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PREVENTION & REHABILITATION: Randomized Controlled Trial

Effects of Qigong practice in office workers with chronic non-specific low back pain: A randomized control trial

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Qigong
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A B S T R A C T

Objective: To investigate the effects of Qigong practice, Guan Yin Zi Zai Gong level 1, compared with a waiting list control group among office workers with chronic nonspecific low back pain (CNLBP).
Methods: A randomized controlled trial was conducted at offices in the Bangkok Metropolitan Region. Seventy-two office workers with CNLBP were screened for inclusion/exclusion criteria (age 20–40 years; sitting period more than 4 h per day) and were allocated randomly into two groups: the Qigong and waiting list groups ($n = 36$ each). The participants in the Qigong group took a Qigong practice class (Guan Yin Zi Zai Gong level 1) for one hour per week for six weeks at their workstation. The participants were encouraged to conduct the Qigong exercise at home every day. The waiting list group received general advice regarding low back pain management. The primary outcomes were pain intensity, measured by the visual analog scale, and back functional disability, measured by the Roland and Morris Disability Questionnaire. The secondary outcomes were back range of motion, core stability performance index, heart rate, respiratory rate, the Srithanya Stress Scale (ST-5), and the global perceived effect (GPE) questionnaire.
Results: Compared to the baseline, participants in the Qigong group experienced significantly decreased pain intensity and back functional disability. No statistically significant difference in these parameters was found in the waiting list group. Comparing the two groups, Qigong exercise significantly improved pain intensity, back functional impairment, range of motion, core muscle strength, heart rate, respiratory rate, and mental status. The Qigong group also had a significantly higher global outcome satisfaction than the waiting list group.
Conclusion: Qigong practice is an option for treatment of CNLBP in office workers.

1. Introduction

Low back pain has become one of the biggest problems for the public health system worldwide. Eighty-four percent of people have low back pain during their lifetime (Maher et al., 2017). Previous studies have also reported that back disorders are associated with a particular occupation (Miedema et al., 2014; Sterud and Tynes, 2013). The increasing use of computers has been linked to the high prevalence of musculoskeletal symptoms of low back pain (Juul-Kristensen et al., 2004). This problem is common among office workers, with one-year prevalence ranging from 23% to 38% (Juul-Kristensen et al., 2004; Omokhodion and Sanya, 2003). Office workers are frequently exposed to repetitive movement, awkward postures, prolonged static postures such as forward flexion and rotation of trunk, and manual handling tasks, which are risk factors for developing musculoskeletal symptoms (Omokhodion and Sanya, 2003; Sterud and Tynes, 2013). Moreover, they may also encounter psychosocial problems such as high job demands, time pressure, mental stress, low job satisfaction, high workload, lack of social support from colleagues and superiors, stressful work, and effort-reward imbalance at work (Rugulies and Krause, 2008; Sterud and Tynes, 2013).

Exercise therapy has been widely used as an alternative and additional method for treatment of chronic nonspecific low back

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pain (CNLBP) (Saragiotto et al., 2016). The exercise can reduce pain, increase the range of motion, lessen the risk of recurrent symptoms, and help people return to normal activities and work (van Middelkoop et al., 2010). Qigong exercise, a traditional Chinese meditative movement therapy, has specific characteristics that involve focusing on body awareness and attention during the slow, relaxed, and flowing body movements from dynamic movement to static postures (Larkey et al., 2009). The aims of both dynamic and static meditative movement practices include attention to breathing to bring the mind to a restful state as well as to bring more oxygen into the body. The deep state of meditative therapy is relaxation. It is an important factor to practice due to the fact that relaxation can improve physical health, mental health, and sleep quality (Morone et al., 2008). Although Qigong exercise seems to be an alternative method for CNLBP patients (Bai et al., 2015; Qaseem et al., 2017), especially among office workers who are frequently exposed to repetitive movement and prolonged static posture, the effectiveness of Qigong for relieving CNLBP in office workers is still questionable, and the results of previous studies have been inconclusive (Blödt et al., 2015). Hence, our study was designed to investigate the effects of Qigong practice, Guan Yin Zi Zai Gong level 1, compared with the waiting list control group among office workers with CNLBP under a randomized controlled trial research design.

2. Materials and methods

2.1. Participants

Seventy-two office workers with CNLBP participated in this study, chosen through a convenience sampling method. They were recruited from two companies in the Bangkok Metropolitan Region through leaflets and announcements. The sample size was calculated using G-power version 3.1.9.2 based on the pilot study. Configuration error was set at $\alpha = 0.05$; power analysis was 0.95 with a 15% attrition rate. A sample size of 36 participants per group was needed for this study. A computer program randomized them equally into two groups: the Qigong practice group and the waiting list group, which served as the control. The treatment codes were placed sequentially in sealed opaque envelopes, and thus, the allocation sequence was blinded to investigators involved in the recruitment. Numbered opaque envelopes were used to implement the random allocation to conceal the sequence until interventions were assigned. Inclusion criteria were: participants had CNLBP (pain localized between the twelfth rib and inferior gluteal folds with or without leg pain); were aged 20–40 years; reported sitting at least 4 h on a working day; had low back pain persisting ≥ 12 weeks; had low back pain with an average intensity over the previous seven days that exceeded 40 mm on a 100 mm of visual analog scale (VAS); had not been involved in any physical treatment during the previous three months; did not have any signs of neurological disorder; had good communication skills in Thai; were not pregnant; and had no neurologic abnormality (motor or sensory deficit). Exclusion criteria included having a tumor, fracture, rheumatoid arthritis, or osteoporosis and taking medication for low back pain at the time of the study.

All procedures were approved by the Institutional Ethics Review Committee for Research Involving Human Research Subjects, Health Science Group. Written consent was obtained from all participants. They were requested to continue normal activities and avoid other forms of treatment during the six weeks of intervention.

2.2. Procedure

Participants in the Qigong group received a 1-hour Qigong practice session each week for six weeks (Guan Yin Zi Zai Gong level 1, developed by Yang Pei Xen since 1995) at their workstation by a professional Qigong instructor from Master Yang Qigong Center, Bangkok, Thailand. Fifteen minutes of Wu Chi meditation and 28 min of static exercise are illustrated in Fig. 1. Eighteen postures of dynamic Qigong exercise are available online at www.youtube.com/watch?v=pioSzJS2TGg&t=481s. The exercise session was performed in a particular room to prevent the participants in the waitlist control group from viewing the sessions. The Qigong practice involved three steps: basic Qigong exercise, meditation, and acupressure based on traditional Chinese medicine (see Table 1). The Qigong exercise consisted of the principal elements of the Qigong concept: static and dynamic posture, meditation/imagination, and breathing exercise. The participants were encouraged to conduct the Qigong exercise at home every day and daily recorded the Qigong exercise to remind them of daily practice.

In the waiting list group, participants received general advice on managing low back pain in order to reduce low back pain and were encouraged to stay active. They were asked to stop any other treatment during the six weeks of the trial. After the end of the study, participants in the control group received the same treatment as those in the Qigong group.

2.3. Outcome measures

There were two primary outcomes in this study: VAS was used to measure pain intensity, and the Roland and Morris Disability Questionnaire (RMDQ) was used to measure back functional disability. The primary outcomes were measured at baseline and every week during the study. There were six secondary outcomes in this study: back range of motion, core stability performance index, heart rate, respiratory rate, the Srithanya Stress Scale (ST-5) scores, and the global perceived effect (GPE) questionnaire results. The secondary outcomes, except GPE questionnaire results, were measured at baseline, week 3, and the end of the intervention (week 6). The GPE questionnaire was administered only one time, at the end of the intervention. The independent physical therapist, who was blinded to the group allocation, performed all objective outcome measurements.

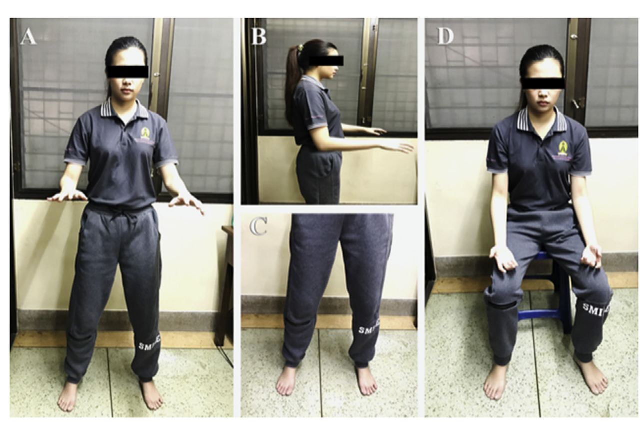

Fig. 1. The static exercise of Qigong practice (A: body position, B: hand position, and C: leg position); Wu Chi meditation (D).

Table 1
Qigong practice program.

Week 1	- Practice static Qigong for 25 min - Practice dynamic Qigong for 5 min - Acupressure at acupoint GV20 for 2 min - Wu Chi meditation for 10 min
Week 2	- Practice static Qigong for 28 min - Acupressure at acupoints KI1 for 4 min - Wu Chi meditation for 15 min
Week 3	- Practice static Qigong for 28 min - Practice dynamic Qigong for 5 min - Acupressure at acupoints LI4 for 4 min - Wu Chi meditation for 15 min
Week 4	- Practice static Qigong for 28 min - Practice dynamic Qigong for 5 min - Acupressure at acupoints PC6 for 4 min - Wu Chi Meditation 15 min
Week 5	- Practice static Qigong for 28 min - Practice dynamic Qigong for 5 min - Acupressure at acupoints ST36 for 4 min - Wu Chi Meditation 15 min
Week 6	- Practice static Qigong for 28 min - Practice dynamic Qigong for 10 min - Acupressure at acupoints HT7 for 4 min - Wu Chi meditation 15 min

2.3.1. Primary outcomes

The VAS consists of a line, usually 100 millimeters long, with ends labeled "no pain" and "severe pain, as bad as it could be." The VAS has a high number of response categories because it is usually measured in millimeters and is 100 millimeters long. Participants had to mark their pain intensity score on the line of the VAS. The validity and reliability of VAS scores have been indicated (Von Korff et al., 2000).

The RMDQ is a health status measure designed to be completed by patients to assess physical disability due to low back pain in the last 24 h (Roland and Fairbank, 2000). The RMDQ focuses on a limited range of physical functions including walking, bending over, sitting, lying down, dressing, sleeping, self-care, and daily activities. The strength of the RMDQ has constructed validity as a functioning measurement and the fact that it is easy to score and understand (Chiarotto et al., 2016; Roland and Fairbank, 2000). The Thai version of the RMDQ has high internal consistency and test-retest reliability (Pensri et al., 2005).

2.3.2. Secondary outcomes

The back range of motion device (BROM II) was used to measure lumbar range of motion in six directions: lumbar flexion, extension, right lateral bending, left lateral bending, right trunk rotation, and left trunk rotation. The BROM II consists of two plastic pieces; the first piece, called an inclinometer, measures the sagittal plane motion of the lumbar (Atya, 2013). The second piece is a combination gravity goniometer/compass unit; it is used to measure the side bending and the rotational motion of the lumbar segment (Kachingwe and Phillips, 2005). The BROM II has high intra-rater reliability (Atya, 2013).

Core stabilizer muscle strength was measured using the abdominal drawing-in test with pressure biofeedback. The participants were in the prone position, and the pressure biofeedback was placed between the umbilicus and the anterior superior iliac spine (ASIS) (Rathod, 2016). Air was infused into the bulb to create a pressure of 70 mmHg (Park and Lee, 2013). Core stability performance index was then calculated by core stability muscle strength (mmHg) multiplied by hold time (sec).

Heart rate was measured by a fingertip pulse oximeter. The finger probe was taped to the right index finger for measurement while the participant was in sitting position. Fingertip pulse oximeters are significantly correlated with electrocardiograms ($r = 0.79$) (Iyriboz et al., 1991). The examiner also measured the participants' respiration in sitting position by counting the chest rise and fall for 1 min without them knowing (Bye et al., 1990; Karlen et al., 2014). The average resting respiratory rate in a normal adult is 12–20 breaths per minute.

The ST-5 was used to measure mental status. The ST-5 consists of five items: sleep problems, distractions, boredom, anxiety, and attention deficit. Each item is recorded using a 4-point Likert scale, ranging from 1 (less often) to 4 (regularly) (Silpakit, 2011). The ST-5 has shown high reliability ($ICC = 0.85$) (Silpakit, 2011).

The GPE scale asked the participant to rate, on a numerical scale, how much their condition had improved or deteriorated since some predefined time point (Kamper et al., 2010). GPE results are recorded using a 7-point rating scale, ranging from 1 (extremely satisfied) to 7 (extremely dissatisfied). The test-retest reliability of the GPE scale is excellent, with intra-class correlation coefficient values of 0.90–0.99 (Kamper et al., 2010).

2.4. Statistical analysis

All data were analyzed using the Statistical Package for the Social Sciences (version 17.0) according to the intention-to-treat principle when noncompliant subjects and participants dropped out; missing data could also be managed by using the last observation carried forward method. The means, mean differences, and standard error of each group were reported. The Shapiro-Wilk normality test was used in this study. The participant characteristics were compared between groups using an independent *t*-test for continuous data and a Chi-square test for noncontinuous data. A two-way repeated measures analysis of variance with a mixed model (group × time point) was used. The primary outcomes were compared at baseline and every week during the study. The secondary outcomes in this study, except the GPE results, were compared at baseline, week 3, and the end of the intervention (week 6). The GPE was administered and the results compared only one time, at the end of the intervention. The pairwise comparison was carried out using Bonferroni's post hoc test. The p-value was set at < 0.05 for statistical analysis.

3. Results

The study was conducted between September 2016 and April 2017. Of 120 interested participants, 48 were excluded because they did not meet inclusion criteria ($n = 38$) and for other reasons ($n = 10$), and 72 were randomized into two groups (the Qigong group, $n = 36$; the waiting list group, $n = 36$) (see Fig. 2). Three participants in the Qigong group and four participants in the waiting list group dropped out in the first week because they were not willing to continue with the program. Two participants in the Qigong group missed one session out of six sessions, but the data were still used. Finally, 72 participants were analyzed using intention-to-treat analysis. The groups had similar characteristics (see Table 2). No significant difference between groups was found at baseline in outcome variables, except in terms of back extension and rotation to the left side.

Table 3 shows the primary outcomes of this study at baseline and weeks 1–6. The Qigong group showed significant decreases in pain, both within the group and between groups at weeks 1–6. The Qigong group also showed significant improvement in back functional disability, both within the group at week 5 and between groups at weeks 4–6. There was no statistically significant difference within the waiting list group in terms of pain or back functional disability.

The Qigong group showed significant increases in the range of

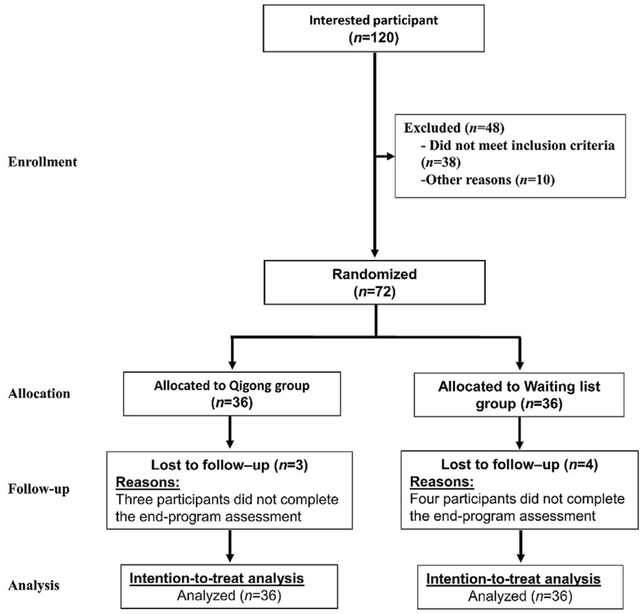

Fig. 2. Study profile.

motion in all directions, both within the group and between groups (see Table 4). The Qigong group also showed significant increases in core stability performance index both within the group and between groups. The Qigong group showed significant decreases in heart rate, respiratory rate, and ST-5 score when the groups were compared. In addition, at the end of the intervention, the Qigong group had a significantly greater GPE score than the waiting list group (see Table 5). There was no statistically significant difference within the waiting list group in all secondary outcomes. Also, during the interviews at the end of the sessions, no participant reported side effects.

The previous study by Ostelo and de Vet (2005) revealed that the minimally clinically important difference (MCID) for the VAS and RMDQ in low back pain was 20 millimeters and 3.5 points, respectively (Ostelo and de Vet, 2005). This study demonstrated that the VAS score in the Qigong group was clinically significant. However, the RMDQ did not meet the MCID level. To the best of our knowledge, no study reported the MCID in low back pain for all secondary outcomes used in this study.

4. Discussion

The goal of this study was to explore the effect of Qigong practice on office workers suffering from CNLBP. This study shows that Qigong practice (Guan Yin Zi Zai Gong level 1) for six weeks improves pain intensity, back function, back range of motion, core stabilizer muscle performance, heart rate, respiratory rate, and stress. Furthermore, the Qigong group had significantly greater global outcome satisfaction than the waiting list group. These results suggest that Qigong practice is a choice for treatment of CNLBP in office workers.

The current study found that Qigong practice significantly reduced pain intensity in the Qigong exercise group as compared to the waiting list group. Because the objective of the current study was to determine the effectiveness of the Qigong practice, the effects of other traditional treatments (i.e., acupressure, exercise, and meditation) were combined with our study results. The present findings seem to be consistent with other studies, which found that Qigong practice could reduce pain intensity in the short term (Rendant et al., 2011) and long term (Blödt et al., 2015; Lansinger et al., 2007). It seems possible that these results are due to the fact that Qigong practice consists of three elements that could reduce pain: posture, deep breathing, and meditation. Qigong practice comprises several poses and movements that could strengthen core stabilizer muscles (Akuthota et al., 2008). Moreover, deep breathing and meditation in Qigong practice influence the body and mind relaxation, which, in turn, reduces muscle activity (Rhoads, 2013). Furthermore, meditation reduces pain perception (Nakata et al., 2014). A previous study by Sharon et al. (2016) demonstrated that meditation significantly reduces the pain and unpleasantness score of cold stimulus-induced pain in healthy adults. Interestingly, intravenous injection of naloxone, an opioid blocker, reverses this analgesic effect of meditation, suggesting that meditation modulates pain via the endogenous opioid mechanism (Sharon et al., 2016). Moreover, a previous study by Movahedi et al. in 2017 demonstrated that acupressure on specific points 3 times per week for three weeks reduced the severity of

Table 2
Baseline Characteristics of study participants.

Measures mean (SD)	Qigong ($n = 36$)	Waiting list ($n = 36$)	*P*-value
Age (years)	35.7 (3.6)	34.8 (4.3)	0.179
Gender (%)	1.7 (0.5)	1.6 (0.5)	0.314
Male: Female	33.3: 66.7	38.9: 61.1	
Weigh (kg)	64.5 (12.8)	62.2 (12.0)	0.220
Height (cm)	164.5 (8.3)	162.9 (7.9)	0.200
Primary outcomes			
VAS score (0–10)	49.7 (15.8)	54.8 (15.0)	0.289
RMDQ score (0–24)	4.6 (4.6)	3.6 (3.3)	0.244
Secondary outcomes			
Lumbar range of motion (degrees)			
Flexion	32.7 (8.7)	35.8 (7.1)	0.071
Extension	9.4 (4.3)	6.7 (2.9)	0.004*
Rotation to right	16.9 (8.6)	14.3 (6.7)	0.127
Rotation to left	16.4 (6.3)	11.9 (6.5)	0.004*
Side bending to right	27.9 (7.4)	26.8 (5.4)	0.429
Side bending to left	26.5 (6.7)	26.1 (5.3)	0.902
Core stability performance index (mmHg*sec)	15.2 (9.1)	18.0 (10.9)	0.264
Heart rate (HR) (beats/min)	73.4 (10.5)	74.2 (8.1)	0.694
Respiratory rate (RR) (breaths/min)	19.6 (2.5)	19.9 (2.0)	0.580
Srithanya stress scale (ST-5) (0–15)	4.4 (2.4)	4.5 (3.1)	0.898

Abbreviations: RMDQ: Roland Morris Disability Questionnaire; VAS: Visual analog scale; *statistically significant at $P \leq 0.05$.

Table 3
Primary outcomes, Visual analog scale (VAS) and Roland and Morris disability questionnaire (RMDQ), at baseline and week 1 to week 6.

	Qigong ($n = 36$)			Waiting list ($n = 36$)			Between groups *P*-value
	Mean ± SD	Mean change from baseline (95% CI)	*P*-value	Mean ± SD	Mean change from baseline (95% CI)	*P*-value	
VAS score							
Baseline	49.7 (15.8)			54.8 (15.0)			0.289
Week 1	32.3 (22.4)	−17.4 (−3.3 to −0.2)	0.009*	51.5 (19.2)	−3.3 (−1.2 to 1.2)	1.000	<0.001*
Week 2	27.8 (22.3)	−21.9 (−3.7 to −0.7)	<0.001*	50.5 (19.2)	−4.3 (−1.9 to 1.1)	1.000	<0.001*
Week 3	26.3 (22.3)	−23.4 (−3.9 to −0.8)	<0.001*	52.8 (19.7)	−2.0 (−1.7 to 1.3)	1.000	<0.001*
Week 4	22.4 (22.3)	−27.3 (−4.2 to −1.2)	<0.001*	53.1 (20.1)	−1.7 (−1.7 to 1.3)	1.000	<0.001*
Week 5	17.5 (21.6)	−32.2 (−4.7 to −1.7)	<0.001*	53.5 (21.3)	−1.3 (−1.6 to 1.4)	1.000	<0.001*
Week 6	14.0 (20.5)	−35.7 (−5.1 to −2.1)	<0.001*	53.5 (20.9)	−1.3 (−1.6 to 1.4)	1.000	<0.001*
RMDQ score							
Baseline	4.6 (4.6)			3.6 (3.3)			0.244
Week 1	3.4 (4.2)	−1.2 (−3.9 to 1.5)	1.000	4.1 (3.4)	0.5 (−2.2 to 3.2)	1.000	0.456
Week 2	2.9 (4.1)	−1.7 (−4.4 to 1.0)	1.000	4.0 (3.3)	0.4 (−2.2 to 3.1)	1.000	0.184
Week 3	2.5 (3.6)	−2.1 (−4.8 to 0.6)	0.430	4.0 (3.1)	0.4 (−2.2 to 3.1)	1.000	0.075
Week 4	2.2 (3.6)	−2.4 (−5.1 to 0.3)	0.153	4.1 (3.2)	0.5 (−2.2 to 3.2)	1.000	0.030*
Week 5	1.9 (3.4)	−2.7 (−5.4 to 0.0)	0.049*	4.1 (3.2)	0.5 (−2.2 to 3.2)	1.000	0.012*
Week 6	2.0 (3.6)	−2.6 (−5.2 to 0.1)	0.083	4.0 (3.2)	0.4 (−2.3 to 3.1)	1.000	0.022*

All analyses are performed using the intent to treat principle. *Statistically significant at $P \leq 0.05$.

Table 4
The lumbar range of motion in all directions at baseline, week 3 and week 6.

	Qigong ($n = 36$)			Waiting list ($n = 36$)			Between groups *P*-value
	Mean ± SD	Mean change from baseline (95% CI)	*P*-value	Mean ± SD	Mean change from baseline (95% CI)	*P*-value	
Range of motion (degrees)							
Flexion							
Baseline	32.7 (8.7)			35.8 (7.1)			0.071
Week 3	35.0 (8.2)	2.3 (−1.8 to 6.5)	0.519	34.4 (6.2)	−1.4 (−5.6 to 2.7)	1.000	0.705
Week 6	38.1 (6.8)	5.4 (1.3–9.6)	0.005*	34.4 (6.5)	−1.4 (−5.6 to 2.7)	1.000	0.031*
Extension							
Baseline	9.4 (4.3)			6.7 (2.9)			0.004*
Week 3	12.0 (4.6)	2.6 (0.4–4.8)	0.013*	7.4 (2.7)	0.7 (−1.5 to 2.8)	1.000	<0.001*
Week 6	13.4 (5.0)	4.0 (1.8–6.2)	<0.001*	7.1 (2.72)	0.4 (−1.8 to 2.6)	1.000	<0.001*
Rotation to right							
Baseline	16.9 (8.6)			14.3 (6.7)			0.127
Week 3	18.9 (7.4)	2.0 (−2.2 to 6.2)	0.758	13.8 (7.3)	−0.4 (−4.6 to 3.8)	1.000	0.004*
Week 6	20.1 (7.3)	3.2 (−1.1 to 7.3)	0.215	13.2 (6.7)	−1.0 (−5.2 to 3.2)	1.000	<0.001*
Rotation to left							
Baseline	16.4 (6.3)			11.9 (6.5)			0.004*
Week 3	19.8 (7.0)	3.4 (−0.3 to 7.1)	0.082	11.9 (6.5)	0.00 (−3.7 to 3.7)	1.000	<0.001*
Week 6	20.3 (6.6)	4.00 (0.3–7.6)	0.031*	12.1 (5.9)	0.17 (−3.5 to 3.9)	1.000	<0.001*
Side bending to right							
Baseline	27.9 (7.4)			26.8 (5.4)			0.429
Week 3	30.4 (7.3)	2.4 (−1.2 to 6.1)	0.328	26.6 (4.7)	−0.2 (−3.8 to 3.4)	1.000	0.012*
Week 6	31.8 (7.0)	3.8 (0.2–7.5)	0.034*	27.1 (5.9)	0.4 (−3.3 to 4.0)	1.000	0.002*
Side bending to left							
Baseline	26.5 (6.7)			26.1 (5.3)			0.764
Week 3	30.1 (6.1)	3.5 (0.2–6.9)	0.035*	25.8 (5.2)	−0.4 (−3.7 to 3.0)	1.000	0.002*
Week 6	31.6 (6.8)	5.0 (1.7–8.4)	0.001*	26.3 (5.2)	0.1 (3.2 to −3.5)	1.000	<0.001*

All analyses are performed using the intent to treat principle. *Statistically significant at $P \leq 0.05$.

chronic low back pain (Movahedi et al., 2017). Therefore, we believe the results of our Qigong practice protocol, which was the combined treatment effects, would benefit and be suitable for office workers suffering from a complexity of pain.

This study found that Qigong practice significantly reduced the back disability score (RMDQ score) in office workers who had low back pain. These findings further support the idea that Qigong practice could reduce disability (Hall et al., 2011). A possible explanation of this might be that Qigong practice comprises postural and body awareness, lower extremity and core stability muscle strengthening, static and dynamic balance, deep breathing, and meditation. These components play a role in low back pain reduction, which, in turn, improves the functional disability of participants.

Another significant finding was that Qigong practice enhanced the core stabilizer muscle performance index. Two elements of Qigong may explain this result: breathing control practice and body movement. Breathing in this Qigong practice is similar to the deep breathing that contracts the diaphragm, the principal muscle of inspiration. Kim and Lee (2013) reported that the contractility of the diaphragm not only improved respiratory volume but also influenced the stabilization of the lumbar spine (Kim and Lee, 2013). During Qigong exercise, the participant needs to maintain static posture and progresses by increasing the time of maintaining the position or the transfer of torque or momentum of upper and lower extremities. Thus, the Qigong positions can improve core stability muscle strength.

Low back pain and limited back range of motion in office workers are caused by the imbalance of back muscles. To be more specific, they are caused by weak core stabilizer muscles and tight

Table 5
The core stability muscle performance index, heart rate (HR), respiratory rate (RR), the Srithanya Stress Scale (ST-5) at baseline, week 3 and week 6, and the global perceive effects (GPE) at week 6.

	Qigong ($n = 36$)			Waiting list ($n = 36$)			Between groups *P*-value
	Mean ± SD	Mean change from baseline (95% CI)	*P*-value	Mean ± SD	Mean change from baseline (95% CI)	*P*-value	
Core stability performance index (mmHg*sec)							
Baseline	15.2 (9.1)			18.0 (10.9)			0.264
Week 3	23.6 (11.6)	8.4 (2.3–14.5)	0.003*	18.6 (11.6)	0.6 (−5.5 to 6.7)	1.000	0.052
Week 6	28.3 (11.5)	13.1 (7.0–19.2)	<0.001*	16.9 (9.4)	−1.1 (−7.1 to 5.1)	1.000	<0.001*
Heart rate (HR) (beats/min)							
Baseline	73.4 (10.5)			74.2 (8.1)			0.694
Week 3	68.1 (8.4)	−5.4 (−0.6 to −10.1)	0.021*	76.6 (7.6)	2.4 (−2.4 to 7.2)	0.666	<0.001*
Week 6	67.6 (6.9)	−5.8 (−1.1 to −10.6)	0.010*	75.9 (8.3)	1.6 (−3.1 to 6.4)	1.000	<0.001*
Respiratory rate (RR) (breaths/min)							
Baseline	19.6 (2.5)			19.9 (2.0)			0.580
Week 3	18.8 (2.3)	−0.8 (−2.1 to 0.6)	0.480	20.2 (2.4)	0.3 (−1.1 to 1.6)	1.000	0.014*
Week 6	18.3 (2.4)	−1.3 (−2.6 to 0.1)	0.073	19.8 (2.4)	−0.1 (−1.4 to 1.3)	1.000	0.007*
Srithanya Stress Scale (ST-5) score (0–15)							
Baseline	4.4 (2.4)			4.5 (3.1)			0.898
Week 6	3.3 (2.2)	−1.2 (−2.4 to 0.1)	0.073	5.1 (3.1)	0.6 (−0.7 to 1.9)	0.369	0.005*
Global perceive effects (GPE) score (1–7)							
Week 6	2.2 (−0.8)	–	–	3.7 (0.7)	–	–	<0.001*

All analyses are performed using the intent to treat principle. Core stability performance index: Core stability muscle strength (mmHg) multiplied by hold time (sec). *Statistically significant at $P \le 0.05$.

global muscles. Low back pain is often associated with sustained static loading of the lumbar spine and surrounding tissues (Valachi and Valachi, 2003). The results of this study showed that Qigong exercises significantly increased back range of motion as compared to the baseline and waiting list group. The slow dynamic posture of Qigong that cooperates with deep breathing and body awareness helped to improve the flexibility of global muscles and strengthening of core stabilizer back muscles. Moreover, the end posture of Qigong practice was similar to the back flexibility exercises and improved the back range of motion (Purepong et al., 2012). It is possible that the static position with deep breathing, concentration, and slow dynamic posture during Qigong practice could improve both local and global muscle function and maintain the balance of these muscle activities. Thus, it induces improvement of back range of motion.

The present finding seems to be consistent with other findings, which were that long-term and short-term Qigong practice had benefits for reducing stress (Griffith et al., 2008; Johansson and Hassmén, 2008; Skoglund and Jansson, 2007). A previous study showed that Qigong practice reduced stress and increased social interaction in hospital staff (Griffith et al., 2008). Similarly, Skoglund and Jansson (2007) demonstrated that Qigong practice reduced low back pain symptoms and stress by reducing sympathetic activity (Skoglund and Jansson, 2007). The results of this study showed that Qigong exercises significantly decreased heart rate and respiratory rate as compared to the baseline and waiting list group. During meditation, the body goes into a state of relaxation response by decreasing the heart rate, respiratory rate, blood pressure, and muscle tone and increasing alpha brain waves, which, in turn, reduces stress (Lee et al., 2000).

This study has a number of strengths, including the randomized blinded study design, using the integrated protocol comprising Qigong exercise, mediation, and self-acupressure. This study used a professional Qigong teacher to deliver the therapy. Otherwise, this study minimized the attrition bias by offering the participants in the control group the opportunity to participate in Qigong practice at the trial's conclusion. Furthermore, this study measured the pain impairment and function both subjectively and objectively. Lastly, unlike most other Qigong studies, this study focused on office workers who were young and middle-aged.

Finally, a couple of important limitations need to be considered. Firstly, this study was conducted among middle-aged subjects who can stay active in the office. The physician and physical therapist should be carefully considered before applying the results to other groups of patients. Further studies should focus on long-term follow-up for 3 months, 6 months, or 12 months of Qigong practice. It would also be very interesting to detect core stabilizer muscle activities during Qigong practice by means of electromyography.

5. Conclusion

The result of this study suggests that Qigong practice (Guan Yin Zi Zai Gong level 1) is a clinical choice for treatment of CNLBP, especially for office workers exposed to repetitive movement, awkward postures, prolonged static postures, and psychosocial problems.

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Conflicts of interest

None.

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References

Akuthota, V., Ferreiro, A., Moore, T., Fredericson, M., 2008. Core stability exercise principles. Curr. Sports Med. Rep. 7, 39–44. https://doi.org/10.1097/01.CSMR.0000308663.13278.69.

Atya, A.M., 2013. The validity of spinal mobility for prediction of functional disability in male patients with low back pain. J. Adv. Res. 4, 43–49. https://doi.

org/10.1016/j.jare.2012.01.002.
Bai, Z., Guan, Z., Fan, Y., Liu, C., Yang, K., Ma, B., Wu, B., 2015. The effects of Qigong for adults with chronic pain: systematic review and meta-analysis. Am. J. Chin. Med. 43, 1525–1539. https://doi.org/10.1142/S0192415X15500871.
Blödt, S., Pach, D., Kaster, T., Lüdtke, R., Icke, K., Reisshauer, A., Witt, C.M., 2015. Qigong versus exercise therapy for chronic low back pain in adults–a randomized controlled non-inferiority trial. Eur. J. Pain Lond. Engl. 19, 123–131. https://doi.org/10.1002/ejp.529.
Bye, P.T., Ellis, E.R., Issa, F.G., Donnelly, P.M., Sullivan, C.E., 1990. Respiratory failure and sleep in neuromuscular disease. Thorax 45, 241–247.
Chiarotto, A., Maxwell, L.J., Terwee, C.B., Wells, G.A., Tugwell, P., Ostelo, R.W., 2016. Roland-Morris Disability Questionnaire and Oswestry Disability Index: which has better measurement properties for measuring physical functioning in nonspecific low back pain? Systematic review and meta-analysis. Phys. Ther. 96, 1620–1637. https://doi.org/10.2522/ptj.20150420.
Griffith, J.M., Hasley, J.P., Liu, H., Severn, D.G., Conner, L.H., Adler, L.E., 2008. Qigong stress reduction in hospital staff. J. Altern. Complement. Med. N. Y. N 14, 939–945. https://doi.org/10.1089/acm.2007.0814.
Hall, A.M., Maher, C.G., Lam, P., Ferreira, M., Latimer, J., 2011. Tai chi exercise for treatment of pain and disability in people with persistent low back pain: a randomized controlled trial. Arthritis Care Res. 63, 1576–1583. https://doi.org/10.1002/acr.20594.
Iyriboz, Y., Powers, S., Morrow, J., Ayers, D., Landry, G., 1991. Accuracy of pulse oximeters in estimating heart rate at rest and during exercise. Br. J. Sports Med. 25, 162–164.
Johansson, M., Hassmén, P., 2008. Acute psychological responses to qigong exercise of varying durations. Am. J. Chin. Med. 36, 449–458. https://doi.org/10.1142/S0192415X08005898.
Juul-Kristensen, B., Søgaard, K., Strøyer, J., Jensen, C., 2004. Computer users' risk factors for developing shoulder, elbow and back symptoms. Scand. J. Work. Environ. Health 30, 390–398.
Kachingwe, A.F., Phillips, B.J., 2005. Inter- and intrarater reliability of a back range of motion instrument. Arch. Phys. Med. Rehabil. 86, 2347–2353. https://doi.org/10.1016/j.apmr.2005.07.304.
Kamper, S.J., Ostelo, R.W.J.G., Knol, D.L., Maher, C.G., de Vet, H.C.W., Hancock, M.J., 2010. Global Perceived Effect scales provided reliable assessments of health transition in people with musculoskeletal disorders, but ratings are strongly influenced by current status. J. Clin. Epidemiol. 63, 760–766 e1. https://doi.org/10.1016/j.jclinepi.2009.09.009.
Karlen, W., Gan, H., Chiu, M., Dunsmuir, D., Zhou, G., Dumont, G.A., Ansermino, J.M., 2014. Improving the accuracy and efficiency of respiratory rate measurements in children using mobile devices. PLoS One 9, e99266. https://doi.org/10.1371/journal.pone.0099266.
Kim, E., Lee, H., 2013. The effects of deep abdominal muscle strengthening exercises on respiratory function and lumbar stability. J. Phys. Ther. Sci. 25, 663–665. https://doi.org/10.1589/jpts.25.663.
Lansinger, B., Larsson, E., Persson, L.C., Carlsson, J.Y., 2007. Qigong and exercise therapy in patients with long-term neck pain: a prospective randomized trial. Spine 32, 2415–2422. https://doi.org/10.1097/BRS.0b013e3181573b4b.
Larkey, L., Jahnke, R., Etnier, J., Gonzalez, J., 2009. Meditative movement as a category of exercise: implications for research. J. Phys. Act. Health 6, 230–238.
Lee, M.S., Kim, B.G., Huh, H.J., Ryu, H., Lee, H.S., Chung, H.T., 2000. Effect of Qi-training on blood pressure, heart rate and respiration rate. Clin. Physiol. Oxf. Engl. 20, 173–176.
Maher, C., Underwood, M., Buchbinder, R., 2017. Non-specific low back pain. Lancet 389, 736–747. https://doi.org/10.1016/S0140-6736(16)30970-9.
Miedema, H.S., van der Molen, H.F., Kuijer, P.P.F.M., Koes, B.W., Burdorf, A., 2014. Incidence of low back pain related occupational diseases in The Netherlands. Eur. J. Pain Lond. Engl. 18, 873–882. https://doi.org/10.1002/j.1532-2149.2013.00430.x.
Morone, N.E., Greco, C.M., Weiner, D.K., 2008. Mindfulness meditation for the treatment of chronic low back pain in older adults: a randomized controlled pilot study. Pain 134, 310–319. https://doi.org/10.1016/j.pain.2007.04.038.
Movahedi, M., Ghafari, S., Nazari, F., Valiani, M., 2017. The effects of acupressure on pain severity in female nurses with chronic low back pain. Iran. J. Nurs. Midwifery Res. 22, 339–342. https://doi.org/10.4103/ijnmr.IJNMR_108_16.
Nakata, H., Sakamoto, K., Kakigi, R., 2014. Meditation reduces pain-related neural activity in the anterior cingulate cortex, insula, secondary somatosensory cortex, and thalamus. Front. Psychol. 5 (1489). https://doi.org/10.3389/fpsyg.2014.01489.
Omokhodion, F.O., Sanya, A.O., 2003. Risk factors for low back pain among office workers in Ibadan, Southwest Nigeria. Occup. Med. Oxf. Engl. 53, 287–289.
Ostelo, R.W.J.G., de Vet, H.C.W., 2005. Clinically important outcomes in low back pain. Best Pract. Res. Clin. Rheumatol. 19, 593–607. https://doi.org/10.1016/j.berh.2005.03.003.
Park, D.-J., Lee, S.-K., 2013. What is a suitable pressure for the abdominal drawing-in maneuver in the supine position using a pressure biofeedback unit? J. Phys. Ther. Sci. 25, 527–530. https://doi.org/10.1589/jpts.25.527.
Pensri, P., Baxter, G.D., McDonough, S.M., 2005. Reliability and internal consistency of the Thai version of Roland-Morris disability questionnaire and Waddell disability Index for back pain patients. Chulalongkorn Med. J. 49, 333–349.
Purepong, N., Jitvimonrat, A., Boonyong, S., Thaveeratitham, P., Pensri, P., 2012. Effect of flexibility exercise on lumbar angle: a study among non-specific low back pain patients. J. Bodyw. Mov. Ther. 16, 236–243. https://doi.org/10.1016/j.jbmt.2011.08.001.
Qaseem, A., Wilt, T.J., McLean, R.M., Forciea, M.A., Clinical Guidelines Committee of the American College of Physicians, 2017. Noninvasive treatments for acute, subacute, and chronic low back pain: a clinical practice guideline from the American College of Physicians. Ann. Intern. Med. 166, 514–530. https://doi.org/10.7326/M16-2367.
Rathod, S.R., 2016. Interrater and intrarater reliability of pressure biofeedback unit in measurement of transverses abdominis activity. Indian J. Phys. Ther. 3, 81–84.
Rendant, D., Pach, D., Lüdtke, R., Reisshauer, A., Mietzner, A., Willich, S.N., Witt, C.M., 2011. Qigong versus exercise versus no therapy for patients with chronic neck pain: a randomized controlled trial. Spine 36, 419–427. https://doi.org/10.1097/BRS.0b013e3181d51fca.
Rhoads, C., 2013. Mechanism of pain relief through Tai chi and Qigong. J. Pain & Relief 2, 1–7. https://doi.org/10.4172/2167-0846.1000115.
Roland, M., Fairbank, J., 2000. The Roland-Morris disability questionnaire and the oswestry disability questionnaire. Spine 25, 3115–3124.
Rugulies, R., Krause, N., 2008. Effort-reward imbalance and incidence of low back and neck injuries in San Francisco transit operators. Occup. Environ. Med. 65, 525–533. https://doi.org/10.1136/oem.2007.035188.
Saragiotto, B.T., Maher, C.G., Yamato, T.P., Costa, L.O.P., Menezes Costa, L.C., Ostelo, R.W.J.G., Macedo, L.G., 2016. Motor control exercise for chronic non-specific low-back pain. Cochrane Database Syst. Rev. CD012004 https://doi.org/10.1002/14651858.CD012004.
Sharon, H., Maron-Katz, A., Ben Simon, E., Flusser, Y., Hendler, T., Tarrasch, R., Brill, S., 2016. Mindfulness meditation modulates pain through endogenous opioids. Am. J. Med. 129, 755–758. https://doi.org/10.1016/j.amjmed.2016.03.002.
Silpakit, O., 2011. Srithanya stress scale. J. Ment. Health Thail. 16, 177–185.
Skoglund, L., Jansson, E., 2007. Qigong reduces stress in computer operators. Complement. Ther. Clin. Pract. 13, 78–84. https://doi.org/10.1016/j.ctcp.2006.09.003.
Sterud, T., Tynes, T., 2013. Work-related psychosocial and mechanical risk factors for low back pain: a 3-year follow-up study of the general working population in Norway. Occup. Environ. Med. 70, 296–302. https://doi.org/10.1136/oemed-2012-101116.
Valachi, B., Valachi, K., 2003. Mechanisms leading to musculoskeletal disorders in dentistry. J. Am. Dent. Assoc. 1939 (134), 1344–1350.
van Middelkoop, M., Rubinstein, S.M., Verhagen, A.P., Ostelo, R.W., Koes, B.W., van Tulder, M.W., 2010. Exercise therapy for chronic nonspecific low-back pain. Best Pract. Res. Clin. Rheumatol. 24, 193–204. https://doi.org/10.1016/j.berh.2010.01.002.
Von Korff, M., Jensen, M.P., Karoly, P., 2000. Assessing global pain severity by self-report in clinical and health services research. Spine 25, 3140–3151.