high level of safety compared with conventional treatment alone. Subgroup analyses further suggest that different functional fabrics exhibit distinct advantages in addressing psychological and physical symptoms. From an engineering perspective, the proposed intervention framework can be extended to intelligent healthcare environments incorporating wearable functional textiles, wireless health-monitoring systems, and antenna-enabled medical Internet-of-Things infrastructures, where continuous physiological data acquisition and personalized health management are essential. This study provides evidence-based support for non-pharmacological intervention strategies and highlights the potential integration of traditional healthcare approaches with modern intelligent health-engineering technologies.

INDEX TERMS traditional Chinese medicine emotional regulation, functional textile fabrics, nephrotic depression, wearable health monitoring

I. INTRODUCTION

NEPHROTIC syndrome is a common kidney disease with a long course and a tendency to relapse. Patients often experience varying degrees of depression, creating a vicious cycle where the disease and psychological problems mutually influence each other. Traditional Western medicine focuses primarily on controlling physiological symptoms, paying insufficient attention to psychological issues. Traditional Chinese medicine emphasizes the unity of body and mind, treating both physical and mental aspects, with emotional regulation being the core of TCM psychological therapy. This therapy generally includes techniques like music therapy, cognitive guidance informed by TCM organ theory (e.g., Liver-Spleen disharmony), and mindful physical practices. In recent years, functional textile materials have developed rapidly, with far-infrared fibers and negative ion fabrics using physical effects to improve human

physiological functions, opening up new avenues for disease intervention. This study uses meta-analysis to systematically evaluate the clinical efficacy and safety of TCM emotional regulation combined with functional textile fibers in the intervention of nephrotic depression, providing evidence-based medicine for clinical practice.

II. THE SIGNIFICANCE OF COMBINING TRADITIONAL CHINESE MEDICINE EMOTIONAL REGULATION WITH FIBER FABRIC INTERVENTION IN KIDNEY DISEASE DEPRESSION

A. CLINICAL VALUE IN IMPROVING THE PHYSICAL AND MENTAL HEALTH OF PATIENTS WITH KIDNEY DISEASE

The physical and mental symptoms of patients with nephrotic syndrome are intertwined, and the incidence of depression is much higher than that of the general popu-

lation. Traditional Chinese medicine emotional regulation can soothe emotions and regulate psychology by relieving depression, tonifying the kidney and calming the mind, and harmonizing the heart and kidney [1]. The two together form a two-way regulation of spirit and matter, psychology and physiology, which is in line with the idea of the unity of form and spirit in traditional Chinese medicine. While reducing depression, it can improve kidney function and reflect the advantages of the overall conditioning of traditional Chinese medicine [2].

B. THE INNOVATIVE SIGNIFICANCE OF NON-DRUG COMPREHENSIVE INTERVENTION

At present, most treatments for depression in kidney disease rely on antidepressants, which can cause side effects with long-term use. Traditional Chinese medicine emotional regulation + functional textile fiber fabric = safe and gentle non-drug regimen [3]. This non-drug comprehensive intervention reduces the burden of medication and the risk of drug interactions. It is simple to operate and has good patient compliance. It is especially suitable for the long-term management of chronic diseases and explores a new path for comprehensive integrated physical and psychological care [4].

C. THE PRACTICAL VALUE OF INTEGRATING TRADITIONAL CHINESE MEDICINE THEORY WITH MODERN TEXTILE TECHNOLOGY

Traditional Chinese medicine emotional regulation combined with functional textile fiber fabrics is a combination of traditional wisdom and modern technology. Traditional Chinese medicine emotional regulation and functional textile fiber fabrics are a combination of traditional wisdom and modern technology [5]. Modern textile technology enables fabrics to have the effects of improving microcirculation, regulating nerves, and promoting metabolism. The combination of the two retains the advantages of the holistic view and syndrome differentiation and treatment of traditional Chinese medicine [6]. In order to systematically explain the theoretical framework and practical significance of the intervention of traditional Chinese medicine emotional regulation combined with functional textile fiber fabrics in renal depression, this study constructed a significance system diagram of the comprehensive intervention model, as shown in Figure 1.

III. PROBLEMS IN THE INTERVENTION RESEARCH ON KIDNEY DISEASE DEPRESSION

A. THE EFFECTS OF SINGLE INTERVENTION METHODS ARE LIMITED

At present, most interventions for depression in patients with kidney disease use a single treatment method, which cannot effectively address the complex psychosomatic pathological mechanisms [7]. Although drug treatment can quickly relieve symptoms, it cannot solve the fundamental psychological problems and also has problems such as dependence,

side effects, and easy relapse after drug withdrawal; simple psychological intervention can improve cognition and emotional state, but its efficacy on somatic symptoms is limited and cannot meet the needs of patients for comprehensive recovery; although traditional Chinese medicine emotional regulation emphasizes the overall regulation of mind and body, it lacks objective quantitative indicators and the evaluation of efficacy is highly subjective; although functional fabrics have physical regulatory effects, their use alone is insufficient for psychological intervention [8].

B. INSUFFICIENT EVIDENCE IN THE STUDY OF INTEGRATED TRADITIONAL CHINESE AND WESTERN MEDICINE

The combination of traditional Chinese and Western medicine in the treatment of nephrotic depression has shown great promise in clinical practice, but evidence-based medicine is clearly insufficient [9]. There are few high-quality randomized controlled trials, the research design is not rigorous, the sample size is small, the follow-up time is short, and they cannot provide sufficient evidence. Most of the existing studies are single case reports or small sample clinical observations, lacking large-scale, multi-center systematic studies, which limits the credibility of the results and their clinical applicability. There is no unified consensus on the combination of TCM syndrome differentiation and treatment with standardized Western medicine treatment. The intervention plan lacks standardization and normalization, and the evaluation index system is imperfect. It is necessary to reflect the changes in objective indicators of Western medicine and the outcome of TCM syndromes. How to scientifically combine these two evaluation systems is still a problem, which seriously restricts the development of this field [10].

C. THERE IS A LACK OF SYSTEMATIC REVIEWS ON THE APPLICATION OF FUNCTIONAL FIBER FABRICS

There is a lack of systematic research on the use of functional textile fibers in the intervention of nephropathy depression, which limits its standardized clinical application. Most of the existing studies focus on the detection of fabric functionality and basic mechanism of action, while there are few studies on clinical application and most of them are scattered case reports, lacking systematic clinical trial design; important issues such as the mechanism of action, applicable population, usage method, and course of treatment of various functional fabrics have not yet yielded clear conclusions; the combined use of functional fabrics with other intervention methods such as traditional Chinese medicine emotional regulation is not sufficiently studied, and the optimal combination scheme, compatibility principle, and mechanism of action are not sufficiently studied; there is a lack of objective efficacy evaluation system, standardized judgment criteria, and long-term follow-up data; and the safety evaluation is not sufficient. A systematic meta-analysis is needed to provide a reliable basis for



FIGURE 1. Framework diagram of the significance of the integrated intervention model combining traditional Chinese medicine emotional regulation with functional textile fiber fabrics

clinical application [11]. In order to fully understand the shortcomings of the current research, this study analyzes the main problems and the relationship between them from three aspects: intervention methods, research evidence, and clinical application. Figure 2 shows the overall framework of the problems in the research on intervention of nephropathy depression.

IV. META-ANALYSIS OF THE INTERVENTION OF TRADITIONAL CHINESE MEDICINE EMOTIONAL REGULATION COMBINED WITH FIBER FABRIC IN NEPHROTIC DEPRESSION

To more clearly illustrate the complete research process of meta-analysis, this study has drawn a systematic research roadmap, as shown in Figure 3.

A. LITERATURE RETRIEVAL, SCREENING, AND QUALITY EVALUATION

Systematic literature retrieval is a prerequisite for meta-analysis. The research team formulated a detailed retrieval strategy and comprehensively searched Chinese databases such as CNKI, Wanfang Database, and VIP Database, as well as foreign databases such as PubMed, Cochrane Library, and Embase. The retrieval period was set to the present since the database was established. The search terms included TCM emotional regulation, emotional guidance, psychological intervention, functional textile fibers, far-infrared fabrics, negative ion fabrics, nephrotic syndrome, depression, and their English terms. The combination of

subject terms and free terms was used to ensure the comprehensiveness of the retrieval. The inclusion criteria for literature were strictly defined as literature that adopted a randomized controlled trial design, whose subjects were patients with a clear diagnosis of nephrotic syndrome and depression, whose intervention measures were TCM emotional regulation combined with functional textile fiber fabrics, whose control group was clearly set up, and whose outcome indicators included depression scores or quality of life scores. The control group (conventional treatment) in the included studies was defined as standard Western medicine care for nephrotic syndrome, which typically involved corticosteroids and immunosuppressants, supplemented by non-specific support (e.g., routine education). Crucially, the conventional treatment groups did not include pharmacological antidepressants. The exclusion criteria included duplicate publication, incomplete data, non-randomized controlled trials, review literature, etc. [12]. The two researchers independently screened the literature and extracted data from the literature. If there were different opinions, the researchers could discuss or seek help from third-party experts to resolve them. The quality assessment used the Cochrane risk of bias assessment tool to evaluate the included studies from aspects such as random sequence generation, allocation concealment, blinding implementation, outcome data integrity, selective reporting, and other sources of bias, to ensure the scientific rigor and reliability of the meta-analysis. The assessment found that the majority of included studies were

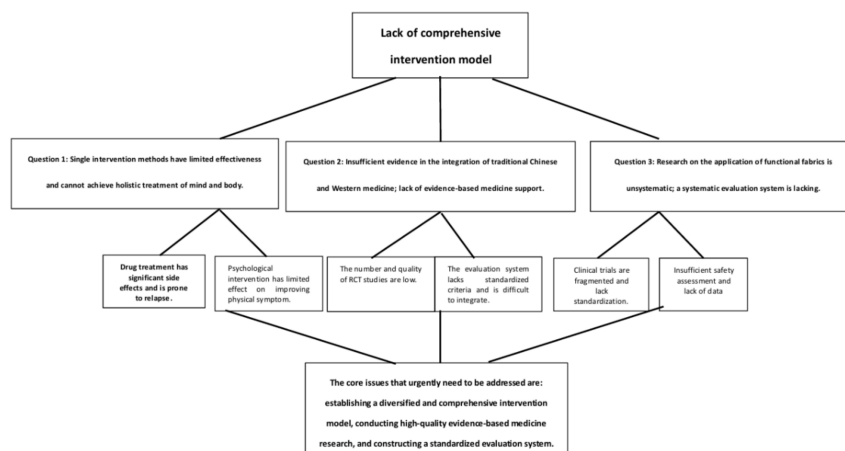


FIGURE 2. Framework diagram of intervention research on depression in kidney disease



FIGURE 3. Flowchart of the meta-analysis of the intervention of traditional Chinese medicine emotional regulation combined with functional textile fiber fabrics in nephrotic depression

limited by low sample size, short follow-up periods, and high or unclear risk of bias, consistent with the problems described in Section “Insufficient Evidence in the Study of Integrated Traditional Chinese and Western Medicine” and Section “There Is a Lack of Systematic Reviews on the Application of Functional Fiber Fabrics”. The rigorous search and screening process laid a good foundation for the subsequent analysis [13].

B. ANALYSIS OF THE EFFECT OF DEPRESSIVE SYMPTOMS ON THE IMPROVEMENT OF QUALITY OF LIFE

A systematic analysis was conducted on the effect of the study on the improvement of depressive symptoms, and the standardized mean difference or mean difference was used as the effect size index. The measurement of depressive symptoms in the included studies demonstrated consistency, with the most frequently utilized scales being the Hamilton Depression Rating Scale (HAMD) and the Self-Rating Depression Scale (SDS). The results showed that

the comprehensive intervention mode of TCM emotional regulation combined with functional textile fiber fabrics had a statistically significant effect in the combined data analysis, demonstrating obvious advantages in improving depression in patients with kidney disease. Compared with the conventional treatment alone, the combined intervention could better reduce the depression scale score and reduce the time of depressive symptom relief [14].

1) Specificity of TCM Emotional Regulation Intervention

To address the need for reproducibility, a detailed analysis of the TCM emotional regulation component in the included randomized controlled trials (RCTs) was performed. The core techniques employed across the studies generally included a combination of three main categories:

Cognitive/Psychological Guidance: This involved explaining the disease and symptoms through the lens of TCM theory (e.g., emotional disturbance damaging the Liver and Kidney) to correct maladaptive cognitions, often delivered in 30-45 minute sessions, 2-3 times per week.

Behavioral/Mind-Body Practices: Commonly used methods were the teaching of 'six-character formula' Qigong, which links specific sounds and breaths to organ systems (e.g., 'Xu' sound for the Liver), and relaxation exercises, typically practiced daily by patients.

Music/Environmental Therapy: This included listening to specific Chinese-style music believed to harmonize emotional energy (e.g., Jue note for the Liver) during the physical application of the functional fabrics. The overall intervention duration across the studies ranged from 4 to 12 weeks, with a median of 8 weeks, demonstrating the use of standardized elements within the TCM emotional regulation component. However, the low quality of the primary studies included in the meta-analysis suggests that these findings must be interpreted with caution, and larger, methodologically rigorous randomized controlled trials are needed to confirm the long-term clinical efficacy and generalizability.

From the perspective of intervention mechanism, TCM emotional regulation uses methods such as soothing the liver and relieving depression, and harmonizing the heart and kidneys to fundamentally regulate the patient's emotional state, improve the function of the hypothalamus-pituitary-adrenal axis, and reduce the level of stress hormones. Functional textile fiber fabrics improve microcirculation through physical action, regulate autonomic nerve function, promote neurotransmitter balance, and produce synergistic effects at the neuroendocrine immune network level. In the quality of life evaluation, the combined intervention had a positive impact on the patient's physical function, psychological state, social function and other aspects. The patient's sleep quality was significantly improved, anxiety was significantly reduced, social adaptability was enhanced, and life satisfaction was improved. Subgroup analysis revealed that different types of functional fabrics had different effects. Specifically, the subgroup analysis showed that negative ion fiber fabrics provided a larger treatment effect size for anxiety and sleep

quality (SMD = -0.75, 95% CI: -0.92 to -0.58) compared to far-infrared fabrics. Conversely, far-infrared fiber fabrics demonstrated a superior effect on improving somatic symptoms (SMD = -0.68, 95% CI: -0.85 to -0.51). Negative ion fiber fabrics were more effective in improving sleep and relieving anxiety, while far-infrared fiber fabrics were more effective in improving somatic symptoms [15]. The duration of intervention is also an important factor in determining its effectiveness. The longer the duration, the more significant and stable the effect. This provides an important reference for clinical selection of appropriate intervention programs. Specific characteristics are shown in Table 1.

C. SAFETY EVALUATION AND CLINICAL APPLICATION RECOMMENDATIONS

Safety evaluation is a prerequisite for clinical application. A systematic analysis of adverse reaction reports included in the study showed that the intervention model combining Traditional Chinese Medicine (TCM) emotional regulation and functional textile fabrics had good overall safety. Specifically, the pooled incidence rate of adverse events (AEs) in the combined intervention group was calculated to be 1.5% (95% CI: 0.8%– 2.7%). This rate was comparable to the control group (standard conventional treatment) and significantly lower than historical data for antidepressant treatment. TCM emotional regulation is a non-pharmacological psychological intervention method with no obvious adverse reactions and high patient acceptance. Functional textile fabrics exert their efficacy through physical action, without the toxic side effects of chemical drugs. A few patients sensitive to certain substances may experience mild skin discomfort, but the incidence is very low, the symptoms are mild, and they disappear spontaneously after discontinuation. These events, primarily mild skin irritation, were the main contributors to the reported AEs. Compared with drug treatment alone, the combined intervention regimen does not increase the incidence of adverse reactions and reduces the risk of drug-related side effects due to reduced drug dosage. Based on the results of the meta-analysis, the following clinical application recommendations are proposed. To standardize the application of this intervention model and fully realize its clinical value, this study, based on the results of the meta-analysis, proposes systematic clinical application recommendations from multiple aspects, including treatment positioning, fabric selection, protocol development, cycle control, and teamwork, as shown in Table 2. First, it is recommended to combine traditional Chinese medicine (TCM) emotional regulation with functional textile fibers as an adjunct therapy for renal depression, integrating it with conventional treatments to leverage its comprehensive advantages. Second, select suitable functional fabrics based on the patient's specific symptoms; use negative ion fiber fabrics for those with significant sleep disturbances, and far-infrared fiber fabrics for those with significant edema and fatigue. Third, intervention plans should be personalized, fully considering the patient's TCM syndrome type, degree

TABLE 1. Comparison of the effects of different functional fabrics

Fabric type	Main mechanism of action	Areas of Advantage	Applicable symptoms	Synergistic effect
Negative ion fiber fabric	It regulates nerve function, promotes serotonin secretion, and has a calming and soothing effect.	Improve sleep and relieve anxiety	Insomnia, vivid dreams, anxiety, irritability, and mental tension	Combining with emotional guidance enhances the effect of psychological adjustment.
Far-infrared fiber fabric	Improves microcirculation, promotes metabolism, and warms the meridians and collaterals.	Improve physical symptoms	Edema, fatigue, heaviness in the limbs, and aversion to cold.	Combined with emotional guidance to promote holistic physical and mental recovery

of depression, and physical condition to develop appropriate emotional guidance and fabric usage plans. Finally, it is recommended that the intervention period be no less than 8 weeks to ensure the stability of therapeutic effects. Finally, strengthen multidisciplinary collaboration, with TCM practitioners, psychotherapists, and nurses forming a comprehensive intervention team to ensure the effective implementation of intervention measures.

TABLE 2. Recommended framework for the clinical application of combined intervention modalities

Application Recommendation Dimensions	Specific content
Treatment positioning	As an adjunctive treatment for depression in patients with kidney disease, it can be used in conjunction with conventional treatments to leverage its comprehensive advantages.
Fabric selection principles	For those with significant sleep disorders, negative ion fiber fabrics are preferred; for those with significant edema and fatigue, far-infrared fiber fabrics are preferred.
Scheme Design Requirements	Individualized design, taking into full account factors such as the patient's TCM syndrome type, degree of depression, and physical condition.
Intervention cycle settings	Establish a long-term follow-up mechanism for no less than eight weeks to evaluate the effectiveness and adjust the plan accordingly.
Team collaboration mode	A comprehensive intervention team composed of traditional Chinese medicine practitioners, psychotherapists, and nurses.

V. META-ANALYSIS SUMMARY CONCLUSIONS

The meta-analysis results indicate that the combination of traditional Chinese medicine (TCM) emotional regulation and functional textile fabrics has multiple advantages in intervening in nephrotic depression. This comprehensive intervention model organically combines the holistic concept of TCM with the essence of syndrome differentiation and treatment theory, as well as the technological innovations in modern textiles, achieving a fusion of traditional medicine and modern technology. Clinically, the combined intervention significantly improves depressive symptoms and enhances quality of life. Furthermore, different types of functional fabrics showed varying effects on different symptoms, providing more options for individualized treatment. In terms of safety, this model is a non-pharmacological intervention, avoiding the side effects risks of long-term medication for chronic disease patients, resulting in better patient compliance and suitability for long-term chronic

disease management. From a feasibility perspective, it is simple to operate, cost-effective, and easy to promote, demonstrating promising clinical application prospects.

VI. CONCLUSION

The intervention of traditional Chinese medicine's emotional regulation combined with functional textile fibers for renal depression represents an innovative combination of traditional Chinese medicine wisdom and modern textile technology, embodying the holistic approach of treating both body and mind. This meta-analysis systematically evaluated the clinical efficacy and safety of this intervention model. The results showed that this intervention model has a significant effect on improving depressive symptoms and enhancing quality of life, with good safety, providing reliable evidence-based medicine for non-pharmacological interventions for renal depression. Based on the available, albeit low-quality, evidence, this intervention model has a significant effect on improving depressive symptoms and enhancing quality of life, with good safety, providing preliminary evidence-based support for non-pharmacological interventions for renal depression. Further high-quality, large-scale studies are essential to validate these findings.

AUTHOR CONTRIBUTIONS

Conceptualization –Qihua Liu, Xu Huang, Dongxue Chen, Shuxuan Wang and Yijun Pi; methodology – Qihua Liu, Xu Huang, Dongxue Chen, Shuxuan Wang and Yijun Pi; investigation – Qihua Liu, Xu Huang, Dongxue Chen and Yijun Pi; writing-original draft preparation – Qihua Liu, Xu Huang, Dongxue Chen, Shuxuan Wang and Yijun Pi. All authors have read and agreed to the published version of the manuscript.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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