

## A 12-week Baduanjin Qigong exercise improves symptoms of ankylosing spondylitis: A randomized controlled trial



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### ABSTRACT

**Background and purpose:** Therapeutic exercises are considered effective treatments for ankylosing spondylitis (AS). Current study aimed to evaluate efficacy and safety of Baduanjin qigong, a traditional Chinese exercise, for treatment of AS in a pilot RCT setting.

**Materials and methods:** A total of 60 patients were randomly assigned, at a 1:1 ratio, to receive a 12-week Baduanjin qigong training (exercise group) or maintain their current lifestyle (no-treatment group). As primary outcomes, Bath Ankylosing Spondylitis Disease Activity Index (BASDAI) and other AS symptoms were assessed at baseline and end of treatment period.

**Results:** A total of 46 patients completed the study. At the end of treatment period, although total BASDAI scores were not statistically different, reduced scores were observed in the exercise group, compared to no-treatment group, with respect to fatigue ( $P = 0.03$ ), intensity ( $P = 0.04$ ) and duration ( $P = 0.01$ ) of morning stiffness; exercise group also exhibited higher patient global assessment scores ( $P = 0.04$ ).

**Conclusion:** Baduanjin qigong exercise appeared to improve AS symptoms.

### 1. Introduction

Ankylosing spondylitis (AS) is a chronic inflammatory disease of unknown etiology. Current practice guidelines recommend a combination of pharmacological and non-pharmacological treatments for optimal management of patients with AS [1,2]. There is evidence that exercise is an effective treatment for AS [3–5]. For example, 1) back exercise has been shown to relieve pain and stiffness and to improve physical function [6]; 2) an 8-week Tai Chi program has been reported to reduce disease activity and improve flexibility [7]; 3) swimming has been shown to be beneficial in relation to the quality of life and pulmonary function of patients, in addition to relieving pain and improving physical function [8,9].

Conventional therapeutic exercises primarily target flexibility, posture, and respiration. Other exercise protocols include aerobic exercise and strength training [10]. In China, some patients prefer traditional exercise, such as Tai Ji, over modern style exercise. Qigong is a form of traditional Chinese exercise that is considered to “exercise the mind and body” [11]; more recently, it has become known as “meditative movement” [12,13]. Therefore, qigong is valuable for treating various

chronic diseases and promoting a healthy life. Baduanjin qigong, with a history of more than 1000 years, was created based on the theory of traditional Chinese medicine to regulate “Yin-Yang” balance, smooth Qi and blood, and prolong life. Baduanjin qigong is widely popular in China. Similar to well-recognized traditional Tai Ji, Baduanjin qigong is also characterized by slow and relaxing movements. It is easy to learn and practice and unlikely to cause injury. A set of Baduanjin qigong practice consists of 8 movements, each with 4–8 repetitions, in addition to starting and ending postures. It typically requires approximately 15–20 min to complete. The exercise comprises movements that stretch the spine and limbs, in addition to improving muscle strength. Baduanjin qigong is considered a low-level aerobic exercise by the Chinese Health Qigong Association [14], and 1–2 sets of practice are recommended per day. Although the therapeutic value of Baduanjin qigong has not been recognized as much as that of Tai Ji, previous studies have shown that Baduanjin qigong has both physical and psychological effectiveness in patients with various diseases, including metabolic diseases and cardiovascular diseases [15–18], cancer [19], and mental conditions [20,21]. Its effectiveness has also been demonstrated in patients with chronic physical diseases, such as fatigue syndrome

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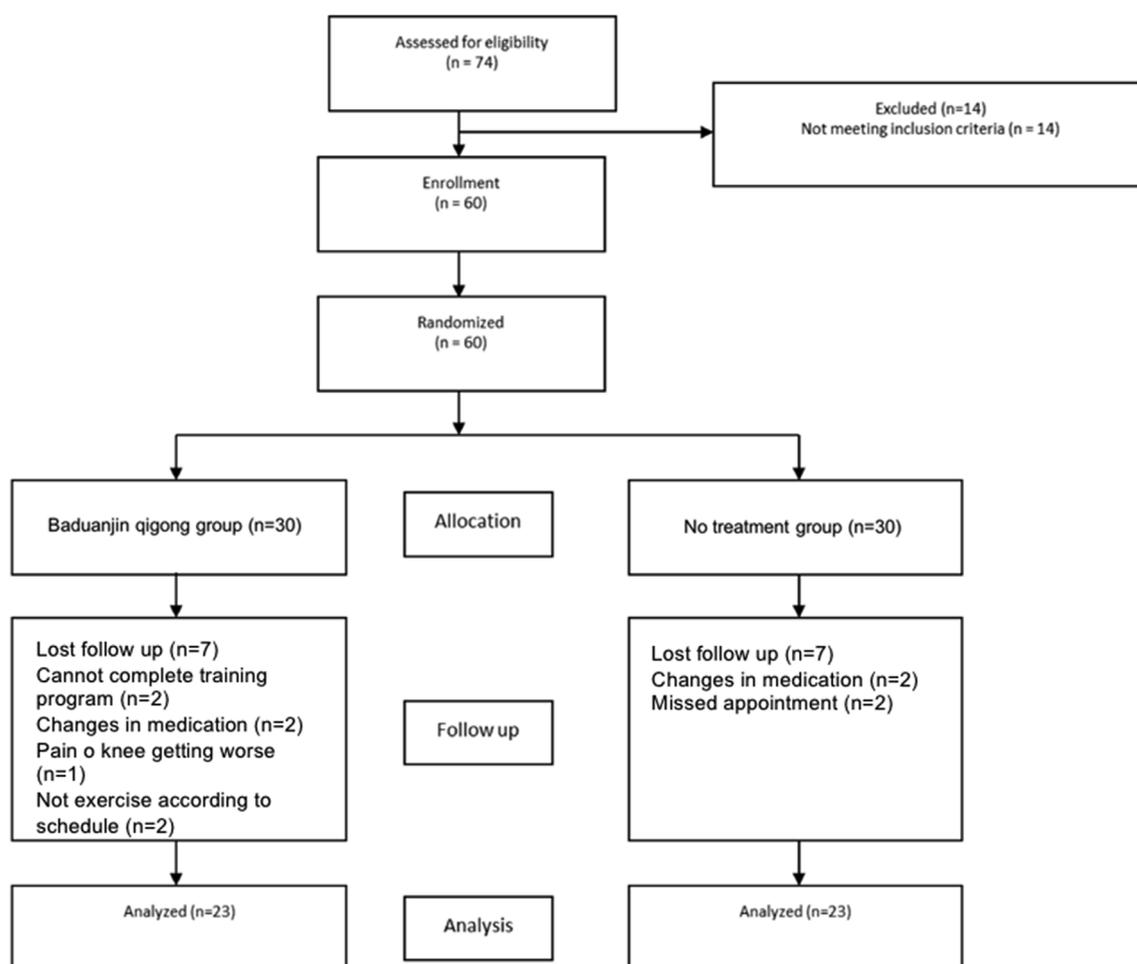


Fig. 1. CONSORT flow diagram for the current study.

[22,23]. It has been suggested that Baduanjin qigong can significantly improve physical flexibility [24], such that it may be a more practical choice of exercise treatment for AS patients in China.

Our previous experience suggests that many patients with AS feel comfortable after practicing Baduanjin qigong in our clinic. We hypothesized that patients with AS may benefit from practicing this exercise. Therefore, we conducted a 12-week randomized controlled trial to assess the short-term efficacy and safety of Baduanjin qigong in improving symptoms of AS.

## 2. Materials and methods

### 2.1. Study design

This was a pilot randomized, parallel group, controlled trial conducted from May 1, 2014 to December 31, 2015. As shown in Fig. 1, a total of 60 eligible AS participants were randomly allocated into the exercise group or the no treatment group at a 1:1 ratio, at the Jiangsu Province Hospital of Traditional Chinese Medicine (Nanjing, China). Patients in the exercise group completed 2-phase Baduanjin practice treatment, while patients in the no treatment group were asked to maintain their current lifestyle during the study period. Bath Ankylosing Spondylitis Disease Activity Index (BASDAI) score and spinal night pain were assessed as the primary outcomes. Other AS symptoms and functional activities were also assessed at baseline and at the end of the treatment period.

The study was performed in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for experiments involving humans. Ethics approval was obtained from the Ethics

Committee of Jiangsu Province Hospital of Traditional Chinese Medicine (Approval No. 2014NL-028-02), and all participants provided written informed consent.

### 2.2. Trial registration

Chinese Clinical Trial Registry: ChiCTR-TRC-14004650. Registered May 16, 2014.

## 3. Participants

### 3.1. Inclusion criteria

Participants were required to meet the following eligibility criteria: confirmed AS diagnosis according to the Modified New York criteria for AS [25]; age of 18–60 years; naïve to medical treatment, or existing therapies had been present for  $\geq 3$  months without significant changes in symptoms; no current participation in any exercise program (e.g., yoga, Tai Ji, or regular swimming) at the time of screening; confirmed written informed consent.

### 3.2. Exclusion criteria

Participants were excluded if they met any of the following criteria: inability to complete an entire Baduanjin qigong practice (e.g., severe limitations in activity) according to the researchers' evaluation; unsuitability for practicing Baduanjin qigong (e.g., patient with vertebral compression fractures, severe lumbar disc herniation, or severe cardiopulmonary disease) according to the researchers' evaluation; inability

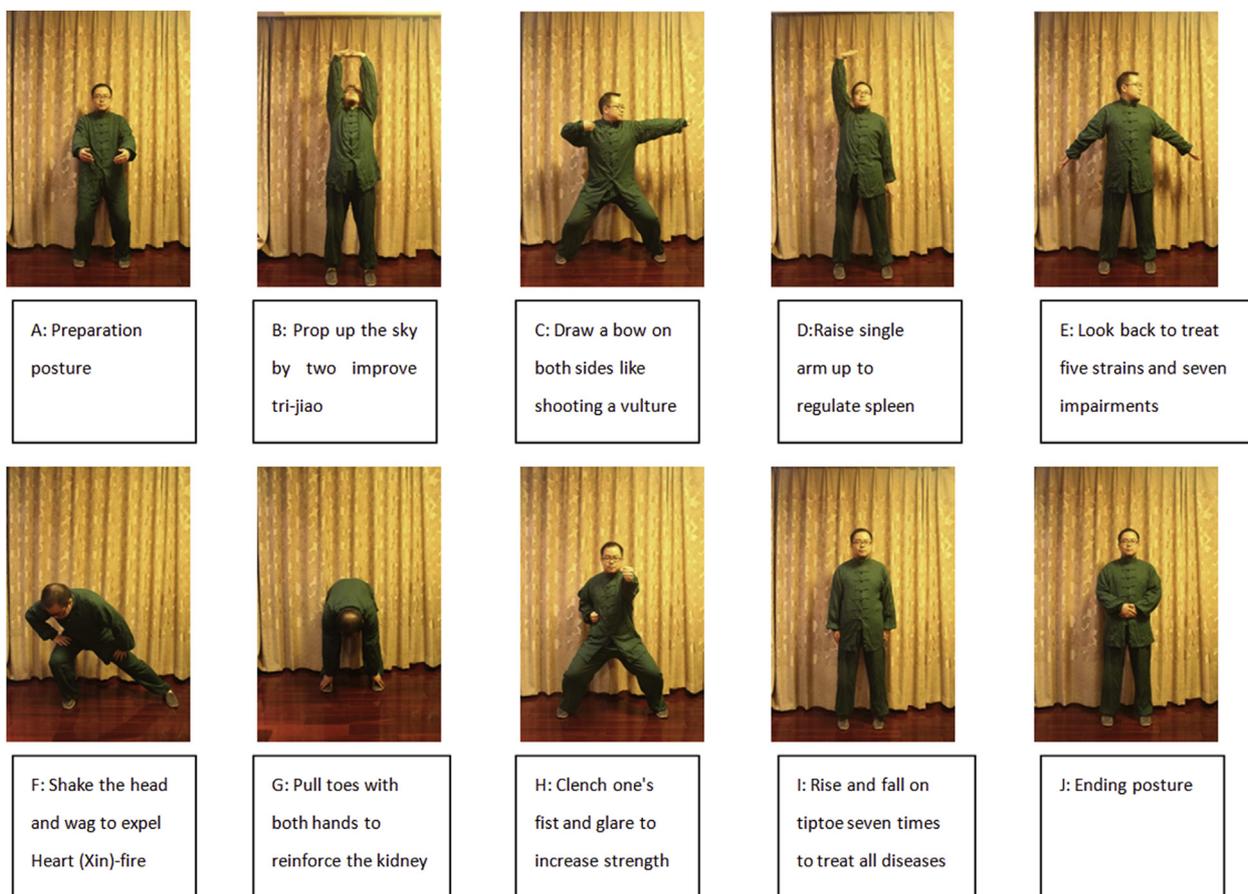


Fig. 2. Illustration of the 10 postures of Baduanjin qigong.

to provide informed consent due to mental or behavioral disorders; suspected or confirmed history of alcohol or drug abuse; presence or history of another disease that could reduce the possibility of enrollment or complicate enrollment.

Participant recruitment was conducted by physicians of the Rheumatology Department of Jiangsu Province Hospital of Traditional Chinese Medicine. Hospital posters, messages posted in QQ group (a social media community), and advertising in newspapers were used to broadcast recruitment. Patients who contacted the recruiters were then screened; those meeting the eligibility requirements, based on the inclusion and exclusion criteria, were enrolled.

## 4. Intervention

### 4.1. Exercise group (Baduanjin qigong)

Patients in the exercise group (Baduanjin qigong) underwent a 12-week, 2-phase Baduanjin qigong training program. The entire set of Baduanjin qigong exercises in this study consisted of 10 postures (Fig. 2) [14]. In the first phase, patients were required to attend classes twice per week for 4 weeks. A rheumatologist who had learned and practiced Baduanjin qigong for 10 years explained the main points of Baduanjin qigong and provided step-by-step instruction. The rheumatologist was permitted to adjust motion appropriately, according to each individual's physical conditions. An assistant carefully monitored participants to ensure each movement was applied appropriately and safely. All patients in this group were encouraged to practice what they learned at home, with DVD tutorials of Baduanjin qigong that were provided as part of their enrollment in the study. Patients who could not complete the entire Baduanjin qigong program were excluded from the final analysis.

In the second phase, patients were required to practice Baduanjin qigong at home at least 3 times per week for 8 weeks. Watching video tutorials was encouraged. Two researchers randomly contacted patients by telephone to encourage and supervise regular performance.

During the 12-week treatment, these patients were required to maintain their current lifestyles except for the introduction of Baduanjin qigong exercise. No changes to current AS medications were permitted; however, medication use for other disease(s) was allowed. Participation in other exercise programs, such as yoga, Tai Ji, and gymnastics, was not permitted. However, general activities, such as walking, jumping, stretching, or swimming occasionally, were not prohibited. All adverse events were required to be recorded and reported to the researchers.

### 4.2. No treatment group

Participants in the no treatment group were required to maintain their current lifestyles for 12 weeks. No changes to current AS medications were permitted; however, medication use for other disease(s) was allowed. Similar to the exercise group, participation in other exercise programs, such as yoga, Tai Ji and gymnastics, was not permitted. However, general activities, such as walking, jumping, stretching, or swimming occasionally, were not prohibited. All adverse events were required to be recorded and reported to the researchers.

### 4.3. Outcomes

The primary outcome was the Bath Ankylosing Spondylitis Disease Activity Index (BASDAI) [26]. BASDAI consists of 6 measurements: fatigue; spinal pain; peripheral arthritis; enthesitis; intensity of morning stiffness; and duration of morning stiffness. The measurements were

**Table 1**  
Comparison of demographic characteristics and ankylosing spondylitis symptoms between Baduanjin qigong exercise group and no treatment group at baseline.

Characteristics and parameters	Exercise Group		No treatment Group		p
	Mean	SD	Mean	SD	
<b>Gender(n)</b>					
Male (n)	17.00		18.00		0.73
Female (n)	6.00		5.00		
<b>BASDAI</b>	2.87	1.09	2.70	1.15	0.49
Fatigue	3.26	2.16	3.65	1.61	0.35
Spinal pain	4.17	1.83	3.91	1.93	0.57
Peripheral arthritis	1.78	1.81	1.13	1.18	0.27
Enthesitis	0.96	1.36	1.26	1.51	0.44
Intensity of morning stiffness	4.43	1.95	3.70	1.49	0.12
Duration of morning stiffness	3.87	1.55	3.35	1.43	0.13
<b>BASFI</b>	1.40	1.10	1.05	1.02	0.29
Putting on your socks or tights without help or aids	0.70	1.15	0.39	0.94	0.29
Bending from the waist to pick up a pen from the floor without aid	1.65	2.29	1.00	1.54	0.39
Reaching up to a high shelf without help or aids	0.96	1.33	0.48	0.79	0.20
Getting up from an armless chair without your hands or any other help	0.61	1.03	0.22	0.52	0.15
Getting up off the floor without help from lying on your back	1.78	2.68	1.57	2.48	0.62
Standing unsupported for 10 min without discomfort	0.78	1.13	0.48	0.73	0.50
Climbing 12–15 steps without using a handrail or walking aid	0.35	0.78	0.09	0.29	0.20
Looking over your shoulder without turning your body	2.04	3.05	1.35	2.50	0.50
Doing physically demanding activities (e.g. physiotherapy exercises, gardening or sports)	2.26	2.12	2.26	1.91	0.91
Doing a full day's activities whether it be at home or at work	2.83	2.33	2.65	1.85	0.90
<b>BASMI</b>	2.97	1.36	1.02	1.01	0.67
Lateral lumbar flexion (cm)	14.11	5.44	13.17	4.80	0.28
Tragus to wall distance(cm)	13.17	2.78	12.94	2.88	0.22
Intermalleolar distance(cm)	116.70	8.12	118.17	5.52	0.09
Cervical rotation (°)	66.72	18.61	66.76	20.23	0.33
Modified scober (cm)	2.96	1.71	2.63	0.98	0.69
<b>Patient global assessment</b>	3.43	1.90	3.35	1.80	0.87
<b>Spinal night pain</b>	4.35	1.90	3.78	1.65	0.25
<b>Chest expansion</b>	2.57	0.99	2.30	0.79	0.27

BASDAI: Bath Ankylosing Spondylitis Disease Activity Index.

BASFI: Bath Ankylosing Spondylitis Functional Index.

BASMI: Bath Ankylosing Spondylitis Metrology Index.

SD: Standard Deviation.

evaluated with a numerical rating scale (NRS) system of 0–10. For the first 5 measurements, 0 indicates “none” and 10 indicates “very severe”, while 0 indicates “0 h” and 10 indicates “2 or more hours” for the measurement of duration of morning stiffness.

Secondary outcomes assessed included functional ability (measured using the Bath Ankylosing Spondylitis Functional Index [BASFI]) [26] and chest expansion (cm) [26], mobility (measured using the Bath Ankylosing Spondylitis Metrology Index [BASMI] [26], patient global assessment, and night spinal pain. The BASFI consists of 10 questions concerning the activities of daily living, which were scored using an NRS with a scale of 0–10; 0 indicates “easy” and 10 indicates “impossible.” Five measurements of the BASMI were assessed by the researchers, including: lateral spinal flexion (cm); tragus-to-wall distance (cm); lumbar flexion (cm); maximal intermalleolar distance (cm); and cervical rotation (degrees). Patient global assessment was measured using an NRS with a scale of 0–10; 0 indicates “not active” and 10 indicates “very active.” Night spinal pain was also measured using an NRS with a scale of 0–10; 0 indicates “no pain” and 10 indicates “most severe pain.”

All outcome measurements were assessed at baseline and at the conclusion of the treatment period. Differences were compared between the two groups.

#### 4.4. Randomization and blinding

A random sequence was generated using software; corresponding numbers were provided in sealed, opaque envelopes that were opened upon each patient's agreement to participate. Assignments were performed by a research assistant who was not involved in recruitment to ensure allocation concealment. Participants were randomly assigned to

the Baduanjin qigong group or no treatment group at a 1:1 ratio. Eligible participants were informed of their allocation result by a project manager via telephone, after their baseline measurements had been assessed.

Although it was impossible to blind the participants and exercise coaches, blinding of the outcome assessors and the statistician was maintained.

#### 4.5. Statistical analysis

Statistical analysis was performed using SPSS version 17.0.0 (IBM Corporation, Armonk, NY, USA). Means and standard deviations were calculated for all dependent variables. The Kolmogorov-Smirnov test was used to test the normality of quantitative data. An independent *t*-test (if data were normally distributed) or the Mann-Whitney *U* test (if data were skewed) was used to assess differences between the two groups at baseline and after treatment. For ranked data, the Mann-Whitney *U* test was used to test differences between the two groups. For categorical variables and enumeration data, the Chi-squared test was used;  $P < 0.05$  was considered statistically significant.

### 5. Results

As shown in Fig. 1, of the total 72 patients screened, 60 were enrolled and randomly assigned to one of the two groups ( $n = 30$  each). Seven participants in each group did not complete the study. Therefore, a total of 46 participants (23 in each group) were included in the final data analysis.

The demographic characteristics and baseline AS symptoms, functional activities, and other measurements at baseline were compared

**Table 2**  
Comparison of Baduanjin qigong exercise group and no treatment group after 12-week intervention.

Parameters	Exercise Group		No treatment Group		p
	Mean	SD	Mean	SD	
<b>BASDAI</b>	2.28	1.09	2.55	1.19	0.39
Fatigue	2.65	1.53	3.74	1.71	<b>0.03*</b>
Spinal pain	2.96	1.55	3.43	1.95	0.47
Peripheral arthritis	1.91	1.98	0.87	1.01	0.09
Enthesitis	1.22	1.51	0.96	1.26	0.62
Intensity of morning stiffness	2.78	1.35	3.96	1.66	<b>0.04*</b>
Duration of morning stiffness	2.52	1.16	3.52	1.47	<b>0.01*</b>
<b>BASFI</b>	1.28	1.02	1.17	1.10	0.74
Putting on your socks or tights without help or aids	0.65	1.07	0.43	0.90	0.47
Bending from the waist to pick up a pen from the floor without aid	1.57	2.06	1.04	1.52	0.45
Reaching up to a high shelf without help or aids	1.09	1.38	0.87	1.18	0.69
Getting up from an armless chair without your hands or any other help	0.61	1.03	0.35	0.71	0.35
Getting up off the floor without help from lying on your back	1.74	2.24	1.70	2.53	0.72
Standing unsupported for 10 min without discomfort	0.52	0.95	0.57	0.84	0.75
Climbing 12–15 steps without using a handrail or walking aid	0.43	0.79	0.09	0.29	0.06
Looking over your shoulder without turning your body	1.91	2.95	1.43	2.63	0.61
Doing physically demanding activities (e.g. physiotherapy exercises, gardening or sports)	1.78	1.68	2.43	2.00	0.26
Doing a full day's activities whether it be at home or at work	2.17	1.97	2.74	2.00	0.26
<b>BASMI</b>	2.84	1.27	3.15	1.21	0.83
Lateral lumbar flexion (cm)	14.37	5.22	12.98	4.69	0.36
Tragus to wall distance(cm)	12.98	2.49	13.15	3.00	0.18
intermalleolar distance(cm)	116.48	7.83	118.61	5.89	0.14
cervical rotation (°)	70.50	16.54	66.20	20.07	0.20
modified scober (cm)	2.98	1.65	2.59	0.97	0.09
<b>Patient global assessment</b>	2.70	1.52	3.57	1.59	<b>0.04*</b>
<b>Spinal pain-night</b>	2.91	1.53	3.61	1.80	0.18
<b>Chest expansion</b>	2.59	0.93	2.35	0.70	0.27

BASDAI: Bath Ankylosing Spondylitis Disease Activity Index.

BASFI: Bath Ankylosing Spondylitis Functional Index.

BASMI: Bath Ankylosing Spondylitis Metrology Index.

SD: Standard Deviation.

\*Significant difference ( $P < 0.05$ ) between exercise and no treatment groups.

between the two groups. As shown in Table 1, no significant differences were detected between the two groups in any of the parameters (all  $P > 0.05$ ).

When the outcome parameters were compared between the two groups at the end of the treatment period (Table 2), the total scores of BASDAI did not significantly differ. However, lower scores with respect to fatigue and the intensity and duration of morning stiffness, as well as higher patient global assessment, were observed in the Baduanjin qigong group, compared to the no treatment group (all  $P < 0.05$ ). Regarding functional ability, after the 12-week treatment, the exercise group did not show a significant difference in BASFI score or any sub-measurements. No statistically significant differences were observed in other outcomes between the two groups ( $P > 0.05$ ).

No severe adverse effects were reported by the patients during the observation period. Seven patients in the Baduanjin qigong group reported mild muscle ache in the thigh and crus during the first two weeks of treatment.

## 6. Discussion

The results of the current study demonstrated that, compared with the no treatment group, a 12-week Baduanjin qigong exercise regimen significantly reduced fatigue, as well as the intensity and duration of morning stiffness, in AS patients. The exercise also improved patient global assessment without significant adverse effects.

Physical exercise is known to be very important for AS treatment. For example, a previous study reported that balneotherapy combined with home exercise therapy could improve BASDAI, BASMI, and BASFI scores in AS patients [27]. It has also been shown that home exercise therapy could improve BASDAI score [28]. International guidelines recommend exercise as a treatment to improve/maintain range of

motion, muscle strength, and well-being of AS patients [1]. In contrast to patients in Western countries, many Chinese patients are not accustomed to such general exercise. Baduanjin qigong is a popular traditional Chinese exercise. An increasing number of studies have demonstrated its effect on hyperlipidemia [29], ischemic stroke [30], sleep disturbances [31], knee osteoarthritis [32], bone loss [33], and oxidative stress [34]. The effects of Baduanjin qigong have been reported for various psychological and physiological parameters among different clinical populations [35]. Such exercise has been reported to improve sleep quality [20,22,23,36], anxiety and depression [18,19,21,23], mental health [37,38], and cognitive function [39]. In addition, the direct effectiveness of Baduanjin qigong on physical functions has been reported, as it reduces musculoskeletal pain [22] and fatigue [16,23,40]. In addition, it improves function of the extremities and the ability to perform daily activities during rehabilitation [18,20]. There has been also a report that Baduanjin qigong enhanced lumbar muscle strength [37]. AS is a chronic spinal inflammatory disease with major symptoms of pain and difficulties in daily activities. Therefore, it is reasonable to expect that Baduanjin qigong may improve the symptoms of AS.

Clear positive effects of Baduanjin qigong were noted in the present study. These results may have several explanations. First, when practicing Baduanjin qigong, the spine and limbs are fully stretched, and muscle strength can be improved. It has been previously demonstrated that Baduanjin qigong can significantly improve physical flexibility in healthy adults [24]. The exercise may relieve muscle spasm and alleviate stiffness in the spine. Moreover, it may maintain muscle relaxation and reduce fatigue. Second, Baduanjin qigong involves breath training, which may improve breathing muscle strength and increase chest expansion. Finally, Baduanjin qigong promotes a restful state and mental tranquility. These influences may help break the “pain cycle,” thus

improving self-efficacy, social function, and depression. These can also help patients reduce discomfort, build confidence, obtain support, and overcome fear of disease. Compared with general exercise, such as walking, swimming, or routine posture exercise, Baduanjin qigong comprises multiple aspects of exercise, together with a mental training component; these may generate more significant results than a single approach.

This study was a pilot randomized, controlled interventional trial to assess the efficacy and safety of Baduanjin qigong in patients with AS; however, it had several limitations. First, this study was not double-blinded, and the placebo effect and objective opinions of clinicians may have contributed to the observed improvement in patient-reported outcomes. Second, the 14 (23%) initial participants who were lost to follow-up may have contributed to the observed improvement in the outcomes. Third, first, and second examinations of the patients were not performed at the same hour of the day. Because there may be some clinical differences in the signs and symptoms of AS in the morning and afternoon, the outcome of the BASMI (and its sub-domains) and chest expansion may be affected; this may be a reason why significant differences were not observed in these items. In addition, due to the lack of effective supervision, we could not exclude the possibility that participants did not exercise as required or that they altered medication or lifestyle without reporting. A previous study of patients with chronic fatigue syndrome-like illness has demonstrated significant correlations between symptom improvement and each of the following: the length of the intervention period, numbers of attended lessons, and amount of practice [23]. A more recent systematic review and meta-analysis also showed that the number of total Baduanjin training sessions is associated with reduced anxiety and depression levels [21]. Participants in the current study were also asked to keep records of home practices. However, due to the incompleteness of home-practice records, the correlation between symptom improvement and amount of exercise was not analyzed in the current study. However, we expect that a prolonged intervention period and more regular self-practice monitoring may enhance the effectiveness of Baduanjin qigong.

## 7. Conclusion

Despite the limitations of the present investigation, our study preliminarily demonstrated that a 12-week Baduanjin qigong exercise regimen was effective in improving the symptoms of fatigue, intensity and duration of morning stiffness, and patient global assessment; moreover, it appears to be safe for patients with AS when practiced correctly. More strictly designed trials are warranted in the future to confirm the findings of the current study.

## Conflicts of interest

The authors declare that they have no competing interests.

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## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ctcp.2018.12.007>.

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