



## Effects of Different Health Qigong Routines on Neck Pain in Chinese College Students with Cervical Spondylosis: A Pilot Study

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### ABSTRACT

Neck pain is one of the earliest and most prominent clinical manifestations of cervical spondylosis. Its impact is not confined to the cervical region but may also extend to the head, back, shoulders, and upper limbs, significantly affecting patients' physical and mental health as well as their overall quality of life. As a traditional exercise-based intervention, Health Qigong has shown particular clinical value in alleviating neck pain associated with cervical spondylosis and improving cervical dysfunction. However, systematic research comparing the effects of different Health Qigong routines on neck pain among college students with cervical spondylosis remains limited. This study employed a cluster randomised controlled trial (CRCT) design to investigate the effects of three Health Qigong routines - Yi Jin Jing (YJJ), Wu Qin Xi (WQX), and Ba Duan Jin (BDJ)- on neck pain related to cervical spondylosis in Chinese college students. Participants aged 18 to 24 were recruited and randomly assigned to three experimental groups (EG-YJJ, EG-WQX, EG-BDJ) and one control group (CG-WE, walking exercise), with the intervention lasting two weeks. Neck pain was assessed before and after the intervention. The results showed that all experimental groups experienced significant reductions in neck pain compared to the control group, with the EG-YJJ group demonstrating the most pronounced improvement. These findings provide further evidence for the effectiveness of Health Qigong in relieving cervical spondylosis-related pain in college students and support its inclusion in exercise prescription frameworks for chronic disease management and health promotion.

**Keywords:** Health Qigong, Neck Pain, Cervical Spondylosis, College Students

### INTRODUCTION

Cervical spondylosis is a common musculoskeletal disorder affecting individuals across various age groups and countries, with a global prevalence ranging from 10% to 17.6%. It has emerged as a significant public health concern (Kolenkiewicz et al., 2018; Xiang et al., 2012; Binder, 2007). Neck pain, the primary symptom of cervical spondylosis, not only undermines individuals' physical and mental well-being and social functioning but also places a considerable burden on healthcare systems (Ayhuallem et al., 2021; Hey et al., 2021; Yates et al., 2020; Zhou et al., 2019; Lv et al., 2018; Cohen, 2015). Global epidemiological data indicate that around 288.7 million people experience neck pain, with as many as 28.6 million cases resulting in disability each year (Safiri et al., 2020). The related direct or indirect mortality rate can be as high as 9.4% (Shao et al., 2011).

Although the incidence of cervical spondylosis increases with age, recent years have seen a downward trend in the age of onset, putting younger populations, such as university students, at greater

risk (Zhang et al., 2022; Lv et al., 2018; Qiao et al., 2017; Wang et al., 2016; Wang & Fan, 2012; Meng et al., 2004; Wang et al., 2004). Studies and national reports indicate that the prevalence of cervical spondylosis among university students is rising each year. For instance, prevalence rates have been reported as 20.8%–54% in Jordan, 32.5%–41.35% in Thailand, 58.3% in India, 67.8% in Ethiopia, 41.6%–69.2% in Saudi Arabia, and as high as 45.12%–79.4% in China (Kandasamy et al., 2024; Hawamdeh et al., 2023; Puntumetakul et al., 2022; Kanaan et al., 2022; Ayhuallem et al., 2021; Felemban et al., 2021; Zhu et al., 2021; Behera et al., 2020; Namwongsa et al., 2018; Cao et al., 2017; Meng et al., 2004). These findings indicate that cervical spondylosis is highly prevalent among university students worldwide, with exceptionally high rates noted in China.

According to the American Physical Therapy Association (APTA), non-surgical treatment is recognised as the preferred first-line intervention for cervical disorders, demonstrating an effectiveness rate of up to 75% (Blanpied et al., 2017). In China, the 2018 expert consensus on the classification, diagnosis, and non-surgical treatment of cervical spondylosis also emphasises non-invasive interventions as the primary approach for managing common types, such as cervical and radiculopathy forms, and as suitable for other subtypes in the early stages (Editorial Department of Chinese Journal of Surgery, 2018). Evidence indicates that exercise prescriptions can effectively alleviate early-stage neck pain by enhancing blood circulation, relieving muscle spasms, reducing pain, and promoting cervical functional recovery (Chao et al., 2024).

The 2023 Chinese Expert Consensus on Exercise Prescription officially categorises Health Qigong as an aerobic exercise. It is recommended for individuals with chronic diseases, sports injuries, perioperative needs, or risk factors related to chronic conditions, as well as for the general population. The key recommended routines include Yi Jin Jing, Wu Qin Xi, Liu Zi Jue, and Ba Duan Jin (Li et al., 2023). Empirical research has confirmed the clinical applicability of Health Qigong in managing over 130 disease types across 17 bodily systems, with an efficacy rate reaching as high as 96.5%, particularly in musculoskeletal disorders.

As research on Health Qigong continues to evolve, it has become evident that differences exist in the pain-relieving effects of various Qigong routines for cervical spondylosis. These differences may arise from factors such as the characteristics of the target population (e.g., age and occupation), the design of intervention routines (standalone versus combined), and intervention parameters (e.g., intensity, total dosage, and duration). Although previous studies have supported the efficacy of Health Qigong in managing cervical spondylosis, the independent effects and underlying mechanisms of specific Qigong routines, as well as their comparative efficacy under consistent intervention protocols, remain unclear - particularly concerning outcomes such as pain relief and functional recovery.

In this context, the present study aimed to investigate the effects of various Health Qigong routines on neck pain in Chinese university students diagnosed with cervical spondylosis. The findings will inform the development of optimised, population-specific exercise prescriptions for this high-risk group.

## **METHODOLOGY**

### **Participants**

The study participants consisted of 20 college students diagnosed with cervical-type cervical spondylosis (CTCS) who were recruited from four colleges in Chengdu, Sichuan Province, China. They were randomly assigned to one control group ( $n = 5$ ) and three experimental groups ( $n = 5$  per group). The inclusion criteria were:

- a) full-time university students aged 18 to 24 showing symptoms of CTCS, including neck pain and limited cervical mobility ( $\text{NDI} > 15$ ,  $\text{VAS} > 4$ );
- b) radiographic evidence of cervical degenerative changes confirming the diagnosis of CTCS;
- c) no prior use of medications or receipt of treatment for cervical spondylosis;
- d) no personal exercise routine or professional training background;
- e) good overall health and essential physical capacity for exercise.

Exclusion criteria included:

- a) any cervical sprain that occurred in the past month or any acute trauma during the intervention period that affects participation;
- b) the presence of alternative clinical conditions such as frozen shoulder, fibromyalgia, neurasthenia, or symptoms not caused by cervical disc degeneration;
- c) congenital malformations, infections, tuberculosis, tumours, or other skeletal pathologies affecting the cervical region;
- d) absence from more than two intervention sessions, which was considered a dropout;
- e) failure to attend any data collection session punctually.

The Sichuan Nursing Vocational College Ethics Review Committee granted ethical approval (Approval No. 2023005). During the intervention, participants were asked not to engage in other physical therapies and to maintain their usual dietary habits, which the researchers monitored and documented. Repeated measurements were conducted throughout the intervention to assess its effectiveness and feasibility.

### **Participant Characteristics**

Basic demographic data were collected, including age, height, and weight. Height and weight were measured using an electronic infrared device. The mean age in the EG-YJJ group was  $18.56 \pm 2.05$  years; for EG-WQX, it was  $18.85 \pm 1.88$  years; for EG-BDJ, it was  $18.61 \pm 2.13$  years; and for CG-WE, it was  $18.33 \pm 1.95$  years. The average height in the EG-YJJ group was  $164.40 \pm 2.54$  cm; for EG-WQX, it was  $162.00 \pm 3.32$  cm; for EG-BDJ, it was  $167.06 \pm 1.08$  cm; and for CG-WE, it was  $163.86 \pm 2.89$  cm. Corresponding mean weights were as follows: EG-YJJ,  $56.27 \pm 4.54$  kg; EG-WQX,  $52.60 \pm 5.56$  kg; EG-BDJ,  $57.90 \pm 4.51$  kg; and CG-WE,  $52.77 \pm 5.89$  kg.

### **Training Program**

The Health Qigong intervention was designed in accordance with the FITT-VP principle and developed based on the latest research (Li et al., 2023). Following this, a panel of experts reviewed and approved the protocol to confirm its relevance and effectiveness for Chinese college students suffering from cervical spondylosis.

Previous studies indicate that the quality of movement execution significantly affects outcomes in full-body functional training (Frost et al., 2012). Since Health Qigong routines involve comprehensive bodily engagement, instructors and assistants from the research team closely monitored the standardisation of movements to ensure consistency and intervention fidelity. Before the intervention commenced, all participants received a detailed briefing on the experimental procedures. Baseline assessments were conducted to evaluate neck pain severity and cervical functional disability. All baseline data were documented prior to the intervention.

The intervention lasted two weeks, featuring five sessions each week. Each session lasted a maximum of 50 minutes and adhered to a consistent daily schedule. Participants were divided into four groups: EG-YJJ, EG-WQX, EG-BDJ, and CG-WE. The total weekly exercise duration amounted to 250 minutes. Exercise intensity was moderate, with gradual progression tailored to participants' adaptations, and sufficient time was dedicated to rest and feedback to maintain the integrity of the intervention. Each session included three components: warm-up, main routine (Health Qigong or walking), and cool-down. The control group engaged in walking exercises at a minimum cadence of 100 steps per minute, supervised by researchers during the intervention sessions (Li et al., 2023; Bull et al., 2020). Each experimental group was guided by a nationally certified first-level Health Qigong instructor responsible for instructing and correcting movements.

i. Warm-up (15 minutes): ii. iii. iv.

- i. **Warm-up (15 minutes):** Designed to prepare participants for the exercise routine. Each group followed its customised warm-up plan, which included light jogging, breath regulation, posture practice, trunk mobility drills, stepping exercises, and stance training.
- ii. **Main exercise (30 minutes):** Depending on their assigned group, participants performed one of the following Health Qigong routines: Yi Jin Jing, Wu Qin Xi, or Ba Duan Jin.

- iii. **Cool-down (5 minutes):** Static stretching exercises targeting the trunk, lower limbs, and core, combined with breathing techniques to enhance recovery.
- iv. **Environmental control:** All sessions were conducted in temperature-controlled indoor gyms within the participating colleges to ensure safety and consistency, and the research team constantly monitored them.

### Test Instrument

This study evaluated the effects of various Health Qigong routines on neck pain among college students with CTCS. Self-reported questionnaires, including the Short-Form McGill Pain Questionnaire (SF-MPQ) and the Neck Disability Index (NDI), were used to assess outcomes. The validity and reliability of these tools have been thoroughly documented in previous studies (Wu et al., 2008; Luo, 1992).

### Statistical Analysis

All statistical analyses were conducted using SPSS version 23 (IBM Corp., USA), with a two-tailed significance level of  $p < 0.05$ . Descriptive statistics were calculated to ensure data quality, and continuous and categorical variables were summarised as means  $\pm$  standard deviations and frequencies. Before performing inferential testing, normality and homogeneity of variance were assessed using ANOVA, Shapiro-Wilk, and Levene's tests. A generalised estimating equation (GEE) model was employed for longitudinal analysis to evaluate the effects of the intervention on neck pain.

## RESULTS

### Primary Outcomes

The Content Validity Index (CVI) is a widely utilised method for evaluating content validity (Almanasreh et al., 2019). To ensure the reliability and validity of each item in this study, a panel of six experts with relevant research backgrounds was enlisted to assess the content validity of the intervention components. The CVI results showed that the content validity indices for all items in the study were within acceptable ranges (CVI = 0.833–1.000 and Kappa = 0.816–1.000), demonstrating the high content validity of the intervention programme. Detailed data are presented in Table 1.

**Table 1.** Correlation and consistency of neck pain

Variables	Measurement Method	Number in Agreement	Clarity	
			I-CVI	KAPPA
Neck Pain	SF-MPQ	6	1.000	1.000
	NDI	5	0.833	0.816

Note: SF-MPQ, short form of McGill pain questionnaire; NDI, neck disability index.

### Reliability

Based on the literature review, self-assessment scales have been widely utilised in pain assessment tools, including unidimensional scales (e.g., VAS, NPS, and VRS) and multidimensional scales (e.g., MPQ, SF-MPQ, and SF-36) (Breivik et al., 2008). In neck pain, this study adopted the SF-MPQ multidimensional assessment scale, as recommended by the 2020 Chinese Pain Assessment Scale Application Expert Consensus (Wan et al., 2020). Furthermore, the literature indicates that the core tool, the VAS scale, within SF-MPQ can be used independently for pain assessment and demonstrates high reliability in evaluating cervical spondylosis pain (Modarresi et al., 2021). A study also revealed that the NDI scale exhibited good validity when compared to the VAS scale ( $r = 0.691$ ), supporting their combined use in the assessment of neck pain (Jones & Sterling, 2021; Saltychev et al., 2018; Hwang & Mun, 2013; MacDermid et al., 2009; Pietrobon et al., 2002; Vernon & Mior, 1991). The present study found that the reliability of the questionnaire tools for measuring neck pain was acceptable. Cronbach's alpha values exceeded 0.9 for all questionnaires, indicating high reliability within this sample group. Details are provided in Table 2.

**Table 2.** Results of reliability of questionnaire

Variables	Items	Cronbach's $\alpha$
SF-MPQ	PRI	0.956
	VAS	0.975
	PPI	0.970
	Total	0.958
NDI	Total	0.926

Note: SF-MPQ, short form of McGill pain questionnaire; PPI, present pain intensity; PRI, pain rating index; NDI, neck disability index.

This study employed the GEE method to evaluate the effect of various Health Qigong routines on neck pain among Chinese college students with cervical spondylosis. GEE analysis was performed on the pre-test and post-test pain-related assessment results to identify differences between and within the groups. Descriptive data for pain assessment (marginal means and standard errors) are displayed in Table 3.

**Table 3.** Descriptive statistics (mean and standard error) of speed performance of each group in different periods

Variables	Time	EG-YJJ	EG-WQX	EG-BDJ	CG-WE
SF-MPQ	Pre-test	33.857(0.622)	32.250(0.743)	32.950(0.651)	33.286(0.684)
	Post-test	8.000(0.331)	18.450(0.462)	14.850(0.514)	19.952(0.571)
NDI	Pre-test	28.381(0.664)	28.000(0.487)	28.700(0.612)	27.333(0.579)
	Post-test	6.143(0.607)	11.050(0.266)	10.850(0.406)	15.857(0.427)

Note: SF-MPQ, short form of McGill pain questionnaire; NDI, neck disability index; EG-YJJ, experimental group Yi Jin Jing; EG-WQX, experimental group Wu Qin Xi; EG-BDJ, experimental group Ba Duan Jin; CG-WE, control group walking exercise.

This study employed generalised estimating equations (GEE) to analyse group and time effects. According to the results of the GEE analysis, the main effects of the group on neck pain (Wald  $\chi^2 = 168.773$ ,  $p < 0.001$ ) and the Neck Disability Index (Wald  $\chi^2 = 173.846$ ,  $p < 0.001$ ) were found to be significant. These results also indicated that time had a significant effect on both neck pain (Wald  $\chi^2 = 2189.849$ ,  $p < 0.001$ ) and the Neck Disability Index (Wald  $\chi^2 = 2877.988$ ,  $p < 0.001$ ). Based on these findings, the interaction between time and group was also significant, suggesting that changes between the pre-test and post-test were substantial across all groups. See Table 4 for details.

**Table 4.** Results of GEE on SF-MPQ and NDI Score

Variables	Source	Wald-Chi Square	df	p-value
25SYT	Group	168.773	2	<0.001
	Time	2189.849	1	<0.001
	Group*Time	179.805	2	<0.001
50SYT	Group	173.846	2	<0.001
	Time	2877.988	1	<0.001
	Group*Time	151.108	2	<0.001

Noted: df: degree of freedom; SF-MPQ, short form of McGill pain questionnaire; NDI, neck disability index; \* $p < 0.05$  level of significance.

The results of the intra-group comparison using Bonferroni indicated that all four groups exhibited statistically significant improvements from pre- to post-test, as demonstrated by p-values less than 0.001. EG-YJJ displayed the most considerable mean improvement among the experimental groups, followed by EG-BDJ and EG-WQX. The control group, CG-WE, showed a significant but

relatively smaller improvement. These findings suggest that while all interventions had positive effects, Yi Jin Jing achieved notable post-test improvements most effectively. Refer to Table 5 for details.

**Table 5.** Pairwise Comparison of SF-MPQ Score across Time for Four Groups

Group	Time	Mean Difference	SE	p-value	95%CI	
					Lower	Upper
EG-YJJ	Pre vs Post-test	25.857*	0.661	<0.00	24.535	27.179
EG-WQX	Pre vs Post-test	13.800*	0.811	<0.00	12.176	15.424
EG-BDJ	Pre vs Post-test	18.100*	0.803	<0.00	16.493	19.708
CG-WE	Pre vs Post-test	13.333*	0.833	<0.00	11.667	14.999

Note. \* Mean difference is significant at the 0.05 level.

The between-group comparisons reveal no statistically significant differences at the pre-test stage, indicating a comparable baseline across all groups ( $p > 0.05$ ). However, significant differences emerged at the post-test stage. The EG-YJJ group demonstrated significantly more substantial improvements than all other groups ( $p < 0.001$ ), with mean differences of -10.450 compared to EG-WQX, -6.850 compared to EG-BDJ, and -11.952 compared to CG-WE. Additionally, EG-BDJ significantly outperformed both EG-WQX and CG-WE ( $p < 0.001$ ). EG-WQX also exhibited a modest but significant advantage over CG-WE. These findings suggest that while all interventions were beneficial, Yi Jin Jing (EG-YJJ) was the most effective, followed by Ba Duan Jin, with Wu Qin Xi and Walking Exercise, resulting in comparatively smaller effects. See Table 6 for details.

**Table 6.** Paired comparisons between groups on SF-MPQ pre-test and post-test

Time	Group	Mean Difference	SE	P-value	95% CI	
					LB	UB
Pre-test	EG-YJJ VS EG-WQX	1.607	0.956	0.097	-0.295	3.510
	EG-YJJ VS EG-BDJ	0.907	0.956	0.345	-0.995	2.810
	EG-YJJ VS CG-WE	0.571	0.944	0.547	-1.307	2.450
	EG-WQX VS EG-BDJ	-0.700	0.967	0.471	-2.625	1.225
	EG-WQX VS CG-WE	-1.036	0.956	0.282	-2.938	0.867
	EG-BDJ VS CG-WE	-0.336	0.956	0.726	-2.238	1.567
Post-test	EG-YJJ VS EG-WQX	-10.450*	0.675	<0.00	-11.794	-9.105
	EG-YJJ VS EG-BDJ	-6.850*	0.675	<0.00	-8.195	-5.505
	EG-YJJ VS CG-WE	-11.952*	0.667	<0.00	-13.280	-10.624
	EG-WQX VS EG-BDJ	3.60000*	0.684	<0.00	2.239	4.961
	EG-WQX VS CG-WE	-1.50238*	0.675	0.029	-2.847	-.1578
	EG-BDJ VS CG-WE	-5.10238*	0.675	<0.00	-6.447	-3.758

Note: SF-MPQ, short form of McGill pain questionnaire; EG-YJJ, experimental group Yi Jin Jing; EG-WQX, experimental group Wu Qin Xi; EG-BDJ, experimental group Ba Duan Jin; CG-WE, control group walking exercise.

The results of the intra-group comparison using Bonferroni showed statistically significant improvements from pre- to post-test across all four groups ( $p < 0.001$ ). The EG-YJJ group exhibited the most substantial improvement, indicating the most potent intervention effect. This was followed by the EG-BDJ and EG-WQX groups, which also demonstrated notable positive changes. In contrast, while the CG-WE group significantly improved, it had the most negligible mean difference. These results further support the superior efficacy of the Yi Jin Jing intervention, with Ba Duan Jin and Wu Qin Xi also providing meaningful benefits, whereas walking exercise yielded relatively limited effects. See Table 7 for details.

**Table 7.** Pairwise Comparison of NDI Score across Time for Four Groups

Group	Time	Mean Difference	SE	p-value	95%CI	
					Lower	Upper
EG-YJJ	Pre vs Post-test	22.238*	0.780	<0.00	20.676	23.800
EG-WQX	Pre vs Post-test	16.950*	0.494	<0.00	15.961	17.939
EG-BDJ	Pre vs Post-test	17.850*	0.648	<0.00	16.551	19.148
CG-WE	Pre vs Post-test	11.476*	0.650	<0.00	10.176	12.776

Note. \* Mean difference is significant at the 0.05 level.

The between-group comparisons at the pre-test stage again revealed no statistically significant differences among the four groups ( $p > 0.05$ ), suggesting that participants had comparable baseline levels. However, significant group differences emerged at the post-test stage. The EG-YJJ group demonstrated significantly more significant improvements than all other groups ( $p < 0.001$ ), with mean differences of -4.907 compared to EG-WQX, -4.707 compared to EG-BDJ, and -9.714 compared to CG-WE. Additionally, EG-WQX and EG-BDJ significantly outperformed the control group, with mean differences of -4.807 and -5.007, respectively. No significant difference was found between EG-WQX and EG-BDJ ( $p = 0.756$ ). These findings reaffirm the superior efficacy of Yi Jin Jing while highlighting the positive effects of both Wu Qin Xi and Ba Duan Jin compared to walking exercises. See Table 8 for details.

**Table 8.** Paired comparisons between groups on NDI pre-test and post-test

Time	Group	Mean Difference	SE	P-value	95% CI	
					LB	UB
Pre-test	EG-YJJ VS EG-WQX	0.381	0.836	0.650	-1.283	2.044
	EG-YJJ VS EG-BDJ	-0.319	0.836	0.704	-1.983	1.344
	EG-YJJ VS CG-WE	1.048	0.825	0.208	-0.595	2.691
	EG-WQX VS EG-BDJ	-0.700	0.846	0.410	-2.384	0.984
	EG-WQX VS CG-WE	0.667	0.836	0.427	-0.997	2.330
	EG-BDJ VS CG-WE	1.367	0.836	0.106	-0.297	3.030
Post-test	EG-YJJ VS EG-WQX	-4.907*	0.633	<0.00	-6.168	-3.646
	EG-YJJ VS EG-BDJ	-4.707*	0.633	<0.00	-5.968	-3.446
	EG-YJJ VS CG-WE	-9.714*	0.626	<0.00	-10.960	-8.469
	EG-WQX VS EG-BDJ	0.200	0.641	0.756	-1.076	1.476
	EG-WQX VS CG-WE	-4.807*	0.633	<0.00	-6.068	-3.546
	EG-BDJ VS CG-WE	-5.007*	0.633	<0.00	-6.268	-3.746

Note: SF-MPQ, short form of McGill pain questionnaire; EG-YJJ, experimental group Yi Jin Jing; EG-WQX, experimental group Wu Qin Xi; EG-BDJ, experimental group Ba Duan Jin; CG-WE, control group walking exercise.

## DISCUSSION

Neck pain is a persistent issue in all stages and types of cervical spondylosis, remaining a key focus throughout the treatment process (Reddy et al., 2019). The recurrence rate for this symptom exceeds 50% (Cohen, 2015). The findings of this study indicate that after intervention with various Health Qigong routines, all three experimental groups showed significant improvements in neck pain and the Neck Disability Index (NDI) among college students with cervical spondylosis ( $p < 0.05$ ). As an aerobic exercise, walking has been shown to enhance pain tolerance (Hviid et al., 2019). Furthermore, studies demonstrate that walking alleviates pain and disability associated with musculoskeletal disorders, although the evidence is of low to moderate quality (O'Connor et al., 2015; Sithipornvorakul et al., 2018; Vanti et al., 2019), aligning with the results of this study.

Further analysis revealed that, although the SF-MPQ has rarely been used as a pain assessment tool in prior studies of Health Qigong interventions for cervical spondylosis, numerous studies have utilised its core assessment indicator, the VAS, to validate the significant pain-relieving effects of



Health Qigong across various intervention durations. This underscores the benefits of Health Qigong in managing neck pain. Specifically, research has indicated a noticeable reduction in VAS scores during a 4-week short-term intervention with Health Qigong (Chen et al., 2024; Zhu et al., 2022). In studies with 6 to 8-week interventions, VAS score improvements varied from 2.3 to 3.6 (Lu, 2024; Guo et al., 2023; Cheng et al., 2022; Z. Li et al., 2020; Li et al., 2019; Zhao et al., 2017). In a 12-week intervention study, the improvement in VAS scores reached 5.2, with statistical significance (Yang et al., 2019). These results correspond with the significant effects of Health Qigong noted in this study.

The Neck Disability Index (NDI) is strongly correlated with other assessment tools, such as VAS and CROM (Jones & Sterling, 2021; Hwang & Mun, 2013; Howell, 2011), and is, therefore, one of the most widely used tools in clinical practice for assessing neck disability and its impact on function (Vernon, 2008). A systematic review indicated that an NDI reduction of at least 15% is clinically significant (Saltychev et al., 2024). Previous studies have shown that the effect of different Health Qigong routines on NDI improvement varies with intervention durations. Specifically, in studies of 4- to 6-week Health Qigong interventions, the improvement in NDI did not meet the clinical significance threshold, with score reductions between 4.5 and 5 points, representing a reduction of less than 15% (Guo et al., 2023; Zhu et al., 2022). However, in studies with intervention periods exceeding 8 weeks, the improvement in NDI was significant, with the most considerable improvement approaching 25 points, representing nearly a 50% reduction (Cheng et al., 2022; Lu, 2024; Zhao et al., 2017; Zhu et al., 2024). This result aligns with the optimal intervention effects of Health Qigong observed in this study.

Abnormal neuromuscular control, inflammatory stimuli, and cervical dynamic imbalance contribute to neck pain and dysfunction in cervical spondylosis (Binder, 2007; Treleaven et al., 2016). Previous studies have demonstrated the beneficial effects of Health Qigong on the musculoskeletal and nervous systems (Klein, 2017; Marks, 2017; Mittelstaedt et al., 2005; McCaffrey & Fowler, 2003). Physical regulation is the foundation of the three-in-one concept of Health Qigong, encompassing both the morphological regulation of the musculoskeletal system and the management of essential physiological functions (Yang, 2021).

Past research has shown that psychological mechanisms play a crucial role in managing pain and neck disability associated with cervical spondylosis (Alghamdi et al., 2023; Jackson et al., 2023; Zheng et al., 2022; Alian et al., 2021; Hwang & Mun, 2013; Kanchanomai et al., 2011; Treleaven, 2008; Binder, 2007). Health Qigong guides the body into a meditative state through various breathing techniques. The rhythmic interplay of breath and movement helps regulate both body and mind, achieving balance and optimal physical and mental health (Zhou et al., 2024). One study demonstrated that, during Health Qigong practice, brainwave monitoring revealed changes in the brain's information processing patterns:  $\beta$  waves decreased, while  $\alpha$  and  $\delta$  waves increased. Furthermore, the global efficiency (GE- $\theta$ ) of the brain network significantly improved, and local efficiency (LE- $\theta$ ) became more homogeneous, enhancing participants' sense of self-efficacy and alleviating negative psychological states (Sun et al., 2022).

## **LIMITATIONS**

The small sample size may have restricted the ability to identify significant training effects when comparing pre-and post-intervention measures. However, the pilot study aimed to provide preliminary data to establish systems and norms for future research. Subsequent studies should consider extending the training period to enhance the potential for training effects.

### **i. Sample Size Limitations**

The small sample size may limit the ability to detect significant training effects when comparing pre-and post-intervention measures. However, this pilot study aims to provide preliminary data to establish a systematic and standardised framework for future research. Therefore, upcoming studies should consider extending the training period to enhance the potential for training effects further. Only 20 participants were recruited for this experiment, and the relatively small sample size restricted the study's statistical power. Additionally, this small sample may hinder the generalizability of the findings. Although recruitment criteria and time constraints influenced the sample size, it is comparable to similar studies. Nonetheless, future research should increase the sample size to improve statistical power and mitigate the impact of data variability.



### **ii. Duration of the Intervention**

The enhanced intervention after activation in this study lasted two weeks, primarily influenced by time limitations and participants' academic commitments. Generally, a two-week exercise intervention has a limited clinical effect on related diseases. However, this study demonstrates that the Health Qigong intervention, conducted five times a week, can still affect neck pain in college students with cervical spondylosis. Future studies should extend the duration of the intervention to observe the long-term effects on clinical symptoms or recurrence rates.

### **iii. Limitations of the Study Population**

The study population included college students from Chengdu, Sichuan, China, who had cervical spondylosis. The homogeneity of this group helped control study variables but also limited the generalizability of the results. Therefore, future researchers should consider broadening the study population to include individuals with different types of cervical spondylosis, as well as various age groups, professional backgrounds, and demographic characteristics, to assess the impact of Health Qigong on diverse populations more comprehensively.

## **CONCLUSIONS**

The results of this study indicate that after two weeks of intervention with various Health Qigong routines, such as Yi Jin Jing, Wu Qin Xi, and Ba Duan Jin, these routines can effectively alleviate neck pain in college students with cervical spondylosis. In the post-test, the Yi Jin Jing routine showed the most significant improvement in relieving neck pain, followed by Ba Duan Jin and Wu Qin Xi. However, when designing different Health Qigong intervention protocols, it is essential to consider the individual characteristics of the participants and their various clinical symptoms to determine the most effective intervention.

Furthermore, the targeted application of exercise prescriptions for disease intervention and prevention not only effectively avoids a range of issues associated with excessive medical treatment, drug dependence, and surgical interventions but also enhances people's quality of life, aiding individuals in recovering from sub-health or diseased states to a healthy condition. Additionally, the intervention raises awareness of cervical spondylosis prevention and encourages healthy lifestyle habits, thereby reducing the incidence of the disease and lowering medical costs (Yang, 2021).

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### **Conflict of Interests**

The authors declare that there are no conflicts of interest.

### **Author Contributions**

All authors contributed equally to the conception and writing of the manuscript.

### **Data Availability Statement**

The datasets used and analysed in this study are available from the corresponding author upon reasonable request.

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