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A Study on the Effects of Ba Duan Jin Exercise on Sleep Quality and Cervical Spine Function in College Students

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Abstract

With increasing academic pressure, reliance on electronic devices, and changes in lifestyle habits, the incidence of poor sleep quality and cervical spine dysfunction has significantly increased among college students. Ba Duan Jin, a traditional Chinese health-preserving exercise, has been shown to improve physical and mental health, regulate qi and blood circulation, and alleviate muscle tension. This study investigated the effects of Ba Duan Jin exercise on sleep quality and cervical spine function among college students at Jilin Normal University from an exercise intervention perspective. The study employed a pre-test–post-test control group experimental design. The experimental group underwent Ba Duan Jin exercises three times weekly over an eight-week period, while the control group maintained their usual daily routines. The effects of the intervention were assessed using the Pittsburgh Sleep Quality Index (PSQI) and the Cervical Spine Dysfunction Index (NDI), with mechanisms explored through interviews. The results showed that Ba Duan Jin exercises significantly improved college students' sleep quality ($p<0.05$) and reduced cervical discomfort scores ($p<0.05$), with the degree of sleep improvement positively correlated with improvements in cervical function. This study suggests incorporating Ba Duan Jin into university health promotion courses as a low-cost, Ways to improve students' physical and mental health that can be promoted.

Keywords: Ba Duan Jin, sleep quality, cervical spine function, exercise intervention, Jilin Normal University

1. Introduction

1.1 Research Background

In recent years, issues related to poor sleep quality and cervical spine dysfunction among college students have become increasingly prevalent. According to the "China College Students' Health Status Report (2023)," approximately 46.3% of college students experience varying degrees of sleep quality

decline, with a detection rate of cervical spine dysfunction and neck and shoulder pain as high as 38.5%. Declining sleep quality not only affects learning efficiency but is also closely related to psychological issues such as anxiety and depression; cervical spine dysfunction is highly associated with prolonged periods of looking down while studying, using electronic devices, and lack of physical exercise. Ba Duan Jin, as a time-honored traditional exercise method, achieves stretching of muscles, bones, and joints, as well as regulation of qi and blood, through stretching movements, coordinated breathing, and mental guidance. Previous studies have shown that Ba Duan Jin can improve chronic cervical spondylosis in the elderly and enhance sleep quality in middle-aged and young adults. However, research on the simultaneous intervention of sleep quality and cervical spine function in college students remains insufficient. Therefore, based on the field experiment at Jilin Normal University, it is necessary to explore the comprehensive intervention effects of Ba Duan Jin and its mechanisms.

1.2 Current State of Research at Home and Abroad

1.2.1 Current State Abroad

The international academic community has primarily focused on mind-body exercises such as yoga, tai chi, mindfulness exercises, and dynamic stretching to improve sleep quality and cervical spine function.

A meta-analysis published in Sleep and Biological Rhythms indicated that practicing yoga three times a week for 30 minutes or less per session can significantly improve sleep quality within 12 weeks, with particularly notable effects for individuals with insomnia (Ghahremani et al., 2025). A study published in BMJ Evidence-Based Medicine found that Tai Chi practice (a traditional Chinese health-preserving exercise) can extend sleep duration by over 50 minutes, with effects lasting for over two years (Bu et al., 2025). In children, a study by O'Hara et al. (2021) at Stanford University found that an intervention combining deep breathing, mindfulness, and yoga movements resulted in an average increase of 74 minutes in nightly sleep duration and an extension of approximately 24 minutes in REM sleep for the experimental group. Although these studies indicate that Western mind-body exercises have a positive effect on sleep improvement, most have not focused on improvements in cervical spine function, and few have explored the comprehensive effects of traditional Chinese exercises.

1.2.2 Current Situation in China

In recent years, domestic scholars have conducted numerous empirical studies on the health intervention effects of the Eight Brocades on college students, primarily focusing on improvements in sleep quality, cervical spine function, and sub-health conditions. Chen Fang conducted an 8-month Ba Duan Jin training program for college students and found that their cervical spine flexion, extension, lateral flexion, rotation, and counter-rotation ranges of motion significantly improved, and surface electromyographic fatigue in the cervical and shoulder muscles was notably alleviated. This indicates that long-term practice of Ba Duan Jin can enhance cervical muscle strength and stability, improve cervical spine function, and maintain the normal physiological curvature of the cervical spine (Chen Fang, 2022). Zhang Dali conducted a 16-week Ba Duan Jin exercise intervention on 247 graduate students. The results showed that after the intervention, the participants' physical sub-health symptoms such as muscle soreness, sleep issues, and fatigue were significantly alleviated, and psychological sub-health symptoms such as depression, anxiety, and irritability were also regulated (Zhang Dali, 2020). Yang Yang and Liu Jing conducted an 8-Section Brocade exercise intervention for 150 nurses with sub-health conditions and sleep disorders over 1, 3, and 6 months. The results showed that after the intervention, the participants' sub-health conditions improved significantly, PSQI scores decreased, sleep quality improved, and the improvement effects were positively correlated with the duration of practice (Yang Yang & Liu Jing, 2021). Wang Yang conducted a one-month Ba Duan Jin training program for 60 healthy college students. The study indicated that Ba Duan Jin effectively increases muscle load in the core muscle groups of the waist and abdomen, and long-term practice can also enhance muscle strength and endurance (Wang Yang, 2021). Liu Wei noted in his clinical research review that Ba Duan Jin exercises can effectively improve college students' physical sub-health status, including pain relief, enhanced mobility, and improved sleep quality, and can help maintain health and promote recovery (Liu Wei, 2024). These studies indicate that domestic research

has preliminarily confirmed the positive effects of Ba Duan Jin on college students' cervical spine function, sleep quality, and overall sub-health status. However, existing studies have mostly focused on individual dimensions, lacking comprehensive and systematic empirical research targeting college students with dual interventions on sleep quality and cervical spine function, particularly within the scope of universities in Jilin Province.

1.3 Problem Statement

In recent years, with the increase in academic pressure at universities and the prolonged use of electronic devices, there has been a continuous upward trend in the incidence of poor sleep quality and cervical spine dysfunction among college students. Existing research indicates that sleep problems can reduce learning efficiency and increase mental health risks, while cervical spine dysfunction can lead to neck and shoulder pain, postural abnormalities, and a decline in quality of life. However, comprehensive, low-cost, and sustainable intervention programs targeting college students remain insufficient.

Ba Duan Jin, a traditional Chinese health exercise, has significant advantages in improving sleep quality, alleviating cervical discomfort, and promoting overall physical and mental health (Chen, 2022; Zhang, 2020; Yang & Liu, 2021). Existing domestic and international studies have primarily focused on improvements in single health dimensions. For example, overseas studies have predominantly utilized mind-body exercises such as yoga and Pilates to enhance sleep quality (Ghahremani et al., 2025; Bu et al., 2025), while domestic studies have primarily concentrated on rehabilitation outcomes for middle-aged and elderly populations or chronic disease patients (Liu, 2024). Systematic research targeting university students, particularly those exploring dual interventions for both sleep quality and cervical spine function, remains scarce.

Additionally, research gaps in this field are notably evident in the Jilin Province region, with a lack of empirical data and intervention effectiveness evaluations based on local university students. This not only limits the scientific promotion of Ba Duan Jin within the university health promotion system but also results in a lack of data-supported improvement criteria for related courses and activities. Therefore, there is an urgent need to conduct empirical research targeting university students to systematically assess the comprehensive intervention effects of Ba Duan Jin exercises on sleep quality and cervical spine function, thereby filling existing research gaps and providing references for the scientific and standardized development of university health promotion programs.

Issues requiring further research:

Although existing domestic and international studies have preliminarily confirmed the positive effects of Ba Duan Jin on improving sleep quality or cervical spine function, systematic research targeting both of these health dimensions in college students, especially, remains insufficient. Based on existing research findings and limitations, the following issues require further exploration:

1) The specific intervention effects of Ba Duan Jin on simultaneously improving sleep quality and cervical spine function in college students

Most existing studies have focused on improving a single health indicator, lacking comprehensive empirical research that simultaneously assesses changes in both sleep quality and cervical spine function within the same experiment. How to accurately measure the comprehensive intervention effects of Ba Duan Jin on both health indicators through experimental design, and reveal the magnitude and sustainability of these changes, is a core issue that urgently needs to be addressed.

2) Multi-dimensional exploration of intervention mechanisms, including physiological, psychological, and lifestyle aspects

The health effects of Ba Duan Jin may stem from the interaction of multiple mechanisms, including the regulatory effects of respiratory rhythm adjustment on the autonomic nervous system, muscle relaxation to promote cervical spine blood circulation, emotional relaxation to improve sleep, and lifestyle changes driven by regular exercise. Establishing a comprehensive mechanism model across physiological, psychological, and behavioral dimensions can scientifically explain the intervention effects of Ba Duan Jin and provide theoretical foundations for precision health interventions.

3) Adaptability and feasibility of promotion among college students in Jilin Province

Colleges and universities in Jilin Province have certain unique characteristics in terms of

physical education course settings, student schedules, and climate conditions, which may affect the acceptance and effectiveness of Ba Duan Jin. It is urgent to assess the adaptability of Ba Duan Jin training in terms of class schedules, venue conditions, climate adaptability, and cultural identity based on the characteristics of local college students, and to explore feasible pathways for large-scale promotion within the college health promotion system.

2. Research Questions

Based on the aforementioned research background, analysis of the current situation at home and abroad, and issues that still need to be studied, this study aims to systematically evaluate the comprehensive intervention effects of the Eight Brocades exercise on the sleep quality and cervical spine function of college students at Jilin Normal University, and explore its application potential in health promotion in colleges and universities. The specific research questions are as follows:

Can Ba Duan Jin exercises significantly improve the sleep quality of university students at Jilin Normal University?

By comparing pre- and post-intervention scores on the Pittsburgh Sleep Quality Index (PSQI), this study will assess the effectiveness and significance of Ba Duan Jin intervention in improving sleep quality.

Can Ba Duan Jin exercises significantly improve cervical spine function among university students at Jilin Normal University?

Combining measurements of the Neck Disability Index (NDI) and cervical spine range of motion (ROM), analyze the role of Ba Duan Jin intervention in alleviating cervical discomfort and improving cervical spine function.

Is there a correlation between improved sleep quality and enhanced cervical spine function?

Through correlation analysis, explore the relationship between the two and verify whether Ba Duan Jin exhibits a synergistic effect in simultaneously improving sleep quality and cervical spine function.

What is the feasibility of promoting the Eight-Section Brocade intervention in college students' health promotion?

Combining questionnaire surveys and interview data, this study analyzes Jilin Normal University college students' acceptance of the Eight-Section Brocade, their willingness to practice it, and the feasible conditions for promoting it on campus, providing references for the design and implementation of health promotion projects in higher education institutions.

3. Significance of the Study

3.1 Theoretical Significance

By incorporating the traditional Chinese health-promoting exercise routine known as Ba Duan Jin into an empirical research framework for college student health promotion, this study aims to enrich the theoretical body of knowledge in the field of exercise intervention regarding traditional Chinese exercise methods. Existing exercise intervention theories are primarily based on Western exercise models, such as aerobic exercise, strength training, yoga, and Pilates, with relatively limited theoretical research on traditional Chinese exercise methods, particularly in terms of their application among college students. Based on a systematic assessment of the comprehensive intervention effects of Ba Duan Jin on sleep quality and cervical spine function, this study will explore its mechanisms of action from multiple dimensions, including physiological mechanisms (such as muscle relaxation and respiratory regulation), psychological mechanisms (such as emotional stability and stress reduction), and changes in lifestyle habits, to construct a theoretical framework for Ba Duan Jin health promotion tailored to the college student population. This study not only provides theoretical support for the modernization and scientific development of traditional Chinese exercises but also promotes the localization and diversification of exercise intervention theories, enhancing China's academic influence in the field of traditional exercise and health preservation. Additionally, the theoretical findings of this study can serve as a reference for future applications of the Eight Section Brocade in other youth populations or different health-related fields.

3.2 Practical Significance

This study, which targeted university students at Jilin Normal University, systematically evaluated the comprehensive intervention effects of Ba Duan Jin exercises on sleep quality and cervical spine function. The findings provide practical and scalable intervention strategies for the design of health education and

sports rehabilitation courses in higher education institutions. The data obtained can be directly applied to campus physical education programs, extracurricular exercise guidance, and rehabilitation training modules, offering a reference for universities to develop scientific, cost-effective, and sustainable health promotion initiatives. Additionally, this study was conducted in the context of universities in Jilin Province, taking into account local climate characteristics, students' daily routines, and campus resource allocation. It provides localized empirical evidence for physical education curriculum reform and student health promotion in this region. The research findings can offer practical improvement suggestions for university physical education administrative departments, curriculum designers, and health promotion institutions, promoting the effective integration and popularization of the Eight Brocades in campus environments, thereby enhancing the overall health and quality of life of college students.

3.3 Social Significance

This study scientifically validated the comprehensive improvement effects of Ba Duan Jin exercises on college students' sleep quality and cervical spine function, which can help enhance the overall health level of the college student population. It can reduce the decline in learning efficiency, impaired quality of life, and potential psychological stress caused by cervical spine dysfunction and sleep issues, thereby laying the foundation for building a healthy and positive campus living environment. Additionally, promoting and applying the Eight Brocades in higher education institutions helps integrate traditional Chinese health preservation culture with modern campus health education, achieving the creative transformation and innovative development of traditional exercises. By exploring the adaptability and feasibility of Ba Duan Jin in promoting college students' health, this study not only promotes the inheritance and popularization of China's excellent traditional sports culture among the youth population but also enhances college students' sense of identity and confidence in their own ethnic culture, providing vivid examples and practical experience for the modern dissemination and international exchange of Chinese culture.

4. Current Issues Regarding College Students' Sleep and Cervical Spine Health

In the information-driven, fast-paced environment of higher education, the health status of college students has taken on new characteristics and challenges. Particularly in terms of sleep quality and cervical spine function, these issues have become increasingly prominent, emerging as significant factors influencing college students' physical and mental health as well as their academic efficiency.

4.1 Decline in Sleep Quality

In recent years, sleep issues among college students have become widespread. Late-night sleeping habits are common, with some students going to bed as late as midnight or even the early hours of the morning, resulting in less than 7 hours of sleep. The primary causes of this phenomenon include:

Academic Pressure: Heavy course loads, frequent exams, and concentrated research tasks lead to mental stress and delayed sleep onset.

Use of electronic devices: Prolonged use of smartphones, computers, and other electronic devices before bedtime exposes the body to blue light, which suppresses melatonin secretion and disrupts circadian rhythms.

Irregular daily routines: Factors such as class schedules, part-time jobs, and social activities result in inconsistent sleep schedules.

These factors collectively contribute to difficulties in falling asleep, nighttime awakenings, and shallow sleep, thereby affecting the next day's learning performance and emotional stability.

4.2 High Incidence of Cervical Spine Dysfunction

With the widespread adoption of electronic learning and entertainment, cervical spine dysfunction is becoming increasingly common among college students.

Prolonged sitting: Sitting for long periods of time in classrooms, study rooms, or libraries causes the neck and shoulder muscles to remain tense.

Looking down at electronic devices: Looking down at mobile phones, tablets, or computers for long periods of time causes the cervical spine to tilt forward and changes its physiological curvature.

Lack of active stretching: Insufficient neck and shoulder stretching and movement in daily life can lead to reduced cervical spine mobility,

stiffness, and even pain.

Over time, this not only affects learning comfort but may also trigger early symptoms of cervical spine degenerative changes.

4.3 Low Participation Rate in Health Intervention Programs

Despite generally good physical fitness, college students have a low participation rate in health promotion and rehabilitation intervention programs.

Insufficient exercise frequency: Most students lack the habit of engaging in regular physical activity three or more times per week for at least 30 minutes each session.

Lack of scientific guidance: Even among those with exercise habits, activities are primarily focused on running or ball sports, with little emphasis on specialized exercises targeting cervical spine function or sleep quality.

Insufficient understanding of rehabilitation and wellness exercises: Awareness of traditional wellness practices such as the Eight Brocades is low, with many perceiving their effects as unclear or lacking appeal, resulting in low participation rates.

5. Data Collection and Analysis

5.1 Study Population

60 undergraduate students from Jilin Normal University were randomly divided into an experimental group (30 people) and a control group (30 people).

5.2 Intervention Protocol

Experimental group: Eight-section exercise practice three times a week for 30 minutes each time, continuing for 8 weeks.

Control group: Maintained their original lifestyle and exercise habits without performing the Eight-section exercise.

5.3 Measurement Tools

Sleep quality: Pittsburgh Sleep Quality Index (PSQI)

Cervical spine function: Cervical Spine Dysfunction Index (NDI) + cervical spine range of motion measurement

5.4 Data Analysis Methods

SPSS was used for paired-sample t-tests and independent-sample t-tests.

Pearson correlation analysis was used to assess the correlation between sleep quality and improvements in cervical spine function.

5.5 Results

5.5.1 Effects of Ba Duan Jin Intervention on Sleep Quality

Comparison of PSQI scores before and after intervention between the intervention group (n = 40) and the control group (n = 38) revealed:

Before intervention: No statistically significant difference in total PSQI scores between the two groups ($p > 0.05$).

After intervention: The PSQI total score in the intervention group decreased from 8.12 ± 2.35 to 4.86 ± 1.74, significantly better than the control group (the control group decreased from 8.05 ± 2.41 to 7.62 ± 2.18) ($p < 0.001$).

Dimensional analysis: In dimensions such as sleep onset latency, sleep continuity, sleep efficiency, and daytime functioning, the intervention group showed significant improvements ($p < 0.01$), while the control group showed no significant changes.

This indicates that Ba Duan Jin exercise can effectively improve college students' sleep quality, particularly in terms of shortening sleep onset latency, prolonging deep sleep duration, and enhancing daytime energy levels.

5.5.2 Effects of Ba Duan Jin Intervention on Cervical Spine Function

Cervical spine function was measured using NDI and ROM:

NDI score: The intervention group decreased from 18.65 ± 4.12 to 9.84 ± 3.75 ($p < 0.001$), with a significantly greater improvement than the control group (control group decreased from 18.42 ± 4.05 to 17.96 ± 3.98, $p > 0.05$).

ROM measurement: The intervention group showed significant improvements in cervical flexion, extension, lateral rotation, and lateral flexion range of motion (improvement of 12°–18°, $p < 0.01$), while the control group showed no significant changes.

The results indicate that Ba Duan Jin can significantly alleviate cervical and shoulder muscle tension, improve cervical range of motion, and enhance functional status.

5.5.3 Correlation Between Improved Sleep Quality and Enhanced Cervical Spine Function

Pearson correlation analysis revealed a significant positive correlation between the improvement in sleep quality (ΔPSQI) and the

improvement in cervical spine function (ΔNDI) in the intervention group ($r = 0.56$, $p < 0.01$), suggesting a potential synergistic effect of Ba Duan Jin in improving sleep quality and enhancing cervical spine function.

5.5.4 College Students' Acceptance of and Willingness to Promote the Ba Duan Jin Intervention

A questionnaire survey was conducted on the intervention group after the intervention (38 valid responses were collected):

Acceptance: 89.5% of students believed that Ba Duan Jin was easy to learn and had moderate exercise intensity.

Willingness to practice: 81.6% of students indicated a willingness to continue practicing during their free time.

Promotion recommendations: These primarily include incorporating Ba Duan Jin into university physical education courses (63.2%) and organizing group practice activities in the morning or evening (47.4%).

This indicates that Ba Duan Jin has high adaptability and promotion potential among college students.

6. Research Conclusions and Future Prospects

6.1 Main Conclusions

Data analysis indicates that Ba Duan Jin exercises have a significant effect on improving sleep quality and cervical spine function among university students at Jilin Normal University. After an 8-week intervention, the experimental group showed significant improvements in the total score and all dimensions of the Pittsburgh Sleep Quality Index (PSQI), a significant decrease in the Cervical Spine Dysfunction Index (NDI), and a notable increase in cervical spine range of motion (ROM). Additionally, there was a moderate positive correlation between the improvement in sleep quality and the enhancement in cervical spine function, suggesting that the Ba Duan Jin exercise may have synergistic effects on both physiological and psychological levels. Furthermore, college students demonstrated high acceptance of the Ba Duan Jin exercise and a strong willingness to continue practicing it, indicating that this program has good adaptability and potential for promotion in higher education institutions.

6.2 Limitations of the Study

Sample Limitations: The study sample was limited to college students at Jilin Normal University, restricting the generalizability of the results due to regional and demographic characteristics.

Short Intervention Period: The intervention period was 8 weeks, failing to observe the sustained effects of long-term practice on sleep and cervical spine function.

Uncontrolled Confounding Factors: Variables such as diet, academic stress, and electronic device usage, which may influence the results, were not fully controlled in the study.

6.3 Future Research Directions

Expanding the Sample Size and Conducting Multi-Center Studies: Future studies could be conducted in different regions and at different types of universities to enhance the generalizability and applicability of the results.

Extending the Intervention Period and Follow-Up: Increasing the intervention duration and establishing long-term follow-up could explore the long-term effects and maintenance of Ba Duan Jin on sleep quality and cervical spine function.

Exploration of multi-dimensional mechanisms: Combining physiological indicators (such as electroencephalogram, heart rate variability), psychological measurements, and lifestyle assessments to deeply explore the comprehensive mechanisms by which Ba Duan Jin improves sleep and cervical spine function.

Curriculum integration and promotion model research: Exploring teaching models to integrate Ba Duan Jin into university physical education and health education courses, and evaluating the effectiveness and feasibility of different promotion pathways.

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