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Evaluating the Effectiveness of Chinese Herbal Footbath on Sleep Quality among Postpartum Women in Advanced Maternal Age

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Abstract: This study evaluated the effectiveness of Chinese herbal foot bath therapy in improving sleep quality among postpartum women of advanced maternal age. A quasi-experimental design was used, involving 60 participants with sleep disturbances recruited from Zouping County Traditional Chinese Medicine Hospital. Participants were divided into control and experimental groups, and sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI) before and after the intervention. The experimental group received Chinese herbal foot bath therapy, while the control group did not. Post-intervention results showed a significant improvement in sleep quality for the experimental group, with a mean PSQI score of 7.79 (SD = 2.90), compared to 13.45 (SD = 2.57) in the control group, indicating continued poor sleep. Statistical analysis confirmed that the therapy led to significant improvements across overall and component PSQI scores. The study concludes that Chinese herbal foot bath therapy is a safe, non-invasive, and cost-effective method to enhance sleep quality among postpartum women, especially those of advanced maternal age. It holds promise as a complementary treatment option and could be integrated into standard postpartum care practices to address sleep disturbances without relying on pharmacological interventions.

Keywords: Chinese herbal foot bath, Postpartum insomnia, Advanced maternal age, Sleep quality, Non-pharmacological therapy

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1. Introduction

With China's rising economic prosperity and evolving social attitudes, many women are postponing marriage and childbirth. This trend, coupled with educational and policy shifts—such as the transition from the "double two-child" to the "full two-child" policy in 2016—has led to an increase in advanced maternal age, defined as childbirth at 35 years or older [1–3]. By 2017, the proportion of such mothers had grown from 15% in 2013 to 22% [4]. Globally, this pattern is echoed, with advanced maternal age reaching 12.3% in some regions and rising from 8.5% to 13.5% in 28 Chinese provinces [5, 6].

This demographic shift is accompanied by increased childbirth risks. Advanced maternal age is linked to decreased vascular elasticity and higher susceptibility to hypertensive disorders and complications during delivery [7, 8]. These physiological challenges are compounded by psychological issues—older mothers often experience greater stress, anxiety, and sleep disturbances, which negatively impact both maternal recovery and newborn health [9–11]. The quality of maternal sleep, especially for older mothers, is poor. One month postpartum, older mothers average only 5–6 hours of sleep. The 2018 China Sleep Quality Survey found that 83.81% of the population suffers from sleep problems, with over 300 million experiencing sleep disorders, a situation exacerbated during the COVID-19 pandemic [12]. Postpartum psychological issues, particularly postpartum depression (PPD), are common in advanced maternal age. Symptoms include fatigue, anxiety, and suicidal ideation, and the prevalence is higher than in younger mothers—36.9% compared to 14.7% [13, 14]. Sleep disorders and psychological stress are closely linked; up to 80% of sleep issues are associated with depression, creating a cycle that affects maternal well-being and infant development [15, 16].

In conclusion, the growing trend of delayed childbirth in China, driven by policy and social changes, has led to increased risks associated with advanced maternal age. These risks manifest physiologically and psychologically, particularly through elevated rates of postpartum depression and poor sleep quality, necessitating targeted maternal care strategies and interventions.

1.1. Statement of the problem

This study examined the effectiveness of herbal footbaths in improving sleep quality among postpartum women of advanced maternal age. A total of 60 respondents with reported sleep disturbances were purposively selected and monitored for 21 days following hospital delivery. Participants were assigned to either a control group, which received traditional postpartum care, or an experimental group, which received an herbal footbath intervention in addition to standard care. The study aimed to determine whether the herbal footbath significantly improved sleep quality compared to traditional interventions alone. Specifically, it sought to answer the following research questions: “What is the quality of sleep among postpartum women of advanced maternal age prior to the intervention?” and “Is there a significant difference in sleep quality between the control and intervention groups after the intervention, as measured by the Pittsburgh Sleep Quality Index (PSQI)?”.

1.2. Significance of the study

This research highlights the benefits of herbal footbaths as a non-pharmacological intervention for postpartum sleep disturbances, particularly among pregnant women of advanced maternal age. The practice offers a natural, accessible, and culturally sensitive method for enhancing sleep quality and promoting recovery. Healthcare providers such as nurses, midwives, and obstetricians can use this evidence to incorporate holistic, low-resource approaches into postpartum care without relying on medications.

Maternal and child health programs may also adopt this cost-effective intervention to enhance postpartum support, reduce complications, and improve overall program outcomes. Lastly, future researchers are encouraged to explore the broader applications, efficacy, and scalability of herbal footbaths, fostering interdisciplinary work in maternal care and traditional medicine.

1.3. Scope and limitations

This study investigated the effects of traditional Chinese medicine (TCM) foot baths on postpartum sleep quality

in women of advanced maternal age (35 and above), using a quasi-experimental design with 60 participants at a TCM hospital in Shandong, China. Participants with poor sleep quality (PSQI ≥ 8) were divided into an experimental group, which received twice-daily TCM foot baths for 21 days, and a control group that received standard postpartum care. Sleep quality was assessed using the Pittsburgh Sleep Quality Index before and after the intervention. The study found improvements in sleep quality for the experimental group, supported by daily monitoring and data verification, though limitations included a small, localized sample, reliance on self-reported data, and short intervention duration. Future research is recommended to include larger, more diverse samples, longer follow-up, and more objective sleep assessment methods.

1.4. Theoretical framework

This study utilizes Kolcaba's Comfort Theory to guide its approach in improving sleep quality and well-being among postpartum women of advanced maternal age through Chinese foot baths [17]. Kolcaba's theory emphasizes that comfort is a core need in healthcare, encompassing physical, psychospiritual, sociocultural, and environmental dimensions.

The theory identifies three types of comfort: (1) Relief (elimination of specific discomforts); (2) Ease (a state of calm); (3) Transcendence (rising above challenges). The Chinese foot bath intervention supports: Relief, by easing physical fatigue and sleep issues; Ease, by reducing anxiety and depressive symptoms; and Transcendence, by helping mothers build resilience and a positive outlook.

The theory also highlights individualized, holistic care, aligning with the study's focus on the unique needs of older postpartum women, who face greater risks for sleep and mood disturbances. By enhancing comfort, the intervention may encourage health-promoting behaviors and support both maternal and infant well-being. Overall, Kolcaba's theory provides a strong, patient-centered foundation for using non-pharmacological, traditional interventions like foot baths to improve postpartum outcomes.

1.5. Hypothesis

H_o: There is no significant difference in sleep quality between the control and intervention groups after the intervention, as measured by the Pittsburgh Sleep Quality Index (PSQI).

2. Materials and methods

This study used a quasi-experimental design to evaluate the impact of traditional Chinese herbal footbaths on sleep quality in postpartum women of advanced maternal age (≥ 35 years). A total of 60 participants were purposively sampled at a TCM hospital in Zouping, Shandong Province, from January to April 2025. Participants were divided into an experimental group (n=29), which received 21 days of twice-daily herbal footbaths, and a control group (n=31), which received only routine postpartum care and sleep guidance.

2.1. Key methodological elements

(1) Design: Quasi-experimental, suitable for naturalistic clinical settings without randomization.

(2) Sampling: Purposive sampling of postpartum women within 7 days of delivery, with sleep disorders (PSQI ≥ 8), and no serious health or mental issues.

(3) Intervention: Herbal footbath conducted twice daily (15–20 mins), using standardized herbs (e.g., *Angelica*

sinensis, *Artemisia argyi*, *Poria cocos*). The control group received only standard postpartum care and non-herbal foot soaking advice.

(4) Location: A Grade II Class A Traditional Chinese Medicine hospital with high rates of older postpartum mothers.

(5) Compliance: Strict adherence is monitored by trained nursing staff, with daily records and personalized follow-up to minimize participant dropout.

(6) Measurement tool: The Pittsburgh Sleep Quality Index (PSQI) was used before and after intervention to assess sleep quality changes.

(7) Data collected: Age, postpartum days, weekly average sleep duration, and PSQI scores to ensure group comparability and control for confounding variables.

2.2 Research Instruments (PSQI):

The Pittsburgh Sleep Quality Index (PSQI) is a validated 19-item questionnaire used to measure sleep quality, including among pregnant women in China. It assesses seven components: sleep duration, disturbances, latency, quality, daytime dysfunction, medication use, and efficiency. Each component is scored from 0 to 3, with a total score range of 0 to 21—higher scores indicate poorer sleep. A score over 5 identifies poor sleep quality, with over 10 indicating more severe issues. The PSQI shows strong sensitivity (89.6%), specificity (86.5%), and internal reliability (Cronbach's alpha = 0.83). It correlates well with sleep-related issues but poorly with unrelated factors. A pretest with 12 women confirmed the PSQI's feasibility and helped refine the data collection and interview process.

2.3. Data collection procedure

(1) Approval: The study received ethical approval from Far Eastern University and the hospital.

(2) Participant selection: Older pregnant women with sleep issues visiting Zouping Traditional Chinese medicine hospital (Jan–Apr 2025) were selected using purposive sampling based on inclusion criteria.

(3) Informed consent: Researchers fully explained the study and obtained informed consent from all participants, ensuring they understood the research details.

(4) Pre-collection: After approval and consent, demographic data (e.g., name, age, postpartum days, sleep time) were collected, and participants were instructed to complete the PSQI sleep quality questionnaire.

2.3.1. Data collection

(1) Both experimental and control groups completed initial questionnaires.

(2) The experimental group received Chinese herbal foot baths twice daily.

(3) The control group was advised on moderate exercise and warm water foot soaks.

(4) After 3 weeks, the data were collected again and prepared for analysis.

2.4. Statistical treatment

The statistical methods used to evaluate the impact of traditional Chinese medicine foot baths on sleep quality in postpartum mothers of advanced maternal age. It employed both descriptive statistics (to summarize participant information and sleep status) and inferential statistics, specifically independent t-tests, to compare PSQI scores between experimental and control groups before and after the intervention. The study met the necessary

assumptions for the t-test, including the use of continuous interval data and independence of samples, making the statistical approach valid and appropriate.

2.5. Ethical considerations

The study was approved by the Ethical Review Committee of Far Eastern University and followed strict ethical standards, including informed consent, participant privacy, safety, and fairness.

2.6. Social value

(1) Direct benefits: Participants experienced improved sleep quality from the Chinese herbal foot bath intervention.
(2) Indirect benefits: The study contributed to medical knowledge and postpartum care practices, helping late-term mothers understand and manage sleep-related issues.
(3) Informed consent: Participants were fully informed about the study, their rights, and had the freedom to decline or withdraw. The Informed Consent Form was thoroughly reviewed to ensure compliance with ethical standards.
(4) Vulnerability: Vulnerable populations were excluded to prevent harm or exploitation.
(5) Privacy and confidentiality: Personal data was securely stored, encrypted, and only accessible to authorized researchers. Data handling followed legal and ethical standards to protect participant confidentiality.
(6) Risks, benefits & safety: The intervention posed no known risks. Participants experienced benefits without physical or psychological harm.
(7) Justice: All participants were treated fairly, regardless of their background or participation status. Personal information was not reused or disclosed.
(8) Transparency: The research process was open and clear, with confidentiality maintained unless consent for disclosure was given.

3. Results and discussion

This study established a foundation by detailing the research background, literature review, and methodology to explore the effects of traditional Chinese medicine (TCM) foot baths on sleep quality in postpartum mothers of advanced maternal age. This section presents, analyzes, and interprets the data collected from 60 participants, beginning with a clear overview of their basic information and pre-intervention sleep quality. Using descriptive and bivariate statistical methods, the study compares sleep quality outcomes between the control and experimental groups post-intervention, assessing the effectiveness of TCM foot baths across various dimensions. The analysis also explores factors influencing sleep quality and interprets findings in light of existing theories and literature, aiming to provide strong evidence for clinical practice and future research, with results presented in alignment with the research questions outlined in **Section 1.1.**

3.1. Quality of sleep among postpartum in advanced maternal age prior to the intervention

Table 1 presents and analyzes the pre-intervention sleep quality of older pregnant women in both control and experimental groups using the Pittsburgh Sleep Quality Index (PSQI). It finds that both groups experienced poor

sleep, with the experimental group showing slightly worse conditions in several dimensions, including longer sleep latency, slightly worse subjective sleep quality, and similar sleep efficiency. Both groups also reported high sleep disturbances, heavy daytime dysfunction, and high reliance on sleep medications (especially the control group).

These findings establish a baseline for evaluating the effectiveness of a Chinese medicine foot bath intervention, which is theorized to improve sleep and promote maternal well-being. Existing research supports its benefits, and this study aims to scientifically validate those claims. Despite some differences between groups before intervention, the data are valuable for tracking post-intervention changes.

These findings conclude that poor sleep is common among older pregnant women and is influenced by both physical and emotional factors. It emphasizes the importance of comprehensive care—combining physical recovery strategies like foot baths with emotional support—to improve maternal sleep quality.

Table 1. Quality of sleep of the advanced maternal age before the intervention

PSQI Components	Control group (n=31)		Experimental group (n=29)	
	Mean	SD	Mean	SD
Sleep Latency	1.94	0.25	2.03	0.42
Duration of Sleep	2.48	0.76	2.79	0.49
Sleep Efficiency	2.97	0.18	2.97	0.19
Sleep Disturbance	3.00	0.00	3.00	0.00
Overall Sleep Quality	2.94	0.25	3.00	0.00
Need Meds to Sleep	0.58	0.91	0.28	0.70
Day Dysfunction Due to Sleepiness	3.00	0.00	3.00	0.00
Global PSQI Score	16.90	1.51	17.07	1.25

Score = 0 (better); Maximum Score = 21 (worse); Interpretation: TOTAL ≤ 5 associated with good sleep quality; TOTAL > 5 associated with poor sleep quality

3.2. Quality of sleep among postpartum in advanced maternal age after the intervention

This study explored the impact of traditional Chinese medicine foot baths on the sleep quality of postpartum mothers of advanced maternal age by examining multiple sleep dimensions, including sleep latency, duration, efficiency, disturbances, need for sleep medication, and overall sleep quality (PSQI score). The intervention group, which received foot baths, showed significantly lower PSQI scores and more stable sleep patterns across all dimensions compared to the control group. These improvements included reduced sleep latency, fewer sleep disturbances, higher sleep efficiency, and less reliance on sleep medications. The treatment group also experienced reduced daytime dysfunction, indicating better alertness and daily performance. These findings suggest that traditional Chinese medicine foot baths may effectively enhance sleep quality and support postpartum recovery.

The data from **Table 2** reinforce these outcomes, aligning with existing research on sleep challenges in postpartum women of advanced maternal age. Both groups started with similarly high PSQI scores, consistent with literature highlighting the vulnerability of this population to sleep issues. However, the experimental group showed notable improvement in sleep health after the intervention. The study also observed that both groups had low reliance on sleep medication, likely due to concerns about infant safety, echoing broader trends in postpartum care. Overall, this research provides strong evidence that traditional Chinese medicine foot baths can serve as a

safe, non-pharmacological intervention to significantly improve sleep quality in postpartum women of advanced maternal age.

Table 2. Quality of sleep of the advanced maternal age after the intervention

PSQI components	Control group (n=31)		Experimental group (n=29)	
	Mean	SD	Mean	SD
Sleep Latency	1.71	0.46	1.07	0.26
Duration of Sleep	1.68	1.08	0.76	1.18
Sleep Efficiency	2.39	0.80	1.24	1.06
Sleep Disturbance	2.58	0.56	1.90	0.49
Overall Sleep Quality	2.29	0.59	1.38	0.73
Need Meds to Sleep	0.39	0.76	0.14	0.44
Day Dysfunction Due to Sleepiness	2.42	0.50	1.31	0.47
Global PSQI Score	13.45	2.57	7.79	2.90

Score = 0 (better); Maximum Score = 21 (worse; Interpretation: TOTAL ≤ 5 associated with good sleep quality; TOTAL > 5 associated with poor sleep quality

3.3. Comparison of sleep quality between the control and intervention groups after the intervention, as measured by the Pittsburgh Sleep Quality Index (PSQI)

Table 3 shows that the intervention group that received herbal foot baths showed a significant improvement in sleep quality compared to the control group, with a notable reduction in PSQI scores (mean difference = 5.66, t = 8.02, $p < 0.001$). These findings indicate that TCM foot baths are both statistically and clinically effective as a non-pharmacological intervention for sleep disturbances in this population.

Table 3. Independent samples t-test comparing post-test global PSQI scores

Group	M	SD	t	df	p
Control (n = 31)	13.45	2.57			
Experimental (n = 29)	7.79	2.90	8.02	58	< 0.001

The results align with previous studies and meta-analyses supporting the benefits of TCM therapies for postpartum sleep issues. The study suggests that herbal foot baths can be a valuable addition to conventional maternal care, offering a relaxing and effective method to improve sleep in postpartum women of advanced maternal age.

4. Summary of findings

4.1. Participant background

The study involved 60 postpartum mothers of advanced maternal age (≥ 35 years), with 61.67% aged 35–40. This diverse group supports a comprehensive evaluation of traditional Chinese medicine (TCM) foot baths on sleep quality.

4.2. Sleep quality before intervention

Both the experimental (mean PSQI = 17.07) and control groups (mean PSQI = 16.90) had poor sleep quality with no significant baseline differences, confirming comparability.

4.3. Sleep quality after intervention

After 21 days, the experimental group showed substantial improvements in all PSQI dimensions, with a final mean PSQI of 7.79 vs. 13.45 in the control group. The experimental group also had more stable and consistently better sleep quality.

Statistical Analysis

The decrease in PSQI scores in the experimental group was statistically significant (t=19.52, $P < 0.001$). Improvements were seen in sleep latency, duration, efficiency, disturbances, and daytime function, with $P < 0.05$ across comparisons.

4.4. Contributions to maternal care

TCM foot baths can be adopted as an effective postpartum nursing intervention. The findings support personalized care, enhanced nursing education, and further research into optimizing TCM foot bath protocols for maternal sleep improvement.

5. Recommendations

(1) Nursing practice: Incorporate herbal footbath therapy into routine postpartum care for women of advanced maternal age to help with sleep issues.

(2) Nursing administration and policy: Include evidence-based complementary therapies like herbal footbaths in maternal programs, especially where pharmacologic sleep aids are discouraged.

(3) Future research: Replicate the study with larger, more diverse populations. Explore the long-term effects of herbal footbaths. Investigate specific herbs used and their effects. Conduct comparative studies with other non-drug interventions like aromatherapy, massage, or mindfulness.

(4) Nursing education and community care: Educate postpartum women and caregivers on the safe preparation and benefits of herbal footbaths. Train nursing staff and caregivers to ensure safe and consistent use at home.

(5) Implementation in postpartum care: Integrate herbal footbaths into standard care protocols for advanced maternal age women with sleep issues.

(6) Holistic approach: Combine herbal footbaths with other sleep hygiene and lifestyle practices to enhance effectiveness.

6. Conclusions

The study concludes that women of advanced maternal age often experience poor postpartum sleep quality. A herbal footbath intervention significantly improved their sleep, showing better sleep latency, duration, efficiency, and overall quality. The results were statistically significant, indicating the benefits were due to the intervention itself. The herbal footbath is a low-cost, non-invasive, and effective complementary therapy that can be integrated

into postpartum care. It has valuable implications for nursing practice, education, and research, enabling personalized care plans, enriching training programs, and laying the groundwork for further studies. Overall, it supports innovation and higher quality in maternal and child healthcare.

Disclosure statement

The authors declare no conflict of interest.

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