ผลเฉียบพลันของการฝึกชี่กง (กวงอิมจื้อไจ้กงขั้นที่ 1) ในผู้ที่ทำงานสำนักงานที่มีอาการปวดหลังส่วนล่างเรื้อรังแบบธรรมดา

นางสาวสุทธิณี ภัทรสุภฤกษ์

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิทยาศาสตรมหาบัณฑิต
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THE IMMEDIATE EFFECTS OF QIGONG PRACTICE (GUAN YIN ZI ZAI GONG LEVEL 1) ON CHRONIC NON-SPECIFIC LOW BACK PAIN IN OFFICE WORKERS

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A Thesis Submitted in Partial Fulfillment of the Requirements
for the Degree of Master of Science Program in Physical Therapy
Department of Physical Therapy
Faculty of Allied Health Sciences
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สุทธิณี ภัทรสุภฤกษ์ : ผลเฉียบพลันของการฝึกชี่กง (กวงอิมจื้อไจ้กงขั้นที่ 1) ในผู้ที่ทำงานสำนักงานที่มีอาการปวดหลังส่วนล่างเรื้อรังแบบธรรมดา (THE IMMEDIATE EFFECTS OF QIGONG PRACTICE (GUAN YIN ZI ZAI GONG LEVEL 1) ON CHRONIC NON-SPECIFIC LOW BACK PAIN IN OFFICE WORKERS) อ.ที่ปรึกษาวิทยานิพนธ์หลัก: ผศ. ดร. อัครเดช ศิริพร, อ.ที่ปรึกษาวิทยานิพนธ์ร่วม: อ. ดร. สมพงษ์ หาญวจนวงศ์, อ. ดร. สุกัญญา เอกสกุลกล้า, 150 หน้า.

บทนำ: การฝึกชี่กงเป็นการออกกำลังกายรูปแบบหนึ่งตามหลักทางแพทย์แผนจีน ชี่กงประกอบไปด้วยท่าทางการฝึกที่ง่าย และไม่ซับซ้อน ในปัจจุบันพบว่าชี่กงเป็นการออกกำลังกายรูปแบบหนึ่งเพื่อบรรเทาอาการปวดหลังส่วนล่างเรื้อรังแบบไม่เฉพาะเจาะจงได้ โดยเฉพาะอย่างยิ่ง ในผู้ที่ทำงานสำนักงาน ที่ต้องเผชิญกับการเคลื่อนไหวซ้ำๆ และทรงท่าอยู่ในท่าเดิมเป็นเวลานานๆ อย่างไรก็ตาม การศึกษาผลของการฝึกชี่กงในผู้ที่ทำงานสำนักงานที่มีอาการปวดหลังส่วนล่างเรื้อรังแบบไม่เฉพาะเจาะจงยังคงไม่ชัดเจน ดังนั้น งานวิจัยนี้จึงมีการศึกษา ผลเฉียบพลันของการฝึกชี่กง (กวงอิมจื้อไจ้กง ขั้นที่ 1) ในผู้ที่ทำงานสำนักงานที่มีอาการปวดหลังส่วนล่างเรื้อรังแบบธรรมดา

วิธีการทดลอง: ผู้เข้าร่วมงานวิจัยเป็นผู้ที่มีการนั่งทำงานมากกว่าหรือเท่ากับ 4 ชั่วโมงต่อวัน และมีอาการปวดหลังส่วนล่างแบบเรื้อรัง อายุระหว่าง 20-40 ปี จำนวน 72 คน ผู้เข้าร่วมงานวิจัยทุกคนถูกสุ่มเข้ากลุ่มใดกลุ่มหนึ่งในโอกาสที่เท่าๆกัน ได้แก่ กลุ่มฝึกชี่กง ได้รับโปรแกรมการฝึกชี่กง (กวงอิมจื้อไจ้กง ขั้นที่ 1) ในโปรแกรมประกอบด้วย การได้รับการสอนชี่กง 1 ครั้งต่อสัปดาห์ (2 ชั่วโมง) จำนวน 6 สัปดาห์ และ กลุ่มควบคุม ได้รับคำแนะนำในการดูแลตนเองเบื้องต้น และได้รับโปรแกรมการฝึกชี่กง เช่นเดียวกับ กลุ่มทดลอง หลังจากสิ้นสุดงานวิจัย ตัวชี้วัดหลักได้แก่ ระดับความปวด และ ระดับภาวะทุพพลภาพของหลัง ตัวชี้วัดรองได้แก่ มุมการเคลื่อนไหวของหลังส่วนล่าง, อัตราการเต้นของหัวใจ, อัตราการหายใจ และระดับความเครียด

ผลการศึกษา: ในกลุ่มที่ได้รับการฝึกชี่กง (กวงอิมจื้อไจ้กง ขั้นที่ 1) เป็นจำนวน 6 สัปดาห์ พบว่าระดับความปวดและภาวะทุพพลภาพของหลัง ลดลงอย่างมีนัยสำคัญทางสถิติ เมื่อเปรียบเทียบกับค่าก่อนฝึก นอกจากนี้กลุ่มการฝึกชี่กง (กวงอิมจื้อไจ้กง ขั้นที่ 1) มีความแตกต่างกันอย่างมีนัยสำคัญทางสถิติเมื่อเปรียบเทียบกับกลุ่มควบคุมทั้งผลจากตัวชี้วัดหลักและตัวชี้วัดรอง ในขณะที่ กลุ่มควบคุมพบว่า ไม่มีการเปลี่ยนแปลงอย่างมีนัยสำคัญทางสถิติ เมื่อเวลาผ่านไป 6 สัปดาห์

สรุปผลงานวิจัย: การฝึกชี่กง (กวงอิมจื้อไจ้กง ขั้นที่ 1) เป็นวิธีการรักษา อาการปวดหลังส่วนล่างเรื้อรังแบบธรรมดาได้ โดยเฉพาะอย่างยิ่ง ในผู้ที่ทำงานสำนักงาน

ภาควิชา กายภาพบำบัด
สาขาวิชา กายภาพบำบัด
ปีการศึกษา 2559

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5776662037 : MAJOR PHYSICAL THERAPY
KEYWORDS: QIGONG, LOW BACK PAIN, OFFICE WORKER

SUTTINEE PHATTHARASUPHARERK: THE IMMEDIATE EFFECTS OF QIGONG PRACTICE (GUAN YIN ZI ZAI GONG LEVEL 1) ON CHRONIC NON-SPECIFIC LOW BACK PAIN IN OFFICE WORKERS. ADVISOR: ASST. PROF. AKKRADATE SIRIPHORN, Ph.D., CO-ADVISOR: SOMPONG HARNVAJANAWONG, Ph.D., SUKANYA EKSAKULKLA, Ph.D., 150 pp.

Introduction: Qigong practice, a traditional Chinese medicine exercise, composes of both dynamic and static posture as well as uncomplicated posture. It seems to be an alternative method for chronic non-specific low back pain (CNLBP) patients, especially among office workers who are frequently exposed to repetitive movement and prolong static posture. However, the effect of Qigong for CNLBP in office workers is still inconclusive. The objective of this study was to investigate the immediate effects of Qigong practice, Guan Yin Zi Zai Gong level 1, among office workers with CNLBP under the randomized controlled trial research design. Methodology: A Randomized controlled trial was conducted. Seventy-two office workers with CNLBP were screened by primary care physicians for inclusion/ exclusion criteria (age between 20-40 years; sitting period more than 4 hours per day) and were divided randomly allocated by computer program into 2 groups: Qigong and waitlist (served as control) group (*n*=36 each). The participants in Qigong group were received a two hours per week Qigong practice class (Guan Yin Zi Zai Gong level 1) for 6 weeks. The waitlist group was received general advice for low back pain management. After 6 weeks, the participants in waitlist group were received the same practice as the Qigong group. The primary outcomes were pain intensity and back functional disability. The secondary outcomes were back range of motion, heart rate, respiratory rate and mental status. Results: As compared to baseline, Qigong group significantly decreased pain intensity and back functional disability. No statistically significant difference of these parameters was found in waitlist group. As compared between groups, Qigong exercise also significantly decreased pain intensity, back functional disability and secondary outcomes. Conclusion: Qigong practice (Guan Yin Zi Zai Gong level 1) may be an alternative choice for treatment the CNLBP in office workers.

Department:	Physical Therapy	Student's Signature	.....
Field of Study:	Physical Therapy	Advisor's Signature	.....
Academic Year:	2016	Co-Advisor's Signature	.....
		Co-Advisor's Signature	.....

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CHAPTER 1
INTRODUCTION AND SCOPE

1.1 BACKGROUND

Low back pain is the most common musculoskeletal disorder around the world developed countries, about 70%-85% of all people have back pain at some time in life (Anderson 1999, Duthey 2013). In Europe, the lifetime prevalence of low back pain is reported to be over 70% (Van Turder and Koes 2006). In Thailand, the prevalence of low back pain is 34% per year, and the highest prevalence occurred in the working population (Janwantanakul, Pensri et al. 2008). The lifetime prevalence of low back pain is informed as high as 84% (Balague, Mannion et al. 2012). During the second half of the 20th century, the low back pain became one of the biggest problems for the public health system in the Western world and now seems to be extending worldwide (Louw, Morris et al. 2007). In the United States, the total cost of low back pain in 2006 surpassed 100 billion US dollars (Katz 2006). Furthermore, in the Netherlands, the total cost of low back pain in 2007 was appraised at 3.5 billion euro (Lambeek, Van Tulder et al. 2011). The increasing use of computers has been related to the high prevalence of musculoskeletal symptoms of low back pain. Previous studies have also reported that back disorder associated with an occupation (Skovron, Szpaiski et al. 1994, Beeck 2000, Guangxing, Dong et al. 2012). The reviews of epidemiologic studies of low back disorder had shown clear relationships with

heavy physical work, lifting and forceful movement, bending and twisting (awkward posture), whole body vibration and static work postures (Bernard 1997, Hulen 2008, Duthey 2013). This problem is common among office workers, industrial workers as well as taxi drivers.

Low back pain is usual among office workers with one-year prevalence ranging 23% to 38% (Omokhodion and Sanya 2003, Juul Kristensen, Sogaard et al. 2004, Janwantanakul, Pensri et al. 2008). The most common cause of work-related disability appears in people <30 and 30-39 years of age (Janwantanakul, Pensri et al. 2008). Office workers are frequently related to awkward postures, repetitive movement, prolonged static postures such as forward flexion and rotation of trunk and manual handling tasks which are risk factors for developing musculoskeletal symptoms (Andersson 1981, Bernard 1997, Duthey 2013). Static sitting leads to increase of disc pressure, muscle imbalance, core stabilizer muscles weakling and tightness of global muscles. It is often associated with sustained static loading of the lumbar spine and surrounding tissues (Andersson, Ortengren et al. 1974, Pope 1989, Valachi and Valachi 2003). Moreover, they may also encounter with the psychosocial problems for example high job demands, time pressure, mental stress, low job satisfaction, high workload, lack of social support from colleagues and superiors (Wahlstrom 2005, Clay, De Bacquer et al. 2007, Spyropoulos, Papathanasiou et al. 2007), stressful work (Yip, Ho et al. 2001) and effort-reward imbalance at work

(Rugulies and Krause 2008). The psychosocial problem became the only factor to increase back pain in office workers (Wahlstrom 2005, Duthey 2013).

The chronic non-specific low back pain can be treated by injection, medication, self-care, acupuncture, acupressure, bed rest, massage, modalities or exercise (Chou, Qaseem et al. 2007, Hulen 2008). Cochrane reviews have concluded that exercise appears advantageous for people with chronic non-specific low back pain, enhances disk surgery outcomes, and assists return to daily activities and work. The recommended type of exercise typically includes combinations of stretching, strengthening, and unloaded movement exercises (Hulen 2008). Exercise therapy has been widely used as an alternative and additional method for the non-specific type of low back pain as well (Hayden, Van Tulder et al. 2005, Hulen 2008). However, systematic reviews have shown that exercise therapy is effective for chronic but not for acute low back pain (Van Middelkoop, Rubinstein et al. 2010). Typical programs for the chronic non-specific low back pain include passive stretching, the McKenzie method, extension exercises, flexion exercise, aerobic exercise, stretching exercise, meditation training (Weifen, Muheremu et al. 2013). The exercise can reduce pain, increase the range of motion (Schwellnus 2003), reduce the risk of recurrent symptom and help to return to normal activities and work (Van Tulder, Malmivaara et al. 2000).

Meditative movement therapy is one of the several treatments for low back pain, which focuses in mind during the body movement (e.g. attention, body

awareness). Meditation techniques vary widely, making standardized research on meditation challenging and include either keeping the mindfulness focused on a specific target such as an image, an ideal, a incantation or the breath itself (Caspi and Burleson 2005). Often in forms of meditative movement therapy, it is recommended that the mind should be involved in the motion practice in the present moment and exclusive of all other thoughts. Meditative movement therapy is a unique technique. It usually includes the body movement that is typically described as slow, relaxed, and flowing, but may range from a high level of dynamic movement to static postures (Larkey, Jahnke et al. 2009). The example of dynamic practice is spontaneous Qigong or tai chi chuan or Wushu (Trakarnvijit 2015). Whereas, static practice includes Qigong standing meditation and yoga in which the body is held in a variety of positions for a period. The aims of both dynamic and static meditative movement practices include a focus on breathing to bring the mind and consciousness to a restful state but also to bring additional oxygenation and "energy" to the body. The breathing may be passive with a simple reminder to keep the mind in a state of watching the breath. In other forms of meditative therapy, breathing is designated in very methods, either for patterning with the movement (e.g. exhaling as they move downward and inhaling as arms slowly rise) or for breathing only exercises in which patterns of slow or quick, short or deep breaths. They are combined to create specific effects of each therapy (Larkey, Jahnke et al. 2009). The deep state of meditative therapy is relaxation. It is an important factor to

practice due to relaxation can improve physical health (Kabat Zinn, Lipworth et al. 1985, Morone, Greco et al. 2008, Tavee, Rensel et al. 2011), mental health (Caspi and Burleson 2005, Kim and Kim 2005, Mackenzie, Poulin et al. 2006) and sleep quality (Mustian 2013, Wang, Lee et al. 2015).

Qigong exercise has specific characteristics which are different from others treatment. It is based on traditional Chinese medicine and composed of both dynamic and static movement as well as uncomplicated posture. Qigong exercise seems to be an alternative method for chronic low back pain patients, especially among office workers who are frequently related to prolong static posture and repetitive movement. Otherwise, Qigong exercise can improve psychological problem in office workers which is one key factor of chronic pain. Furthermore, the effect of Qigong for low back pain is still inconclusive, no study has involved in office worker so far, and the protocol in the previous researches are inconclusive (Hall, Maher et al. 2009, Lee, Max et al. 2009, Blodt, Pach et al. 2014, Yuan, Guo et al. 2014). Hence, our study was designed to investigate the immediate effects of Qigong practice, Guan Yin Zi Zai Gong level 1, among office workers with chronic non-specific low back pain under the randomized controlled trial research design.

1.2 OBJECTIVE OF THIS STUDY

To investigate the immediate effects of qigong practice (Guan Yin Zi Zai Gong level 1) in office worker suffering with chronic non-specific low back pain.

1.3 RESEARCH QUESTION

Does Qigong practice (Guan Yin Zi Zai Gong level 1) improve pain intensity, disability, range of motion of back and mental status in office worker suffering with chronic non-specific low back pain?

1.4 STUDY HYPOTHESIS

Qigong practice (Guan Yin Zi Zai Gong level 1) should improve on pain, disability, range of motion of back and mental status in office worker suffering with chronic non-specific low back pain.

1.5 SCOPE OF THE STUDY

Participants consists of 72 patients, who are the full time office worker, aged 20-40 years with chronic non-specific low back pain, both male and female. They were recruited from the companies in Bangkok Metropolitan Region. The subjects were selected according to criteria below:

1.5.1 INCLUSION CRITERIA

- Having non-specific chronic low back pain (The pain localized between the twelfth rib and inferior gluteal folds with or without leg pain)
- Male and female aged 20-40 years

- The companies in Bangkok Metropolitan area
- Reported sitting at least four hours on a working day
- Having low back pain persisting ≥12 weeks
- Intensity of the average LBP over last seven days exceeded 40 mm. on a 100 mm visual analog scale (VAS)
- Not involved in any physical treatment during the last three months
- Without any sign of neurological disorder
- Willingness to participate and Good communication skills in Thai language
- No pregnancy
- No neurologic abnormality (motor or sensory deficit)

1.5.2 EXCLUSION CRITERIA

- Red flags (for example tumor, fracture, rheumatoid arthritis, osteoporosis, etc.)
- Having medications during the treatment

1.6 EXPECTED BENEFIT

Qigong practice (Guan Yin Zi Zai Gong level 1) is effective to improve on pain, disability, range of motion of back and mental status in office worker suffering with chronic non-specific low back pain.

1.7 CONCEPTUAL FRAMEWORK

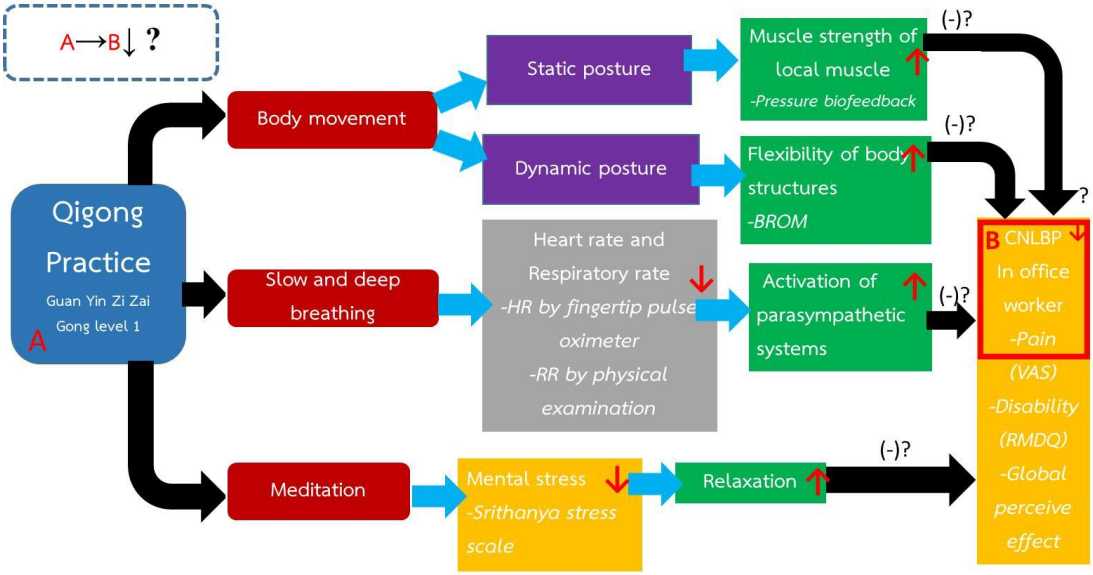

Figure 1.1 Conceptual framework

CHAPTER 2
LITERATURE REVIEW

2.1 DEFINITION OF LOW BACK PAIN

Low back pain definition is the pain localized between the twelfth rib and inferior gluteal folds with or without leg pain (Krismer and Van Tulder 2007). Low back pain is regularly classified based on either the cause of symptoms or the duration of pain condition. The cause of low back pain is typically divided into two groups: specific and non-specific low back pain. Specific low back pain was defined as low back pain that known pathological and specific cause whereas non-specific low back pain was defined as low back pain not attributable to a recognizable specific cause of the pain (Van Turder and Koes 2006, Chou 2011, Balague, Mannion et al. 2012). About 90 percent of low back pain cases of low back pain were defined as non-specific low back pain (Manek and MacGregor 2005). Moreover, low back pain may also be classified according to the duration of pain as acute pain (less than 4 weeks), sub-acute pain (between 4 weeks and 3 months), or chronic pain (3 months or more) (Bratton 1999, Chou, Qaseem et al. 2007, Krismer and Van Tulder 2007).

2.2 CHARACTERISTIC OF NON-SPECIFIC LOW BACK PAIN

Non-specific low back pain is painful tension, soreness or stiffness in the lower back region for which it is not possible to identify a specific pathology of the

pain such as osteoporosis, tumor, infection, fracture, rheumatoid arthritis, structural deformity, inflammatory disorder (e.g. ankylosing spondylitis), radicular symptom or cauda equine syndrome (Van Turder and Koes 2006, Chou 2011, Balague, Mannion et al. 2012). Non-specific low back pain is caused by problems with structures in the back examples muscles, joints, ligament, discs, or tendons (NICE 2009, Hutchinson, Ball et al. 2012). It is an intermittent and recurring condition (Pengel, Herbert et al. 2003, Stanton, Henschke et al. 2008). Besides, non-specific low back pain made loss of work potency, poor quality of life, and high medical expenses, and economic burden for society in the patients (Deyo, Mirza et al. 2006, Krismer and Van Tulder 2007, Dagenais, Caro et al. 2008). Moreover, non-specific low back pain symptom is a major source of morbidity and disability among the office worker population (Vargas, Gonzalez et al. 2012).

2.3 MEDITATIVE MOVEMENT THERAPY

Meditative movement therapy is one of the several treatments for low back pain, which focuses in mind during the body movement (e.g. attention, body awareness). Meditation techniques vary widely, making standardized research on meditation challenging and include either keeping the awareness focused on a specific target such as an image, an ideal, a mantra or the breath itself (Caspi and Burleson 2005). Often in forms of meditative movement therapy, it is suggested that the mind should be involved in the movement practice in the present moment and

exclusive of all other thoughts. Meditative movement therapy is a unique technique. It usually includes the body movement that is characteristically described as slow, relaxed, and flowing, but may range from a high level of dynamic movement to static postures (Larkey, Jahnke et al. 2009). The example of dynamic practice is spontaneous Qigong or tai chi chuan or Wushu (Trakarnvijit 2015). Whereas, static practice includes Qigong standing meditation and yoga in which the body is held in a variety of positions for a period. The aims of both dynamic and static meditative movement practices include a focus on breathing to bring the mind and consciousness to a restful state but also to bring additional oxygenation and "energy" to the body. The breathing may be passive with a simple reminder to keep the mind in a state of observing the breath. In other forms of meditative therapy, breathing is prescribed in very specific ways, either for patterning with the movement (e.g. inhaling as arms slowly rise and exhaling as they move downward) or for breathing-only exercises in which patterns of quick or slow, deep or short breaths. They are combined to create specific effects of each therapy (Larkey, Jahnke et al. 2009). The deep state of meditative therapy is relaxation. It is an important factor to practice due to relaxation can improve physical health (Kabat Zinn, Lipworth et al. 1985, Morone, Greco et al. 2008, Tavee, Rensel et al. 2011), mental health (Caspi and Burleson 2005, Kim and Kim 2005, Mackenzie, Poulin et al. 2006) and sleep quality (Mustian 2013, Wang, Lee et al. 2015). In this review, we have compiled related research about the effects of meditative movement therapy for pain reducing in low back

pain patients as showed in Table 2.1. Databases were searched (Scopus, Pedro, Pubmed, ScienceDirect, The Cochrane Library from 1980 to November 2015) using keywords: Qigong or Qi gong or Qigong or Qi Kong or Chigong or Chi gong or Chikong or Chi-kong or Qi Kung or Qi kung or Chikung or Chi kung or Jinghong or Jin gong or Tai chi or Tai qi or Meditation or Breath Therapy or Yoga and Low back pain and randomized controlled trial or randomized controlled trial or controlled clinical trial. The result indicated 20 meditative movement therapies conducted. Six randomized controlled trials (RCTs) were classified as high quality based on PEDro scale (Appendix 17). 6 studies showed greater statistical significant difference ($P<0.05$) for pain and disability improvement in chronic low back pain patients comparing with other treatments (e.g. general practice care, physical therapy, self-care book, general exercise, education and no intervention).

Table 2.1 Characteristics of the Studies about meditative movement therapy in chronic low back pain patient

Reference	Sample size, No. of groups	Mean Age (± SD)	Inclusion Criteria	Treatment group	Control group	Outcome Assessment a) Short term b)Long term follow up	Outcome measure	Results	Pedro Score (10)
(Zhuo, Dighe et al. 1983)	LBP 16:16	N/A	-Age 23-71 year old -Disease duration: 2 week to 49 year	-Qigong (breathing and relaxation with tape instruction, 30 min, twice weekly for 2 weeks)	-EMG biofeedback (30 min, twice weekly for 2 weeks)	-Baseline a) 2 weeks b) -	-Pain intensity (4-point Likert scale)	-Intergroup: No significant -Within group: Qigong: (p-value<0.04) Biofeedback: No significant	** N/A
(Mehling, Hamel et al. 2005)	CLBP 16:12	Breath therapy (49.7±12.1) Physical therapy (48.7±12.5)	-Age 20-70 year old -Continuous CLBP of 3 to 24 months -Seeking help from primary care providers for LBP	-Breath therapy (BT) was provided by 5 certified breath therapy 1 session (60 min.) and 12 individual therapy session of equal duration (45 min.) for 6-8 weeks	-Physical therapy (PT) was provided by physical therapist 1 session (60 min.) and 12 individual therapy session of equal duration for 6-8 weeks	-Baseline a) 6 weeks b) 6 months	-Pain intensity (VAS) -Back disability (RMDQ) -Quality of life (SF-36)	-No significant difference between groups but: -Pre to post intervention in both groups improved pain -BT improved in function , physical and emotional role -PT improved in vitality	6

Reference	Sample size, No. of groups	Mean Age (± SD)	Inclusion Criteria	Treatment group	Control group	Outcome Assessment a) Short term b)Long term follow up	Outcome measure	Results	Pedro Score (10)
(Sherman, Cherkin et al. 2005)	CLBP 36:35:30	Yoga group (44±12) Exercise group (42±15) Self-care group (45±11)	-Age 20-64 year old -Back pain 3-15 months -Had visited a primary care provider for treatment	-Yoga class (1 session/week , total 12 sessions) -Conventional therapeutic exercise classes (warm up, aerobic exercise, strengthening exercise) 12 weekly 75 minute classes and received handouts that described home practice	-Self-care book	-Baseline a.1) 6 weeks a.2) 12 weeks b) 26 weeks	-Back disability *(RMDQ)* -Bothersomeness of Pain symptom	-Between yoga group and self-care group in 6, 12, 26 weeks are significant difference between groups all outcomes (p-value<0.05)	7
(Williams, Petronis et al. 2005)	NCLBP 24:20	Yoga group (48.7±10.6) Control group (48.0±1.96)	-Age>18 year old -NLBP>3 months - Ability speak English -Ambulatory	-Iyengar yoga 15 hours class each week taught by yoga instructors and practice at home 30 min./day and 5days/week Total 16 weeks	-Education	-Baseline a) 16 weeks b) 3 months	-Functional outcomes: Pain Disability Index Present Pain Index (VAS) -Other outcomes: Fear of movement Pain attitude Self-efficacy Range of Motion Pain medication usage	-Significant difference between groups in all outcomes (p-value<0.05) except psychological and behavioral outcome	5

Reference	Sample size, No. of groups	Mean Age (± SD)	Inclusion Criteria	Treatment group	Control group	Outcome Assessment a) Short term b)Long term follow up	Outcome measure	Results	Pedro Score (10)
(Mehling 2006)	CLBP 14:12	Subjects were similar in age on average about 49 years old	Primary medical care for CLBP of at least 3 months	-Breath therapy (BT) (1 evaluation session (60 min.) and 12 individual 45 min. therapy sessions over 6-8 week at medical center and They were introduced to 20-30 min. at home exercise)	-Physical therapy (PT) (1 evaluation session (60 min.) and 12 individual 45 min. therapy sessions over 6-8 week at medical center and They were introduced to 20-30 min. at home exercise)	-Baseline a) 6-8 weeks b) 6 months	-Pain intensity (VAS) -Back disability *(RMDQ)* -Quality of life (SF-36)	-BT group improved significant difference in LBP related functional physical and emotional role components of SF36 at 6-8 weeks (p-value<0.05) -PT group improved significant difference of SF36 at 6-8 weeks (p-value<0.05) -6 months were similar in both group	4
(Tekur, Singphow et al. 2008)	CLBP 40:40	Yoga group (49±3.6) Control group (48±4)	-Age 18-60 year old -CLBP>3 months -Pain in lumbar spine with or without radiation to legs	-Yoga (1 week intensive residential yoga program)	-Control group (Physical exercise under a trained physiatrist)	-Baseline a) 1 week (post intervention)	-Pain-related outcomes (ODI) -Spinal flexibility By goniometer	-Significant difference reduction in ODI scores in the yoga group compared to control group (p-value<0.05) -Spinal flexibility measures improved significantly in both groups (p-value<0.05) but yoga group had greater improvement as compared to control group	7

Reference	Sample size, No. of groups	Mean Age (± SD)	Inclusion Criteria	Treatment group	Control group	Outcome Assessment a) Short term b)Long term follow up	Outcome measure	Results	Pedro Score (10)
(Williams, Abildso et al. 2009)	CLBP 43:47	Yoga group (48.4±1.86) Control group (47.6±1.47)	-Age 18-70 year old -Live within 1 hour drive of Morgantown -Insured by a participating provider -BMI<37 -LBP>3 months -ODI score 10-60 -VAS score of 3-8 cm.	-Yoga group (24 weeks of yoga consisting of twice weekly 90 minute classes and 30 minute of yoga at home on non-class days)	-Control group :Information about the individual's medication and waitlisted (received yoga class 6 months after the conclusion of the study)	-Baseline a.1)12 weeks a.2) 24 weeks b) 48 weeks (6 months follow up)	-Functional disability (ODI) Questionnaire -Pain intensity (VAS) -Back depression inventory -Pain medication -Usage Questionnaire	-Yoga group are significant difference improves functional disability, pain intensity and depression compared to control group (p-value<0.05)	6

Reference	Sample size, No. of groups	Mean Age (± SD)	Inclusion Criteria	Treatment group	Control group	Outcome Assessment a) Short term b)Long term follow up	Outcome measure	Results	Pedro Score (10)
(Tekur, Chametcha et al. 2010)	CLBP 40:40	Yoga group (49±3.6) Control group (48±4)	-Age 18-60 year old - CLBP>3 months -Pain in lumbar spine with or without radiation to legs	-Yoga group (1 daily schedule)	-Control group (physical exercise)	-Baseline a) after treatment	-Quality of life (WHOQOL-BREF) -Perceived stress scale (PSS) -SLR test	-After treatment, all outcomes have significant difference between groups (p-value<0.05)	8
(Hall, Maher et al. 2011)	NCLBP 80:80	-Tai Chi (43.4±13.5) -Control (44.3±13.0)	-Age 18-70 year old -Persistent NCLBP±leg pain	-Tai chi (Included warm up and cool down) 40 min./ session, two sessions/week for eight weeks followed by once per week for two weeks (total 18 sessions)	-Waitlist group	-Baseline a) 10 weeks b) -	-Bothersomeness of pain symptom -Pain intensity (NRS) -PDI -RMDQ -QBPDS -PSFS -GPE	-Statistically significant difference between groups in all outcomes (p-value<0.05)	7

Reference	Sample size, No. of groups	Mean Age (± SD)	Inclusion Criteria	Treatment group	Control group	Outcome Assessment a) Short term b)Long term follow up	Outcome measure	Results	Pedro Score (10)
(Sherman, Hogeboom et al. 2001)	CLBP 92:91:45	Yoga group (46.5±9.8) Stretching group (49±9.9) Self-care group (50.8±9.1)	-CLBP>3 months -Ability speak English	-Yoga 12 weeks -Stretching exercise 12 weeks	-Self-care book	-Baseline a.1) 6 weeks a.2) 12 weeks b) 26 weeks	-Back disability *(RMDQ)* -Bothersomeness of pain symptom -Patient global rating of improvement -Patient satisfaction	-Between baseline and 12 weeks have significant difference between group in all outcomes (p-value<0.05)	5
(Tilbrook, Cox et al. 2011)	CLBP 156: 157	Yoga group (46.4±11.3) Usual care (46.3±11.5)	-Age 18-65 year old -LBP in the past 18 months -Score of 4 or more on RMDQ Musculoskeletal pain bounded by the lowest ribs and gluteal folds	-Yoga group (75 minute/ class, 1class/week, 12 classes by 12 teachers over 3 months)	-Control group was offered 1-time session of yoga after final follow up	-Baseline a) 3 months b.1) 6 months b.2) 12 months	-Back disability *(RMDQ)*	-Yoga group had better back function at 3,6,12 months significant difference than the usual care group (p-value<0.05)	6
				All participants received a back pain education booklet and usual care					

Reference	Sample size, No. of groups	Mean Age (± SD)	Inclusion Criteria	Treatment group	Control group	Outcome Assessment a) Short term b)Long term follow up	Outcome measure	Results	Pedro Score (10)
(Hartfiel, Burton et al. 2012)	Employee with Stress and LBP 37:37	Yoga group (46.1 ±11.5) Control group (43.6 ±11.5)	-Age 25-64 year old	-Yoga group (received one 50 min. Dru Yoga session each week for 8 weeks and 20 min. DVD for home practice)	-Control group (No intervention)	-Baseline a) 8 weeks	-Perceived stress (PSS) -Back disability (RMDQ) -Psychological well-being (PANAS-X)	-Yoga group reported significant difference of reductions in perceived stress and back pain (p-value<0.05) and substantial improvement in psychological well-being	4
(Tekur, Nagarathna et al. 2012)	CLBP 40:40	Yoga group (49±3.6) Exercise group (48±4)	-Age 18-60 year old - CLBP>3 months -Pain in lumbar spine with or without radiation to legs	-Yoga group exercise (Special technique for back pain) every day in 1 week	-General exercise for back pain every day in 1 week	-Baseline a) 1 week	-State of anxiety -Trait anxiety -BDI -Pain intensity (NRS) -Sit and reach	-Between group are significant difference of all outcomes (p-value<0.05)	8

Reference	Sample size, No. of groups	Mean Age (± SD)	Inclusion Criteria	Treatment group	Control group	Outcome Assessment a) Short term b)Long term follow up	Outcome measure	Results	Pedro Score (10)
(Saper, Boah et al. 2013)	NCLBP 49:46	1 class /week (46.4 ±11.1) 2 classes /week (48.7 ±10.3)	-Age 13-64 year old -Current NCLBP persisting≥12 weeks -Having average LBP intensity≥4 for previous week	-1 yoga class/week 12 weeks	-2 yoga classes/week 12 weeks	-Baseline a.1) 6 weeks a.2) 12 weeks	-Pain intensity -Back Disability (RMDQ) - Quality of life (SF-36)	-Pain and Back-related function improved within both group (p-value<0.05) but no significant difference between once-weekly and twice-weekly yoga classes	6
				Both groups have instructors encouraged all participants to practice 30 minutes daily at home and for home practice participants received an audio CD of the protocol and hand book					
(Tilbrook, Hewitt et al. 2014)	CLBP 156:157	-	-	-Yoga exercise 12 classes in 3 months	-Usual GP care 12 classes in 3 months	-Baseline a) 3 months b.1) 6 months b.2) 12 months	-Back disability (RMDQ)	-Between group are significant difference in RMDQ score in 3,12 months (p-value<0.05)	4
				All participants received a copy of book back and usual care					

Reference	Sample size, No. of groups	Mean Age (± SD)	Inclusion Criteria	Treatment group	Control group	Outcome Assessment a) Short term b)Long term follow up	Outcome measure	Results	Pedro Score (10)
(Sherman, Wellman et al. 2013)	NCLBP Main cohort 78:74:40 Saliva cohort 57:51:25	Main cohort Yoga group (47±9.5) Stretching group (49±10.1) Self-care group (51±8.4) Saliva cohort Yoga group (49±8.9) Stretching group (50±9.5) Self-care group (52±7.9)	-Age 20-64 year old -CLBP>3 months -Rated their pain at least 3 on 11 point	-Yoga class (1 session/week , total 12 sessions) -Stretching exercise (1 session/week , total 12 sessions)	-Self-care book	-Baseline a.1) 6 weeks a.2) 12 weeks b) 26 weeks	-Back disability (RMDQ) -Potential mediating Variables: -Cognitive appraisal : Fear avoidance, Self-efficacy, Self-awareness,-Affect and Stress: Psychological distress, Perceived stress (PSS), Positive States of mind, Sleep Quality -Physical Activity -Physiological Measures of Neuroendocrine function	-Significant difference between in all outcome after 6, 12 weeks (p-value <0.05)	4

Reference	Sample size, No. of groups	Mean Age (± SD)	Inclusion Criteria	Treatment group	Control group	Outcome Assessment a) Short term b)Long term follow up	Outcome measure	Results	Pedro Score (10)
(Weifen, Muheremu et al. 2013)	NCLBP in Retired Athletes 38:47:47:47:141	Tai chi group (37.5±5.2) Backward walking (38.2±5.8) Jogging (37.2±5.6) Swimming (37.5±5.5) No exercise (38.1±5.2)	-Age 25-45 year old -NCLBP confined to the lumbar vertebrae with a duration of 1-5 years -Intensity of average LBP over last 7 days>40 mm. in VAS -Not involved in any physical treatment during the last three months	-Tai chi group (Chen Style 24 steps) 45 min. in each day and 5 days a week over 6 months -Backward walking group 5 days/week 30 min./day following a 15 min. warm up exercise over 6 months -Jogging group 5 days/week 30 min./day following a 15 min. warm up exercise over 6 months -Swimming group 5 days/week 30 min./day following a 15 min. warm up exercise over 6 months	-No exercise	-Baseline a.1) 3 months a.2) 6 months	-Pain intensity (VAS) -BMI -HR -BP	-Two time points (3,6 months) pain intensity no significant difference between tai chi and swimming group but significant between tai chi and backward walking, jogging and no exercise (p-value<0.05)	6

Reference	Sample size, No. of groups	Mean Age (± SD)	Inclusion Criteria	Treatment group	Control group	Outcome Assessment a) Short term b)Long term follow up	Outcome measure	Results	Pedro Score (10)
(Blodt, Pach et al. 2014)	CLBP 64:64	-Qigong (45.7±10.0) -Exercise therapy (47.7±10.8)	-Age 20-65 year old -LBP>3months but<5 years -LBP more prominent than pain in other spine areas -Average pain intensity in the previous 7 days≥40 mm. measured on VAS (0-100 mm.) -Informed consent -Not involved in any Qigong/or exercise therapy or participation in the previous 12 months	-Qigong (based on Neiyang gong: Jin and Dong gong) weekly session of 90 min. over a period of 3 months (12 sessions)	-Exercise therapy (Warm-up using a dynamic gym ball, Strengthening exercise, Stretching and relaxation) 60 min./session and Weekly session, 12 sessions over 3 months	-Baseline a) 3 months b.1) 6 months b.2) 12 months	-Pain intensity (VAS) -Back disability (RMDQ) -Quality of life (SF-36)	-At 3 months : No significant difference between groups -At 6 months: Significant difference between groups in VAS (p-value<0.05) -AT 12 month: Significant difference between groups in RMDQ (p-value<0.05)	5

Reference	Sample size, No. of groups	Mean Age (± SD)	Inclusion Criteria	Treatment group	Control group	Outcome Assessment a) Short term b)Long term follow up	Outcome measure	Results	Pedro Score (10)
(Aboagye, Karlsson et al. 2015)	NCLBP 52:52:55	Yoga group (46.9±9.6) Exercise group (46.3±9.3) Advice group (43.9±11.7)	-Age 18-60 year old -Pain intensity ≥90 point of OMPSQ screening -Sufficient command of Swedish	-Yoga (Kundalini based standardized program) Twice a week for 6 weeks -Exercise program Twice a week for 6 weeks -In both group received one evaluation session (60 min.) and individual 45 min. therapy sessions over 6-8 weeks. They were introduced 20-30 min. of home exercise	-Self-care advice and Booklet (over 6 weeks)	-Baseline a) 6 weeks b.1) 6 months b.2) 12 months	-HRQOL : mobility, self-care, usual activities, pain/ discomfort and anxiety/ depression	-Medical yoga is cost effective compared with self-care advice and significant improvement in HRQOL (p-value<0.05)	7

Reference	Sample size, No. of groups	Mean Age (± SD)	Inclusion Criteria	Treatment group	Control group	Outcome Assessment a) Short term b)Long term follow up	Outcome measure	Results	Pedro Score (10)
(Nambi, Inbasekaran et al. 2014)	NCLBP 30:30	Iyengar yoga group (44.26±9.26) General exercise group (43.66±8.82)	-Age 18 year old -Symptoms persisting for 3 months -Ambulatory	-Iyengar yoga for 4 weeks	-General exercise group for 4 weeks	-Baseline a) 4 weeks b) 6 months	-Pain Intensity (VAS) -General health (HRQOL)	-At 4 weeks and 6 months pain intensity, physically unhealthy days, mentally unhealthy days and activity limitation days shows significant difference in between groups (p-value<0.01)	5

N/A= Not applicable and full paper is not available
LBP= Low Back Pain
VAS= Visual Analogue Scales
GP= General Practitioner
SF-36= The Short Form (36) Health Survey
BDI = Beck's Depression Inventory
HR= Heart Rate
RMDQ = Roland-Morris Disability
NRS= Numerical Rating Scales
PSS= Perceived Stress Scale
QBPDS= Quebec Back Pain Disability Scale
BMI= Body Mass Index
BP= Blood Pressure
PANAS-X= the Positive Affect and Negative Affect Schedule-Expanded Form
HRQOL= Health-Related Quality of Life
EMG= Electromyography
NCLBP= Nonspecific Chronic Low Back Pain
SLR= Straight Leg Raise
PDI= Pain Disability Index
GPE= 11-point Global Perceived Effect Questionnaire
PSFS= The Patient Specific Functional Scale
WHOQOL-BREF= The World Health Organization Quality of Life
ODI= Oswestry Disability
CLBP= Chronic Low Back Pain
OMPSQ= Orebro Musculoskeletal Pain Screening Questionnaire

Based on the literature review, we found that the meditative movement therapies used for low back pain consisted of yoga (n=14/19), breath exercise (n=2/19) and Qigong exercise (tai chi) (n=4/19). However, Qigong exercise has specific characteristics which are different from others. It is based on traditional Chinese medicine and composed of both dynamic and static movement as well as uncomplicated posture. Otherwise, the therapeutic effect is still unclear (Weifen, Muheremu et al. 2013, Blodt, Pach et al. 2014) and small research reported the effect of Qigong exercise for low back pain conditions so far (Yuan, Guo et al. 2014). Therefore, our study is interested in and focus on the effects of Qigong exercise according to traditional Chinese medicine in improving the non-specific chronic low back pain symptom.

2.4 DEFINITIONS OF QIGONG

Qi, a Chinese term refers to all types of vital energy in humans, animals and nature. Human received qi from their parents at birth and received from other activities and source such as eating, breathing, walking and sunlight. Gong means training, practice, action and working with the purpose of cultivation (Yang 1946). Qigong means the method of practice to achieve a balance of life energy (Yang 1946). Qigong consists of three main elements include breathing exercise, meditation and general movement. Qi has three characteristics: Heaven qi is made up from the

forces which are outside the world such as sunshine, moonlight, and the moon's effect on the tides. Earth qi, which is the most important of the three, is everything in the world such as land, sea, rivers, trees, wind and animals. Finally, human qi is the energy related to human. Three qi energy will interchange together when the qi is balance, the human will not have illness, plants will grow, the animals will thrive and rain will come as normal (Yang 1946).

2.5 HISTORY OF QIGONG IN THAILAND

. Qigong originated from Chinese culture since ancient times for healing the diseases. Later, when religion became influence, it has become the subject of the training of each sector such as Taoism or philosophy. For this reason, Qigong exercise has many forms. When China entered the culture revolution, Qigong exercise was published. Qigong classes and clubs were opened and research on Qigong was conducted. Later, Qigong has been accepted by the government and the Chinese people (Yang 1946). In 1953, the therapeutic Qigong clinic (The named is "Pai Jai Her") was opened for the first time and has conducted courses and published officially by Professor Liu Gui Zen. In 1958, Thailand had organized a seminar on Qigong course for treatment for the first time of cooperation with Pai Jai Her clinic from China. In 1968, Professor Kamon Kativorate opened the school for the Qigong exercise and had written the book "How to train energy for therapeutic". Though,

this is the first time in Thailand, it failed to draw interest among Thai people. In 1994, the Chinese people in Thailand invited Professor Yang Pei Xen from China to treat ill and sick people in Thailand. During Professor Yang Pei Xen stays in Thailand for over 20 years and to date, He teaches the basic of Qigong exercise to improve the self-care management to many Thai people (Ariyanuchitakun 2002). Currently, there are several Qigong exercise classes and Qigong exercise is popular among Thai-Chinese people and others in Thailand for health promotion, health prevention and treatment

2.6 QIGONG IN TRADITIONAL CHINESE MEDICINE

Qigong, which is part of Chinese medicine, follows the principle of regulating the “qi” and is described as combination of mind and body and activating self-healing capacities (Blodt, Pach et al. 2014). The Chinese called qi as a complex energy. It is an energy that is manifested both physically and spiritually-mentally. Qi energy will move with blood and oxygen circulation in the whole body (Carnie 2002). Qi energy flows in every part of the body and encourages the work of the organs. According to the understanding of Chinese, Qigong creates energy in the body and internal organs and qi flows in the body along the meridian lines. The meridian lines are pathways or lines of energy that consists of 20 major channels. Twelve of these relate to specific internal organs or functions, which are: Heart, Pericardium, Triple

Heater, Large Intestine, Small Intestine, Gall Bladder, Liver, Bladder, Lungs, Kidneys, Stomach and Spleen (Yang 2012, Trakarnvijit 2015) and the remaining eight extraordinary vessels have their own functional characteristics and clinic utility of the channels (Yang 1946).The characteristic of twelve main meridian lines is a link line between internal and external organs and meridian line is able to give blood and oxygen for the revolution to the various systems within the body. It made tendons, bones and joints to have flexibility. So, it very important if the qi energy flows in the meridian lines, the organ will perform its functions effectively (Carnie 2002).

2.7 LOW BACK PAIN ACCORDING TO TRADITIONAL CHINESE MEDICINE THEORY

In Traditional Chinese Medicine, low back pain is related with unbalance of Yin-Yang, the five elements and the stagnancy of qi & blood circulation (Yang 1946, Sherman, Hogeboom et al. 2001, Lee, Jang et al. 2003, Xiong, Virasakdi et al. 2011). It also relates to the function impairment of the visceral organs and meridians: Kidney (Xiong, Virasakdi et al. 2011), Urinary bladder (Sherman, Hogeboom et al. 2001), Liver (Sherman, Hogeboom et al. 2001), Spleen (Sherman, Hogeboom et al. 2001), Pancreas and Gall bladder (Sherman, Hogeboom et al. 2001). Qigong exercise is one of traditional complementary intervention to help Yin-Yang balance, improve qi and blood circulation and stretch the meridian line (Yang 1946, Sancier 1996, Low and Ang 2010). When qi and blood can move without obstacle, the tissues are nourishing

and then low back pain has been cured (Trakarnvijit 2015). Especially, in office workers who suffer from the pain caused by prolonging static posture. Since the meridian lines are compressed during the long period of sitting caused the qi and blood stagnant (Yang 1946, Teeguarden 2015, Trakarnvijit 2015).

2.8 TYPE OF QIGONG

Regarding movement, Qigong is divided into two types: dynamic Qigong (dong gong) and tranquil Qigong (jing gong). Dong gong is a rhythmic movement of the body that cooperates with breathing and body awareness, whereas Jing gong is static Qigong with concentration (Lee, Max et al. 2009, Trakarnvijit 2015). Besides, regarding benefit, Qigong is separated into three types: healing Qigong, meditation Qigong and martial Qigong. Healing Qigong consists of two styles. The first style is internal Qigong that is self-directed and involves body movements and meditation. It can be performed with or without a practitioner (Ernst, Pittler et al. 2008). The second style is external Qigong; it is conducted by a trained practitioner using hands and any part of the body to direct qi energy go through the patient's body. Generally, external Qigong is used for the beginner and internal Qigong for the advanced practitioner (Lee, Max et al. 2009). For meditation Qigong, it focuses on the qi energy to move in a particular part of the body, breathing pattern, sounds, specific thought, images, and

concepts. Martial Qigong is dynamic and strenuous; it is used by martial artists to supplement their power by way of stimulating qi in the body (Trakarnvijit 2015).

2.9 QIGONG AND LOW BACK PAIN

Three essential elements of Qigong compose of body position, meditation and breathing exercises. Posture in Qigong practice can be static or slow dynamic position. It helps improve the flexibility of global muscles of back, joints, fascia, tendons and nerves and also the strength of local muscles of the back (Comerford and Mottram 2001, Larkey, Jahnke et al. 2009, Yang 2012). Meditation in Qigong exercise can change brainwave frequency from beta to alpha and can reduce symptoms of stress such as noradrenaline excretion in urine and also the activity of sympathetic nervous system; consequently, it can reduce the emotional of stress (Skoglund and Jansson 2007). The last part of Qigong is breathing exercise. Flow qi energy in the meridian lines. So, if qi energy flows within the meridian lines, the internal and external organs will perform its functions efficiently. Therefore, it is reasonable to say that Qigong seems to be able to reduce the chronic low back pain in office workers who have to face up with stress and prolong sitting during their daily work.

2.10 QIGONG PRACTICE (GUAN YIN ZI ZAI GONG)

Guan Yin Zi Zai Gong practice was developed by Professor Yang Pei Xen since 1995. The objectives of this practice are increasing the Qi energy in the body and moving qi within meridian lines. The practice pattern is easy and comprehensive to manage the physical, mental and emotional problems. The key elements of Guan Yin Zi Zai Gong level 1 include the three steps of basic Qigong such as dynamic and static Qigong, breath therapy, meditation and additional with the instruction of Qigong practice for daily life (acupressure, food dietary and general exercise) based on Traditional Chinese Medicine. (Yang, Kim et al. 2005). Guan Yin Zi Zai Gong level 1 is related to improve the chronic non-specific low back pain problem since the program is holistic with the combination of physical and mental treatment (Yang 2012). The physical treatment in this program consists of the static and dynamic movement with deep breathing; it helps strengthening and flexibility of back muscles (Yang 2008, Yang 2012). Moreover, the meditation was conducted during the whole period of exercise to reduce the mental stress (Yang 2012). So, this program would improve chronic non-specific low back pain, particularly among office worker who are frequently exposed to the physical and psychological problem.

2.11 RELATED RESERCH CORNCERNING PSYCHOLOGICAL EFFECT AFTER QIGONG EXERCISE

Qigong is practiced as a stress managing method. It can affect several functions that the nervous systems and brain involved with calmness, slow breathing and relaxation (Skoglund and Jansson 2007, Trakarnvijit 2015). In 2003, Lee et al. investigated the effects of Qigong by comparing mimic therapy in elderly. The results revealed that qi therapy could reduce anxiety in elderly subjects when compared to the placebo group (P=0.04) (Lee, Jang et al. 2003). These results suggested that qi energy may exert a positive psychological and physiological effect. Also, Yang et al., (2005) studied the efficacy of external Qigong in improving symptoms of pain and mood state in elderly peoples with chronic pain. After four weeks, the results revealed that external Qigong could improve mood disturbances in elderly more than general care group (Yang, Kim et al. 2005). In 2007, Skoglund et al. studied the effect of Qigong exercise by comparing with no treatment group for improving stress within five weeks. The results showed that Qigong group could decrease heart rate and significantly reduced symptoms of stress and low back symptoms ($P<0.05$) in a computerized working patient (Skoglund and Jansson 2007). The conclusions from the previous studies could suggest that Qigong exercise can improve psychological problem: symptoms of stress, anxiety and mood disturbances (Lee, Jang et al. 2003, Yang, Kim et al. 2005, Skoglund and Jansson 2007).

2.12 RELATED RESEARCHS IN QIGONG EXERCISE FOR PAIN CONDITIONS

Based on our systematic search for meditative therapy, it lacks evidence research of Qigong for low back pain. No systematic review concerning Qigong exercise for low back pain has been conducted, moreover, few RCT papers (n=4) for low back pain were published so far (Zhuo, Dighe et al. 1983, Hall, Maher et al. 2011, Weifen, Muheremu et al. 2013, Blodt, Pach et al. 2014). Therefore, from our literature search, we included the systematic review of Qigong exercise for general pain management to study the common effect of Qigong. And the literature search of Qigong RCTs for low back pain was reported in the next session also.

Qigong exercise for pain conditions

From a systematic review research of Lee et al. (2009), the reviewed papers about effects of internal Qigong for pain conditions from 20 databases including MEDLINE, CINAHL,British Nursing Index, EMBASE, Psyclnfo, AMED, The Cochrane Library 2009, DBPIA, Korean Studies information, KMbase, Korean Institute of Science, Research Information Center for Health Database, Technology Information, KoreaMed, China Academic Journal, National Assembly Library, China Doctor/Master Dissertation Full text DB, Century Journal Project, China Proceedings Conference Full-text Database and The Qigong and Energy Medicine Databases. Databases were searched up to February 2009 using keywords: Qigong OR (chi ADJ kung) OR (chi ADJ gong) OR

(qi ADJ kung) OR (qi ADJ gong) OR (jih ADJ gong) OR (Korean and Chinese terms for Qigong) AND pain. Only one of seven papers involved RCTs of low back pain. Four of seven papers involved RCTs for internal Qigong exercise for other musculoskeletal pain (neck pain (n=2/4), shoulder pain (n=1/4) and fibromyalgia (n=1/4)) and two of seven papers involved RCTs for internal Qigong exercise for other pain conditions: breast cancer (n=1/7) and labor pain (n=1/7). The results indicated that three articles were classified as high quality. The systematic review concluded that it lacked evidence to support the effect of Qigong exercise on low back pain and the internal Qigong exercise in the treatment of low back pain is still far from convincing (Lee, Max et al. 2009).

In 2009, Hall et al. reviewed the effectiveness of Tai Chi for chronic musculoskeletal pain conditions under systematic review and meta-analysis designs. Eight databases (Embase, CINAHL, Medline, SportDiscus, the Cochrane Central Register of Controlled Trials, LILACS, Pedro and AMED) were searched for RCTs. Databases were searched up to June 2008 using the search terms Tai Chi, Taiji.mp was performed to identify all articles on Tai Chi. Only seven papers involved RCTs for chronic musculoskeletal pain. Six of seven papers involved RCTs for tai chi in chronic arthritis and one of seven papers involved RCTs for tai chi in chronic tension headaches. The result indicated that only one paper was classified as high quality. The systematic review concluded that the available data on the effect of tai chi is

sparse and derived principally from low-quality studies. The extent to which it benefits other forms of musculoskeletal pain is still unclear (Hall, Maher et al. 2009).

According to the previous two systematic reviews of pain condition, only one study was conducted among patients with low back pain (Zhuo, Dighe et al. 1983). Qigong exercise for low back pain has not yet to confirm its effectiveness, and the RCTs in this area are still needed from those practitioners and researchers in this field.

Randomized controlled trials of Qigong for low back pain

Four RCTs of Qigong exercise for low back pain were identified based on the literature search. In 1983, Zhou et al. studied effects of Qi Kung (Breathing and relaxation with tape instruction) by comparing between Qi Kung and EMG biofeedback for two weeks in low back pain patient. The results showed Qigong group improved pain scale when compared within the group ($P<0.04$) but biofeedback group was not significant between before and after treatment. However, the researcher suggested that this study was small in sample size (n=16) and total treatment frequency was also little (2 weeks) (Zhuo, Dighe et al. 1983). In 2011, Hall et al. investigated among patients with persistent low back pain by comparing between tai chi and waitlist group for ten weeks. The results showed tai chi improved pain and disability than waitlist group (Hall, Maher et al. 2011). Weifen et al. (2013), studied the effects of tai chi for nonspecific chronic low back pain on

retired athletes by comparing swimming group, backward walking, jogging and no exercise groups for three months. The results revealed that tai chi group could improve pain than backward walking, jogging and no exercise after three months and follow up six months (P<0.05) (Weifen, Muheremu et al. 2013). Besides, Blodt et al. (2014) investigated the effects of Qigong versus exercise therapy for chronic low back pain in adults. The results showed Qigong could improve pain intensity between Qigong and exercise over the last seven days after six months and for the Roland-Morris disability after 12 months (P<0.05) (Blodt, Pach et al. 2014). We found the method of Qigong in the studies were quite wide. Several Qigong styles were conducted and determined their effectiveness. The effect of Qigong seemed to be positive for chronic low back pain (n=3). Only two RCTs were studied in chronic non-specific chronic low back pain but no study conducted among office worker. The detailed treatment protocol of Qigong exercise used for low back pain from the 4 RCTs was showed in Table 2.2

Table 2.2 Treatment protocol according to the 4 randomized controlled trials of qigong for low back pain

Reference	Control group, Number of sample Size	Practice form	Duration a=After exercise b=Follow up	Frequency	Session	Pedro Score (10)	Result / Conclusion
(Zhuo, Dighe et al. 1983)	-EMG biofeedback (30 min., twice Weekly for 2 wk.) (16:16)	Qigong (breathing and relaxation with Tape instruction)	-Baseline a) 2 weeks b) -	30 min. twice weekly for 2 weeks	4 sessions	N/A	-Intergroup:NS -Within group: Qigong (p-value<0.04) Biofeedback:NS
(Hall, Maher et al. 2011)	-Waitlist group (80:80)	Tai chi developed by Dr. Pual Lam "Stepwise Progressive Teaching Method"	-Baseline a) 10 weeks b) -	2 tai chi sessions 40 minutes/week for 8 weeks follow 1 tai chi session/ week for 2 weeks	18 sessions	7/10	-Statistically significant difference between groups in all outcomes (p-value<0.05)
(Blodt, Pach et al. 2014)	-Exercise therapy (Warm-up using a dynamic gym ball, Strengthening exercise, Stretching and relaxation) 60 min./session and Weekly session, 12 sessions over 3 months (64:64)	Neiyang gong contains static/still (Jin gong) and moving (Dong gong) exercise. Qigong lessons started with 14 movement Exercises for the spine and legs out of the basic level and was followed by seven exercises out of the intermediate level "Change musces and tendons and improve the qi"	-Baseline a) 3 months b.1) 6 months b.2) 12 months	Weekly sessions of 90 minute over a period of 3 month	12 sessions	5/10	-At 3 months : No significant between groups -At 6 months: Significant difference between groups in VAS (p-value<0.05) -AT 12 month: Significant difference between groups in RMD (p-value<0.05)
(Weifen, Muheremu et al. 2013)	-Backward walking -Jogging -Swimming -No exercise (38:47:47:47:141)	Moves of 24-step Chen Style tai chi quan (Four cycles) aimed to increase the flexibility of joints, enhance circulation, strengthen the muscles of the lower back and limbs	-Baseline a.1) 3 months a.2) 6 months	45 min. in each day and 5 days a week over 6 month	120 sessions	6/10	-Two time points (3,6 months) significant difference in VAS between tai chi and backward walking, jogging and no exercise (p-value<0.05)

Based on the literature review, Qigong exercise seems to be an alternative method for chronic low back pain patients, especially among office workers who are frequently related to repetitive movement and prolong static posture. Otherwise, Qigong exercise can improve psychological problem in office workers which is one key factor of chronic pain. Furthermore, the effect of Qigong for low back pain is still inconclusive, no study has involved in office worker so far, and the protocol in the previous researches are inconclusive (Hall, Maher et al. 2009, Lee, Max et al. 2009, Blodt, Pach et al. 2014, Yuan, Guo et al. 2014). Hence, our study was designed to investigate the immediate effects of Qigong practice, Guan Yin Zi Zai Gong level 1, among office workers with chronic non-specific low back pain under the randomized controlled trial research design

CHAPTER 3
RESEARCH METHODOLOGY

3.1 PARTICIPANTS

This study was conducted in a convenient sampling of 72 office workers. They were recruited from the companies in Bangkok Metropolitan Region. A computer program randomized them equally into two groups (n=36 per group). The treatment codes were placed sequentially in sealed opaque envelopes, and thus, allocation sequence was blinded to investigators involved in recruitment. Numbered opaque envelopes were used to implement the random allocation to conceal the sequence until interventions were assigned. The sample size was calculated using the G-power version 3.1.9.2. Configuration error was set at α=0.05; power analysis was 0.95. Thirty-one participants are required for each group. Allowing for 15 percent attrition, a sample size of 36 participants per randomized group would be required for this study.

3.2 PROCEDURE

A randomized controlled study was designed to compare the Qigong practice (Guan Yin Zi Zai Gong level 1) and the waitlist group. In experiment group, subjects were received six sessions of Qigong practice (Guan Yin Zi Zai Gong level 1) 1 session

per week, 2 hours/ session by professional Qigong instructor at Master Yang Qigong Center, Bangkok Thailand. The study protocol was approved by Chulalongkorn University human ethics committee. Written consent was obtained from all participants. The participants in both groups were measured the baseline data, which consisted of three self-administered questionnaires and four objective measurements. They were requested to continue normal activities and avoid other forms of treatment during the six weeks of intervention.

Qigong practice (Guan Yin Zi Zai Gong level 1) (Table 3.1)

The Qigong practice (Guan Yin Zi Zai Gong level 1) consisted of 6 weeks of Qigong classes. Participants in the Qigong group were received 2 hours of Qigong class per week for six weeks by the Qigong instructor. The contents of the Qigong practice included three steps of basic Qigong exercise, meditation, breathing exercise and the basic instruction of Qigong practice for daily life (acupressure, food dietary and general exercise) based on Traditional Chinese Medicine. Qigong exercise consisted of the principal elements of Qigong concept: static and dynamic posture, meditation/imagination and breathing exercise. The participants were encouraged to spend their daily life according to Qigong practice and conducted Qigong exercise at home every day. The participants in Qigong group were recorded the Qigong exercise in Qigong daily to remind them for daily practice. Otherwise, the phone text message was sent to all participants as a reminder.

Waitlist group

In the waitlist group, participants were received general advice for management low back pain for improving low back pain and encourage to stay actively. They were asked for stopped any other treatment during six weeks of the trial. After the end of treatment participants in the waitlist were received the same treatment as the Qigong group.

Table 3.1: The Qigong Practice Program

Practice under supervision	Self-practice and daily record
Day 1 of Week 1 - Practice luó hàn zhuāng (罗汉桩) for 15 minutes (Appendix C)., lā qì zhuāng (拉氣桩) for 5 minutes (Appendix D), and bào qiú zhuāng (抱球桩) for 10 minutes (Appendix E) - End posture (Appendix L). - Acupressure at bǎi huì (百会) acupoint (GV20) for 2 minutes (Appendix M). - Wú jí (無極) meditation for 10 minutes (Appendix F).	Self-practice During Day 2-7 of Week 1 - Practice luó hàn zhuāng (罗汉桩) for 15 minutes (Appendix C), lā qì zhuāng (拉氣桩) for 5 minutes (Appendix D), and bào qiú zhuāng (抱球桩) for 10 minutes (Appendix E). - End posture (Appendix L). - Acupressure at bǎi huì (百會) acupoint GV20 for 2 minutes (Appendix M). - Wú jí (無極) meditation for 10 minutes (Appendix F).
Day 1 of Week 2 - Practice shào lín nèi jìng yī zhǐ chán qì gong (少林内劲一指禅气功) for 28 minutes (Appendix J). - End posture (Appendix L). - Acupressure at yǒng quán (涌泉) acupoints (KI1) for 4 minutes (Appendix M). - Wú jí (無極) meditation for 15 minutes (Appendix F).	Self-practice During Day 2-7 of Week 2 - Practice shào lín nèi jìng yī zhǐ chán qì gong (少林内劲一指禅气功) for 28 minutes (Appendix J). - End posture (Appendix L). - Acupressure at yǒng quán (涌泉) acupoint (KI1) for 4 minutes (Appendix M). - Wú jí (無極) meditation for 15 minutes (Appendix F).

Practice under supervision	Self-practice and daily record
Day 1 of Week 3 - Practice guān yīn zì zài gōng (观音自在功) posture 1: Pái zhuó jiàng xié (排浊降邪) for 5 minutes (Appendix G). - Practice shào lín nèi jìng yī zhǐ chán qì gong (少林内劲一指禅气功) for 28 minutes (Appendix J). - End posture (Appendix L). - Acupressure at hé gǔ (合谷) acupoints (LI4) for 4 minutes (Appendix M). - Wú jí (無極) meditation for 15 minutes (Appendix F).	Self-practice During Day 2-7 of Week 3 - Practice guān yīn zì zài gōng (观音自在功) posture 1: Pái zhuó jiàng xié (排浊降邪) for 5 minutes (Appendix G). - Practice shào lín nèi jìng yī zhǐ chán qì gong (少林内劲一指禅气功) for 28 minutes (Appendix J). - End posture (Appendix L). - Acupressure at hé gǔ (合谷) acupoints (LI4) for 4 minutes (Appendix M). - Wú jí (無極) meditation for 15 minutes (Appendix F).
Day 1 of Week 4 - Practice guān yīn zì zài gōng (观音自在功) posture 2: jīn gāng dǎo chǔ (金刚捣杵) for 5 minutes (Appendix H). - Practice shào lín nèi jìng yī zhǐ chán qì gong (少林内劲一指禅气功) for 28 minutes (Appendix J). - End posture (Appendix L) - Acupressure at nèi guān (内 关) acupoints (PC6) for 4 minutes (Appendix M) - Wu Chi Meditation 15 minutes (Appendix F).	Self-practice During Day 2-7 of Week 4 - Practice guān yīn zì zài gōng (观音自在功) posture 2: jīn gāng dǎo chǔ (金刚捣杵) for 5 minutes (Appendix H). - Practice shào lín nèi jìng yī zhǐ chán qì gong (少林内劲一指禅气功) for 28 minutes (Appendix J). - End posture (Appendix L) - Acupressure at nèi guān (内 关) acupoints (PC6) for 4 minutes (Appendix M) - Wu Chi Meditation 15 minutes (Appendix F).
Day 1 of Week 5 - Practice guān yīn zì zài gōng (观音自在功) posture 3: tiān chuán guàn dǐng (天传灌顶) for 5 minutes (Appendix I). - Practice shào lín nèi jìng yī zhǐ chán qì gong (少林内劲一指禅气功) for 28	Self-practice During Day 2-7 of Week 5 - Practice guān yīn zì zài gōng (观音自在功) posture 3: tiān chuán guàn dǐng (天传灌顶) for 5 minutes (Appendix I). - Practice shào lín nèi jìng yī zhǐ chán qì gong (少林内劲一指禅气功) for 28

Practice under supervision	Self-practice and daily record
minutes (Appendix J). - End posture (Appendix L) - Acupressure at zú sān lǐ (足三里) acupoints (ST36) for 4 minutes (Appendix M) - Wu Chi Meditation 15 minutes (Appendix F).	minutes (Appendix J). - End posture (Appendix L) - Acupressure at zú sān lǐ (足三里) acupoints (ST36) for 4 minutes (Appendix M) - Wu Chi Meditation 15 minutes (Appendix F).
Day 1 of Week 6 - Practice shuǎi shǒu gōng (甩手功) for 10 minutes (Appendix K). - Practice shào lín nèi jìng yī zhǐ chán qì gong (少林内劲一指禅气功) for 28 minutes (Appendix J). - End posture (Appendix L) - Acupressure at shén mén (神门) acupoints (HT7) for 4 minutes (Appendix M) - Wu Chi Meditation 15 minutes (Appendix F)	Self-practice During Day 2-7 of Week 6 - Practice shuǎi shǒu gōng (甩手功) for 10 minutes (Appendix K). - Practice shào lín nèi jìng yī zhǐ chán qì gong (少林内劲一指禅气功) for 28 minutes (Appendix J). - End posture (Appendix L) - Acupressure at shén mén (神门) acupoints (HT7) for 4 minutes (Appendix M) - Wu Chi Meditation 15 minutes (Appendix F)

3.3 OUTCOME MEASURES

PRIMARY OUTCOME

THE VISUAL ANALOGUE SCALE (VAS)

The visual analog scale consists a line, usually 100 millimeters-long, with ends labeled as the extremes of pain (e.g. “no pain” to “severe pain as bad as it could be”) (Appendix O). Patients were asked to show their pain intensity and the distance from the end label. Furthermore, patients had to mark the patient's pain intensity score in a line of the VAS. At this time, there were many pieces of evidence to support the validity of the VAS of pain intensity. The construct validity and reliability

of VAS scores have also been indicated (Revill, Robinson et al. 1976, Carlsson 1983, Sriwatanakul, Kelvie et al. 1983, Korff, Jensen et al. 2000). The VAS has a high number of response categories because it is usually measured in millimeters and 100 millimeters-long. The VAS can be considered as having 101 response levels, makes the VAS potentially more sensitive to changes in pain intensity than measures with a more limited number of response categories. Internal consistency of the VAS scale: alpha coefficient = 0.77 (Dworkin, Korff et al. 1990).

ROLAND AND MORRIS DISABILITY QUESTIONNAIRER (RMDQ)

The RMDQ is a health status measure designed to be completed by patients to assess physical disability due to low back pain that day (i.e. the last 24 hours) (Roland and Fairbank 2000). The RMDQ-24 score is calculated by adding up the number of items checked. Items are not weighted. The scores, therefore, range from 0 (no disability) to 24 (maximum disability) (Roland and Morris 1983). The RMDQ focuses on a limited range of physical functions including walking, bending over, sitting, lying down, dressing, sleeping, self-care and daily activities. This limited range is both a strength and a weakness for its content validity. The weakness is that psychological and social problems are not included. The strength is that the RMDQ is easy to score, understand and translate (Roland and Fairbank 2000). Furthermore, the RMDQ has demonstrated positive and significant correlations with other measures of self-reported disability, such as the Oswestry Disability Index, the Quebec Back Pain Disability Scale and the physical subscales of the SF-36. RMDQ in Thai version

(Appendix P) has internal consistency from the calculation: Cronbach's alpha=0.85 and have high test-retest reliability: ICC = 0.97 (Pensri, Baxter et al. 2005).

SECONDARY OUTCOME

BACK RANGE OF MOTION DEVICE (BROM)

The BROM device was used to measure a lumbar range of motion such as lumbar forward flexion, extension, right rotation, left the rotation, right side bending and left side bending,. The BROM consists of two plastic pieces; the first piece calls an inclinometer to measure the sagittal plane motion of lumbar (Atya 2013). The second piece is a combination gravity goniometer/compass unit; it uses to measure the side bending and the rotational motion of lumbar segment (Kachingwe and Phillips 2005). The Intra-rater reliability of BROM II in lumbar flexion (ICC = 0.84), extension (ICC = 0.91), rotation (ICC ranged from 0.86-0.88) and lateral bending (ICC ranged from 0.81-0.82) (Atya 2013).

ABDOMINAL DRAWING IN-TEST WITH PRESSURE BIOFEEDBACK UNIT

The abdominal drawing-in test with pressure biofeedback unit is the test for measuring activation of core stabilizer muscle (Transversus abdominis muscle and Lumbar Multifidus muscle). The subject was prone position, and the pressure biofeedback was placed between the umbilicus and the ASIS (Rathod and Vyas 2015). Air was infused into the bulb to create a pressure of 70 mmHg (Park and Lee

2013). A decrease of 4-10 mmHg after 10 seconds of the abdominal drawing-in test performance indicates improving core stabilizer muscle activity in patients with chronic non-specific low back pain (for inter-rater reliability, ICC=0.89, for intra-rater reliability, ICC=0.87) (Rathod and Vyas 2015).

FINGERTIP PULSE OXIMETER

Fingertip pulse oximeters are often used for evaluation heart rate based on the contractions of the ventricles (beats per minute) at rest and during exercise. Fingertip pulse oximeters are significantly correlated with electrocardiogram ($r=0.79$, $p< 0.0001$) (Iyriboz 1991). The participants were sat in relaxed posture on a stool for 5 minutes then the finger probe was taped to the right index finger for measurement (Iyriboz 1991).

RESPIRATORY RATE BY PHYSICAL EXAMINATION

The measurement of respiratory rate is the observation method (Karlen, Gan et al. 2014). It consists of two steps. First, the patients were sat in upright. Then the examiner measured the subject's respirations by counting at the chest rise and fall without them knowing for 1 minutes (Bye, Ellis et al. 1990, Cahill 2010, Dow and Dinning 2011, Smith, Mackay et al. 2011). The average resting respiratory rate in normal adult is 12-20 breaths per minute (Dow and Dinning 2011).

SRITHANYA STRESS SCALE (ST-5)

Srithanya Stress Scale (ST-5) is the most popular self-administered instrument for measuring the general mental stress (Pannanusorn and Sakthong 2012). It is developed since the year 2008 by Slipakit and very widely used in Thailand. The ST-5 is short form questionnaire, easy to understand and very apprehensive. The ST-5 consists of five items such as sleep problem, distraction, boredom, anxiety and attention deficit (Pannanusorn and Sakthong 2012) (Appendix R). Each item is recorded using the 4 point Likert scales, ranging from 1 or less to 4 or regularly (Silpakit 2008). Moreover, The ST-5 has been accepted by Department of Mental Health of Thailand and showed high reliability: ICC= 0.85 (Silpakit 2008).

GLOBAL PERCEIVE EFFEECT QUESTIONNAIRE (GPE)

Patient satisfaction is measured in many ways (Hudak and Wright 2000). Global ratings of change are often used to measure satisfaction with treatment outcome (Norman, Stratford et al. 1997). The GPE scale asked the patient to rate, on a numerical scale, how much their condition had improved or deteriorated since some predefined time point (Kamper, Ostelo et al. 2010). Based on the review by Hudak et al. in 2000, the experts recommend the use of a 7-point rating scale (Appendix Q) (Hudak and Wright 2000). Example question: “All things considered, how satisfied are you with the results of your recent treatment?” 1=extremely satisfied, 2=very satisfied, 3=somewhat satisfied, 4=mixed (approximately same

satisfaction and dissatisfaction), 5=somewhat dissatisfied, 6=very dissatisfied, 7=extremely dissatisfied and 8=not sure/no opinion (Hudak and Wright 2000). Test-retest reliability of GPE is excellent as reproducibility of the GPE scale: intra-class correlation coefficient values of 0.90-0.99 (Kamper, Ostelo et al. 2010).

All outcomes were provided to participants in both groups at baseline, four weeks and the end of treatment except VAS scale and RMDQ were provided to participant every week for six weeks, and the GPE was provided to participant at the end of the sixth week. The independent physical therapist performed all objective outcome measurements (Figure 3.1).

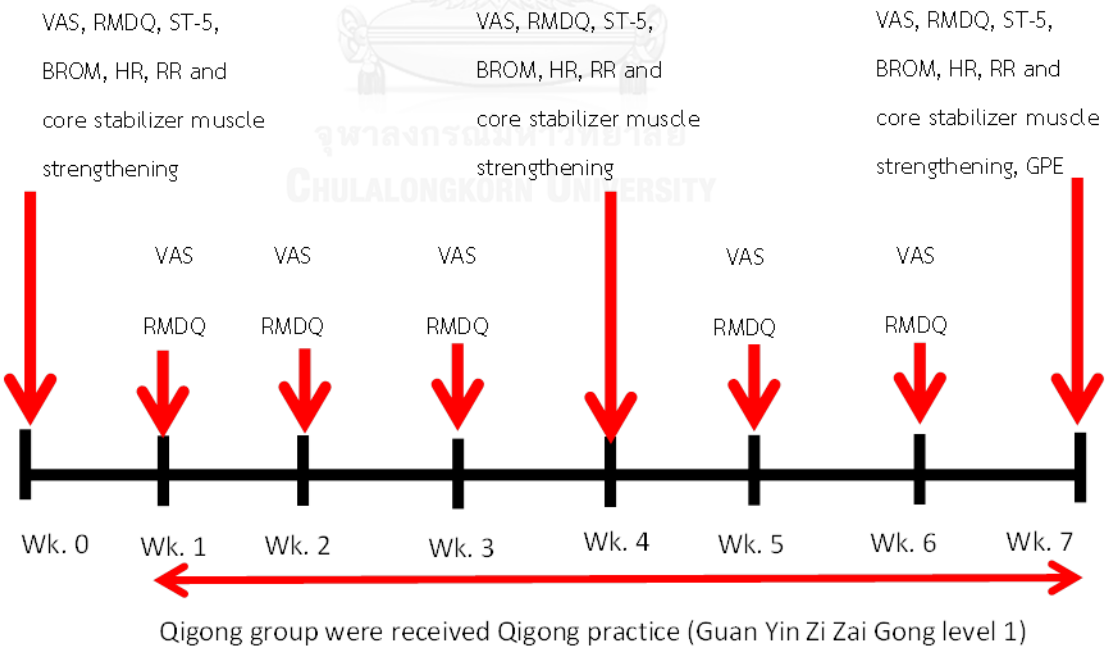

Figure 3.1 Experimental Timeline

ETHICAL CONSIDERATION

All participants in this research were recruited based on the voluntary willingness. They had the right to withdraw from the study at any time without any penalties. All information of the participants in this study were kept confidentially and were not disclosed in any circumstance, except for research purpose only. After the completion of this study, document related to the raw data of the participants were kept for one year and destroyed after. All procedures in this study were approved by the Ethics Review Committee for Research Involving Human Research Subjects, Health Science Group, Chulalongkorn University (COA No. 120/2559) (APPENDIX A).

3.4 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 the noncompliant subject and participant dropped out. The means, mean differences, and standard error of each group were reported. The subject characteristics were compared between group using the independent *t*-test for continuous data, and Chi-square test for non-continuous data. Two-way repeated measures analysis of variance (ANOVA) with the mixed model were used. The pairwise comparison was carried out using Bonferroni. P-value was set at < 0.05 for statistical analysis.

CHAPTER 4
RESULT

CHARACTERISTICS

The study was conducted between September 2016 and April 2017. From 120 interested participants, 48 were excluded because did not meet inclusion criteria (n=38) and others reasons (n=10), 72 were randomized into two group (Qigong group n=36, waitlist group n=36) (See Figure 4.1.). In Qigong group, three participants were drop out in 1st week because they did not complete the end-program assessment. Four participants for waitlist group were drop out at 1st week also because they did not complete the end-program assessment. Finally, seventy-two participants were analyzed by intention-to-treat analysis. The groups were similar with characteristics (see Table 4.1). The baseline data for all variables were normally distributed except the data of weight. No significant difference between groups was found at baseline in outcome variables such as age, gender, weight, height, pain, back functional, heart rate, respiratory rate, stress, core stability muscle strength and range of motion of lumbar spine in all directions except back extension and rotation to left side. The participants in this study were an office worker who had chronic non-specific low back pain (pain ≥ three months).

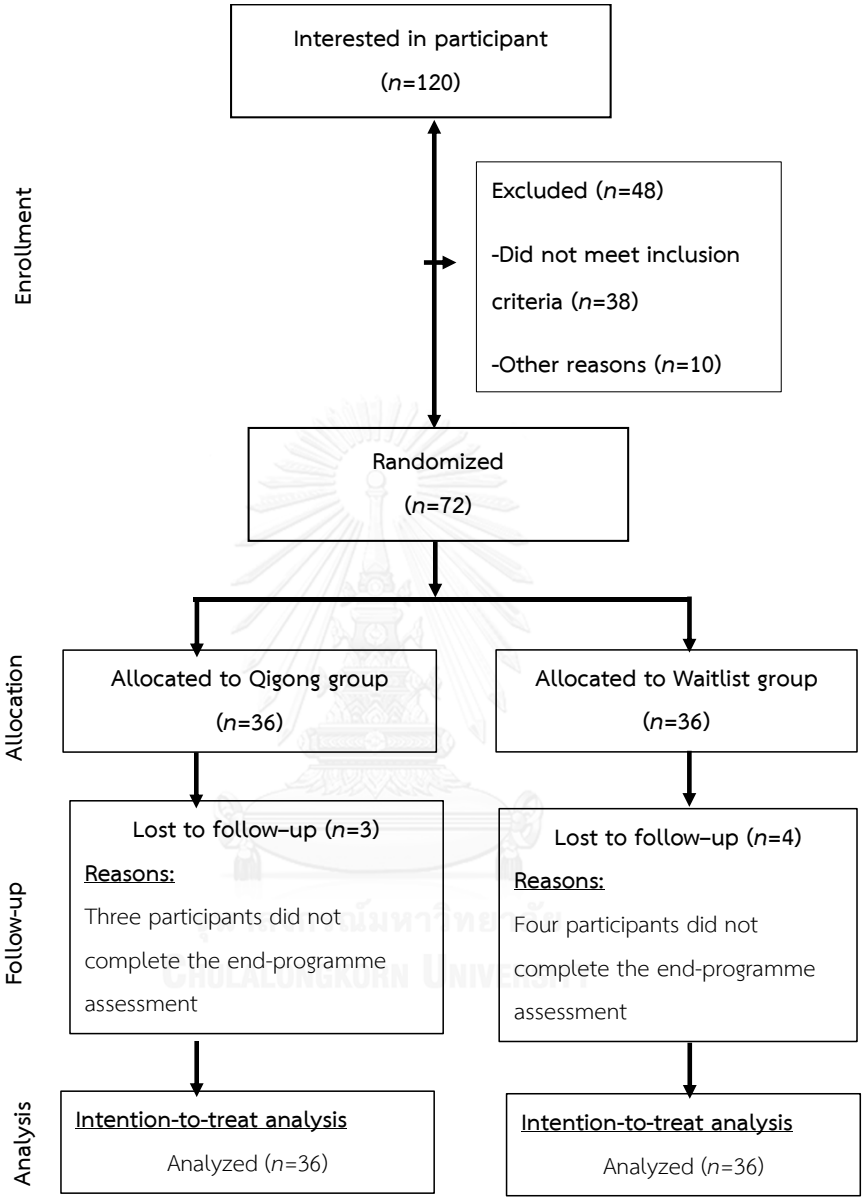

Figure 4.1 Study profile

Table 4.1 Baseline Characteristics of study participants

Measures mean (SD)	Qigong (*n*=36)	Waitlistl (*n*=36)	*P*-value
Age (years)	35.67 (3.62)	34.80 (4.26)	0.179
Gender	1.67 (0.48)	1.61 (0.49)	0.314
-Male (%)	33.33	38.89	
-Female (%)	66.67	61.11	
Weigh (kg)	64.47 (12.75)	62.21 (12.03)	0.220
Height (cm)	164.53 (8.32)	162.92 (7.89)	0.200
Primary outcome			
-VAS score (0-10)	4.97 (1.58)	5.48 (1.50)	0.289
-RMDQ score (0-24)	4.58 (4.57)	3.58 (3.33)	0.244
Secondary outcome			
-Lumbar range of motion (degrees)			
-Flexion	32.69 (8.71)	35.81 (7.05)	0.071
-Extension	9.36 (4.33)	6.71 (2.91)	0.004*
-Rotation to Rt.	16.92 (8.65)	14.25 (6.73)	0.127
-Rotation to Lt.	16.38 (6.33)	11.89 (6.50)	0.004*
-Side bending to Rt.	27.94 (7.44)	26.75 (5.44)	0.429
-Side bending to Lt.	26.54 (6.70)	26.12 (5.31)	0.902
-ST-5 score (0-15)	4.44 (2.43)	4.53 (3.12)	0.898
-Heart rate (beats/min)	73.44 (10.47)	74.22 (8.12)	0.694
-Respiratory rate (breaths/min)	19.58 (2.54)	19.89 (2.03)	0.580
-Core Stability performance index (mmHg*sec)	15.17 (9.14)	18.00 (10.94)	0.264

Abbreviations: SD: standard deviation; RMDQ: Roland Morris Disability Questionnaire; VAS: Visual analog scale; Rt.: Right; Lt.: Left; core stability performance index: core stability muscle strength (mmHg)* Hold time (sec); ST-5: Srithanya Stress Scale

*statistically significant at $P \leq 0.05$

PRIMARY OUTCOME

Table 4.2 showed the mean pain and RMDQ scores at baseline and week 1 to 7. Qigong group showed significantly decreases pain at week 2 to week 7 as compared to baseline (Table 4.2). Back functional disability also improved in Qigong group at week 6. Comparing between two groups, Qigong group significantly decrease pain intensity at week 1 to week 7 and in back function at week 5 to week 7. However, there was no statistically significant difference within the group in pain or back functional disability in waitlist group.

Table 4.2 Primary outcome measurements, Visual analog scale (VAS) and Roland and Morris disability questionnaire (RMDQ), at baseline and week 1 to week 7.

	Qigong (*n*=36)		*P*-value	Waitlist (*n*=36)		*P*-value	Between groups
Time	Mean ±SD	Mean change from baseline (95% CI)		Mean ±SD	Mean change from baseline (95% CI)		*P* -value
VAS score							
-Baseline	4.97 (1.58)			5.48 (1.50)			0.289
-Week 1	3.78 (2.25)	1.18 (-0.32 to 2.68)	0.393	5.19 (1.97)	0.28 (-1.23 to 1.79)	1.000	0.003*
-Week 2	3.23 (2.24)	1.74 (0.23 to 3.25)	0.009*	5.15 (1.92)	0.33 (-1.18 to 1.84)	1.000	<0.001*
-Week 3	2.78 (2.23)	2.19 (0.68 to 3.7)	<0.001*	5.05 (1.92)	0.42 (-1.09 to 1.93)	1.000	<0.001*
-Week 4	2.63 (2.23)	2.34 (0.82 to 3.85)	<0.001*	5.28 (1.97)	0.20 (-1.31 to 1.71)	1.000	<0.001*
-Week 5	2.24 (2.23)	2.73 (1.22 to 4.24)	<0.001*	5.31 (2.01)	0.17 (-1.34 to 1.68)	1.000	<0.001*
-Week 6	1.75 (2.16)	3.22 (1.71 to 4.73)	<0.001*	5.35 (2.13)	0.13 (-1.38 to 1.64)	1.000	<0.001*
-Week 7	1.40 (2.05)	3.56 (2.05 to 5.07)	<0.001*	5.35 (2.09)	0.12 (-1.39 to 1.64)	1.000	<0.001*
RMDQ score							
-Baseline	4.58 (4.57)			3.58 (3.33)			0.244
-Week 1	3.80 (4.46)	0.78 (-1.91 to 3.47)	1.000	4.19 (3.47)	-0.61 (-3.30 to 2.08)	1.000	0.650
-Week 2	3.42 (4.24)	1.17 (-1.52 to 3.85)	1.000	4.05 (3.35)	-0.47 (-3.16 to 2.22)	1.000	0.456
-Week 3	2.89 (4.07)	1.69 (-0.99 to 4.38)	1.000	4.03 (3.25)	-0.44 (-3.13 to 2.24)	1.000	0.184
-Week 4	2.50 (3.61)	2.08 (-0.61 to 4.77)	0.430	4.03 (3.13)	-0.44 (-3.13 to 2.24)	1.000	0.075
-Week 5	2.19 (3.57)	2.39 (-0.30 to 5.08)	0.153	4.05 (3.17)	-0.47 (-3.16 to 2.22)	1.000	0.030*
-Week 6	1.89 (3.44)	2.69 (0.01 to 5.38)	0.049*	4.05 (3.23)	-0.47 (-3.16 to 2.22)	1.000	0.012*
-Week 7	2.03 (3.57)	2.55 (-0.13 to 5.24)	0.083	4.00 (3.21)	-0.42 (-3.11 to 2.27)	1.000	0.022*

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

SECONDARY OUTCOME

Qigong group were found significant differences (P ≤0.05) within group between baseline, week 4 and week 7 (Table 4.3) in range of motion in extension improved at week 4: -2.61 (95% CI -4.79 to -0.43) and week7: -5.45 (95% CI-9.60 to -1.29) and side bending to left side improved at week 4: -3.54 (95% CI -6.90 to-0.18) and week 7: -5.01 (95% CI -8.37 to -1.65), heart rate improved at week 4: 5.36 (95% CI 0.60 to 10.12) and week 7: 5.83 (95% CI 1.07 to 10.60), core stability muscle performance index improved at week 4: -8.39 (95% CI -14.49 to-2.28) and at week 7: -13.11 (95% CI -19.22 to -7.01). Moreover, Qigong group were found significant differences (P ≤0.05) within group between baseline and improved week 7 in range of motion in flexion direction: -5.45(95% CI -9.60 to -1.29), rotation to left side: -3.96 (95% CI -7.64 to -0.27) and side bending to right side: -3.84 (95%CI -7.47 to -0.21). Comparing between groups showed significantly improved all secondary outcome measures such as heart rate, respiratory rate, the range of motion all directions at week 4 and week 7 except the range of motion in flexion and core stability muscle strength statistically significant (p ≤ 0.05) only at week 7. In the other hand, in waitlist group, at baseline, week 4, week 7 were no statistically significant difference within group in all directions of back range of motion, heart rate, respiratory rate and core stability muscle performance index.

Table 4.3 The secondary outcome measurements, lumbar range of motion in all directions, heart rate (HR), respiratory rate (RR) and core stability muscle performance index at baseline, week 4 and week 7

	Qigong (*n*=36)			Waitlist (*n*=36)			Between groups
Time	Mean ±SD	Mean change from baseline (95% CI)	*P*- value	Mean ±SD	Mean change from baseline (95% CI)	*P*- value	*P* -value
- Range of motion (degrees)							
Flexion							
-Baseline	32.69 (8.71)			35.81 (7.05)			0.071
-Week 4	35.04 (8.21)	-2.35 (-6.51 to 1.80)	0.519	34.39 (6.23)	1.42 (-2.73 to 5.58)	1.000	0.705
-Week 7	38.14 (6.76)	-5.45 (-9.60 to -1.29)	0.005*	34.40 (6.50)	1.41 (-2.74 to 5.56)	1.000	0.031*
Extension							
-Baseline	9.36 (4.33)			6.71 (2.91)			0.004*
-Week 4	11.97 (4.57)	-2.61 (-4.79 to -0.43)	0.013*	7.35 (2.72)	-0.64 (-2.82 to 1.54)	1.000	<0.001*
-Week 7	13.35 (5.03)	-3.99 (-6.17 to -1.80)	<0.001*	7.12 (2.72)	-0.41 (-2.59 to 1.77)	1.000	<0.001*
Rotation to Rt.							
-Baseline	16.91 (8.64)			14.25 (6.73)			0.127
-Week 4	18.90 (7.40)	-1.99 (-6.19 to 2.20)	0.758	13.83 (7.29)	0.42 (-3.77 to 4.62)	1.000	0.004*
-Week 7	20.06 (7.30)	-3.15 (-7.34 to 1.05)	0.215	13.24 (6.69)	1.01 (-3.18 to 5.20)	1.000	<0.001*
Rotation to Lt.							
-Baseline	16.38 (6.33)			11.89 (6.50)			0.004*
-Week 4	19.77 (7.01)	-3.39 (-7.07 to 0.29)	0.082	11.88 (6.47)	0.01 (-3.68 to3.69)	1.000	<0.001*
-Week 7	20.34 (6.56)	-3.96 (-7.64 to -0.27)	0.031*	12.06 (5.93)	-0.17 (-3.86 to 3.51)	1.000	<0.001*

Time	Qigong (*n*=36) Mean ±SD	Mean change from baseline (95% CI)	*P*- value	Waitlist (*n*=36) Mean ±SD	Mean change from baseline (95% CI)	*P*- value	Between groups *P* -value
Side bending to Rt.							
-Baseline	27.94 (7.44)			26.75 (5.44)			0.429
-Week 4	30.36 (7.28)	-2.42 (-6.05 to 1.21)	0.328	26.55 (4.74)	0.20 (-3.43 to 3.83)	1.000	0.012*
-Week 7	31.78 (6.97)	-3.84 (-7.47 to -0.21)	0.034*	27.11 (5.94)	-0.36 (-3.99 to 3.27)	1.000	0.002*
Side bending to Lt.							
-Baseline	26.54 (6.70)			26.12 (5.31)			0.764
-Week 4	30.07 (6.05)	-3.54 (-6.90 to-0.18)	0.035*	25.76 (5.19)	0.36 (-3.00 to 3.72)	1.000	0.002*
-Week 7	31.55 (6.75)	-5.01 (-8.37 to -1.65)	0.001*	26.26 (5.21)	-0.14 (-3.50 to 3.22)	1.000	<0.001*
HR (beats/min)							
-Baseline	73.44 (10.47)			74.22 (8.12)			0.694
-Week 4	68.08 (8.37)	5.36 (0.60 to 10.12)	0.021*	76.64 (7.61)	-2.42 (-7.18 to 2.35)	0.666	<0.001*
-Week 7	67.61 (6.88)	5.83 (1.07 to 10.60)	0.010*	75.86 (8.34)	-1.64 (-6.40 to 3.12)	1.000	<0.001*
RR (breaths/min)							
-Baseline	19.58 (2.54)			19.89 (2.03)			0.580
-Week 4	18.81 (2.25)	0.78 (-0.55 to 2.11)	0.480	20.17 (2.41)	-0.28 (-1.61 to 1.05)	1.000	0.014*
-Week 7	18.33 (2.41)	1.25 (-0.08 to2.58)	0.073	19.83 (2.36)	0.06 (-1.28 to 1.39)	1.000	0.007*

Time	Qigong (*n*=36) Mean ±SD	Mean change from baseline (95% CI)	*P*- value	Waitlist (*n*=36) Mean ±SD	Mean change from baseline (95% CI)	*P*- value	Between groups *P* -value
Core stability performance index (mmHg*sec)							
-Baseline	15.17 (9.14)			18.00 (10.94)			0.264
-Week 4	23.56 (11.57)	-8.39 (-14.49 to-2.28)	0.003*	18.61 (11.61)	-0.61 (-6.72 to 5.49)	1.000	0.052
-Week 7	28.28 (11.45)	-13.11 (-19.22 to -7.01)	<0.001*	16.94 (9.39)	1.06 (-5.05 to 7.16)	1.000	<0.001*

All analyses are performed using the intent to treat principle. Abbreviations: Rt.: Right; Lt.: Left; Core stability performance index: Core stability muscle strength (mmHg)* Hold time (sec). *Statistically significant at *P* ≤0.05\

PSYCHOLOGICAL OUTCOME

Table 4.4 showed the mean of stress score at baseline and after a trial at week 7 and mean of global perceived effect at after trial (week7). Between groups, analysis showed statistically significant in both ST-5 and GPE (Table 4.4).

Table 4.4 the immediate effects of Qigong practice (Guan Yin Zi Zai Gong level1) on Stress (ST-5) at baseline and week 7 and Global perceive effects (GPE) at week 7

	Qigong (*n*=36)			Waitlist (*n*=36)			Between groups
Time	Mean ±SD	Mean change from baseline (95% CI)	*P*-value	Mean ±SD	Mean change from baseline (95% CI)	*P*-value	*P* -value
ST-5 score (0-15)							
-Baseline	4.44 (2.43)			4.53 (3.12)			0.898
-Week 7	3.28 (2.24)	1.17 (-0.11 to 2.44)	0.073	5.11 (3.08)	-0.58 (-1.86 to 0.67)	0.369	0.005*
GPE (score)							
-Week 7	2.19 (-0.82)	-	-	3.69 (0.67)	-	-	<0.001*

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

CHAPTER 5

DISCUSSION AND LIMITATIONS

5.1 DISCUSSION

The results of this study support the hypothesis that Qigong practice (Guan Yin Zi Zai Gong level 1) for six weeks could improve pain intensity, back functional, the back range of motion, mental status and quality of life in office worker who was suffering from chronic non-specific low back pain. Forty-seven percent of participants practised Qigong (Guan Yin Zi Zai Gong level 1) more than three days per week for six weeks.

In the Traditional Chinese Medicine theory, Low back pain, back disability and range of motion were improved by the improvement of Qi and blood circulation and the equilibrium of Yin- Yang balance after Qigong practice (Guan Yin Zi Zai Gong level 1) (Yang 1946, Low and Ang 2010, Sancier 1996). After Qigong practice, Qi could flow in the body along the twelve major meridian lines, collaterals, internal and external organs (Yang 2012, Trakarnvijit 2015). It could give blood and oxygen for the revolution to the various systems within the body and made tendons, bones and joints to have flexibility. If the Qi energy flows in the meridian lines, the organ will perform its functions efficiently (Carnie 2002). When Qi and blood can move without barrier, the tissues are nourishing and then the low back pain has been cured (Trakarnvijit 2015). Especially, in office workers who suffer from the pain caused by

prolonging static posture. Since the meridian lines were compressed during the extended period of sitting caused the qi and blood stagnant (Yang 1946, Teeguarden 2015, Trakarnvijit 2015).

Moreover, the acupressure in Qigong program (Guan Yin Zi Zai Gong level 1) could also improve Qi stagnation in the meridian line and could improve the heart rate because this qigong program had the instruction about the acupressure point for improving the functional of heart (HT7) and maintained cardiopulmonary system (PC6) (Yang 2008, Yang 2012).

EFFECTS OF QIGONG PRACTICE ON PAIN INTENSITY

The results of this study indicate that Qigong exercise significantly reduced pain intensity as compared to waitlist group. This finding is consistent with those of other studies which showed that Qigong practice could reduce pain intensity in short- (Zhuo, Dighe et al. 1983, Skoglund and Jansson 2007, Hall, Maher et al. 2011, Rendant, Pach et al. 2011) and long- term (Lansinger, Larsson et al. 2007, Weifen, Muheremu et al. 2013, Blodt, Pach et al. 2014). It seems possible that these results are due to Qigong practice consists of the three elements that could reduce pain, i.e., posture in Qigong practice, deep breathing, and meditation.

Qigong practice comprises of several poses and movements that could strengthen core stabiliser muscles (Akuthota, Ferreiro et al. 2008). These poses are similar with the recommend postures to reduce low back pain in office worker

(Zauner-Dungl 2004). Moreover, deep breathing and meditation in Qigong practice influence the body and mind relaxation (Benson 1975) which, in turn, reduces muscle activities (Rhoads 2013). Furthermore, meditation reduced pain perception (Nakata, Sakamoto et al. 2014) and increased alpha brainwaves (Benson 1975, Sancier 1996, Faber, Lehmann et al. 2012, Henz and Dcholl-Horn 2017). The brain releases several neurotransmitters during alpha waves activities, e.g., dopamine (Vollenweider FX., Vontobel et al. 1999) serotonin,(Newberg and Iversen 2003), noradrenaline (Bujitti and Riederer 1976), acetylcholine (Udupa 1978), gamma-aminobutyric acid (GABA) (Guglietti, Daskalakis et al. 2013), norepinephrine (Skoglund and Jansson 2007), and endorphins (Husband 1990, Infanate, Peran et al. 1998, Rokade 2011). The increased neurotransmitters provoke the vagus nerve to activate, the para-sympathetic system is stimulated, and the body is then relaxation. Moreover, Beta-endorphin, an endogenous opioid peptide neurotransmitter, produce an analgesic effect by blocking the pain signals going to the brain (Rokade 2011). It increased during meditation in a state of deep calmness with increased pain tolerance (Infanate, Peran et al. 1998).

EFFECTS OF QIGONG PRACTICE ON BACK FUNCTIONAL DISABILITY

On the question of functional impairment of the back, this study found Qigong exercise significantly reduced back disability score (RMDQ score) in office worker who had low back pain. These findings further support the idea of Qigong

practice could reduce disability (Hannan, Monteilh et al. 2005, Hall, Maher et al. 2011). A possible explanation of this might be that the Qigong practice (Guan Yin Zi Zai Gong level 1) composes of the 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, improve functional disability of the participants.

EFFECTS OF QIGONG PRACTICE ON CORE STABILITY MUSCLE PERFORMANCE

The result in this study showed that Qigong practice improved the core stability muscle performance index. Two elements of Qigong may explain this results, i.e., breathing therapy and body movement. Breathing in this Qigong practice (Guan Yin Zi Zai Gong level 1) is similar to the deep breathing by contracting the diaphragm (Yang 2012). The diaphragm, the principal muscle of inspiration, is also involved in trunk stability and postural control. In 2013, Kim and Lee 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). Also, Michel et al. in 2006 showed that co-contraction of the diaphragm and abdominal muscles increase abdominal pressure, increase trunk stability and improve the stress on the spine, especially the lumbar region (Michel, Erik et al. 2006).

Moreover, the postures In Qigong practice were similar to the core stabiliser muscles exercise (Akuthota, Ferreiro et al. 2008). It improved the core stabilizer

muscles strengthening since participant need to maintaining posture in static posture (Panjabi 1992, Kellie and Barton 2013). This practice regimen was also progressed by the increase time for maintaining position or the transfer of torque or momentum of upper and lower extremities while qigong practice (Akuthota and Nadler 2004, Kibler, Press et al. 2006, Behm, Drinkwater et al. 2010). The initial stages of qigong (Guan Yin Zi Zai Gong level 1) training (week 1 and week 2) started with the static posture with motor control and concentrated about 15 minutes and practised the static pose with the slow movement of upper limbs about 15 minutes. The middle stage of qigong (Guan Yin Zi Zai Gong level 1) training (week 3-5) consisted of static posture with motor control and concentrated about 30 minutes and slow dynamic qigong for 5 minutes. Finally, in the latter stage of qigong (Guan Yin Zi Zai Gong level 1) training (week 6) consisted the dynamic Qigong 10 minutes and the static posture with motor control and concentrated about 30 minutes. The position of Qigong practice can improve the core stability muscle strength (Kim and Lee 2013) and decrease loads in the lumbar spine (Hong and Li 2007). Besides, the postures in Qigong are similar to the recommended position for the office worker who had low back pain (Zauner-Dungl 2004).

EFFECTS OF QIGONG PRACTICE ON HEART RATE AND RESPIRATORY RATE

Heart rate showed a significant difference between baseline at week 4 and after Qigong practice in week seven within Qigong group and between groups ($p \leq 0.05$).

The result is similar to the result of previous studies (Skoglund and Jansson 2007, Chang, Tsai et al. 2013, Chang 2015). It may be that participants benefitted from the deep breathing and meditation during Qigong practice which consecutively reducing heart rate. It has been argued that slow and deep breathing pattern helps to balance the autonomic nervous system activities by stimulated the para-sympathetic nervous system (Jahnke, Larkey et al. 2010). This state was associated with the relaxation response, characterised by decreased heart rate and respiratory rate. Although the respiratory rate in this study was no significant difference within the group between baseline at week 4 and after Qigong practice in week seven the results of respiratory rate between groups were a significant difference. Moreover, long-term practice of qigong could maintain significant decreased heart rate, respiratory rate and blood pressure (Channer, Barrow et al. 1996, Lee, Jang et al. 2003, Wolf, Bamhart et al. 2003, Lan, Chou et al. 2004, Thomas, Hong et al. 2005, Skoglund and Jansson 2007).

EFFECTS OF QIGONG PRACTICE ON BACK RANGE OF MOTION

The result in this study showed that Qigong exercises significantly increased back range of motion as compared to baseline and waitlist group. It is may be possible that the body movement combined with deep breathing and meditation in Qigong practice induce these changes. Body movement in Qigong practice (Guan Yin Zi Zai Gong level 1) consists of the static posture with deep breathing and concentration (Lee, Max et al. 2009, Trakarnvijit 2015) and slow dynamic position that

cooperates with deep breathing and body awareness (Weifen, Muheremu et al. 2013).

Low back pain and limit back range of motion in office worker caused by the imbalance of back muscle. To be more specific, the core stabiliser muscles were weak, and the global muscles were tight. It is often associated with sustained static loading of the lumbar spine and surrounding tissues (Andersson, Ortengren et al. 1974, Pope 1989, Valachi and Valachi 2003). The slow dynamic posture that cooperates with deep breathing and body awareness helped to improve the flexibility of global muscles and strengthening of core stabiliser back muscle.

Moreover, the posture in the end posture of qigong practice (Guan Yin Zi Zai Gong level 1) (Appendix L) was the dynamic qigong. It was similar to the back flexibility exercises and made the back range of motion improving all directions (Purepong, A. et al. 2012), although the partial direction (rotation to right side) was no significant different within the group. It was possible that the static posture with deep breathing, concentration and the slow dynamic posture during qigong practice (Guan Yin Zi Zai Gong level 1) could improve both local and global muscle function and maintain the balance of these muscle activities. Thus, it induce improvement of the back range of motion.

EFFECTS OF QIGONG PRACTICE ON STRESS

Office workers were often stressed from work organisation (Wahlstrom 2005, Clay, De Bacquer et al. 2007, Spyropoulos, Papathanasiou et al. 2007 and Rugulies and Krause 2008). Previous study showed that the Qigong practice (Guan Yin Zi Zai Gong level 1) reduced the stress in office worker suffering chronic non-specific low back pain from moderate stress to little stress after qigong exercise for 6 weeks (Griffith, Hasley et al. 2008). The present finding seem to be consistent with other findings which found that long-term and short-term qigong practices had the benefits for reducing stress (Frankenhaeuser 1989, Lee, Kim et al. 2000, Lan, Chou et al. 2004, Skoglund and Jansson 2007, Griffith, Hasley et al. 2008, Ryu, Jun et al. 1995). Qigong practice improved the stress by the multiple mechanisms. The practice of slow and deep breathing patterns improved stress by reducing of sympathetic activity and increasing para-sympathetic activity. Qigong practice improved blood pressure, respiratory rate, heart rate, and stress hormone such as norepinephrine (Skoglund and Jansson 2007), adrenocorticotropic hormone (ACTH) (Ryu, Lee et al. 1996, Infanate, Peran et al. 1998, Lee, Lim et al. 2004), and beta-endorphin (Ryu, Lee et al. 1996, Infanate, Peran et al. 1998). Meditation, one element of Qigong practice, also decrease stress (Lee, Kim et al. 2000, Lane, Seskevich et al. 2007). During participants meditated, the body goes into the state of relaxation response by decreasing heart rate, respiratory rate, blood pressure, muscle tone and increasing alpha brain waves (Benson 1975, Sancier 1996, Faber, Lehmann et al. 2012, Henz and Dcholl-Horn 2017)

5.2 LIMITATION

The results of this study showed that Qigong exercise (Guan Yin Zi Zai Gong level 1) had statistical significance in the primary and secondary outcomes. It could improve pain intensity, back disability, back range of motion and stress on chronic non-specific low back pain in office workers. However, this study was not investigated the minimal clinically important differences (MCID), clinical significance and minimal detectable change (MDC). The physician and physical therapist should be carefully considered before using in the clinic. Furture study should be investigated these values and should be focused the long-term follow-up study for 3 months, 6 months or 12 months of the Qigong practice (Guan Yin Zi Zai Gong level 1). It is also very interesting to detect core stabiliser muscle's activities during qigong practice by mean of the electromyography (EMG) study.

CHAPTER 6

CONCLUSION

The result of this study suggests that Qigong practice (Guan Yin Zi Zai Gong level 1) may be a clinical choice for treatment for chronic non-specific low back pain patients, especially the office workers who exposed to repetitive movement, awkward postures, prolonged static postures and psychosocial problems.

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APPENDIX

APPENDIX A

ETHICAL CONSIDERATION FORM

AF 01-12

คณะกรรมการพิจารณาจริยธรรมการวิจัยในคน กลุ่มสหสถาบัน ชุดที่ 1 จุฬาลงกรณ์มหาวิทยาลัย
254 อาคารจามจุรี 1 ชั้น 2 ถนนพญาไท เขตปทุมวัน กรุงเทพฯ 10330
โทรศัพท์/โทรสาร: 0-2218-3202 E-mail: eccu@chula.ac.th

COA No. 120/2559

ใบรับรองโครงการวิจัย

โครงการวิจัยที่ 077.1/59 : ผลฉับพลันของการฝึกชี่กง (กวงอิมจื้อไจกง ขั้นที่ 1) ในผู้ที่ทำงานสำนักงานที่มีอาการปวดหลังส่วนล่างเรื้อรังแบบธรรมดา

ผู้วิจัยหลัก : นางสาวสุทธิณี ภัทรสุภฤกษ์

หน่วยงาน : คณะสหเวชศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย

คณะกรรมการพิจารณาจริยธรรมการวิจัยในคน กลุ่มสหสถาบัน ชุดที่ 1 จุฬาลงกรณ์มหาวิทยาลัย ได้พิจารณา โดยใช้หลัก ของ The International Conference on Harmonization – Good Clinical Practice (ICH-GCP) อนุมัติให้ดำเนินการศึกษาวิจัยเรื่องดังกล่าวได้

ลงนาม.....
(รองศาสตราจารย์ นายแพทย์ปรีดา ทัศนประดิษฐ)
ประธาน

ลงนาม.....
(ผู้ช่วยศาสตราจารย์ ดร.นันทรี ชัยชนะวงศาโรจน์)
กรรมการและเลขานุการ

วันที่รับรอง : 21 มิถุนายน 2559 **วันหมดอายุ** : 20 มิถุนายน 2560

เอกสารที่คณะกรรมการรับรอง

1) โครงการวิจัย
2) ข้อมูลสำหรับกลุ่มประชากรหรือผู้มีส่วนร่วมในการวิจัยและใบยินยอมของกลุ่มประชากรหรือผู้มีส่วนร่วมในการวิจัย
3) ผู้วิจัย
4) แบบสอบถาม

เลขที่โครงการวิจัย 077.1/59
วันที่รับรอง 21 มิ.ย. 2559
วันหมดอายุ 20 มิ.ย. 2560

เงื่อนไข

1. ข้าพเจ้ารับทราบว่าเป็นการผิดจริยธรรม หากดำเนินการเก็บข้อมูลการวิจัยก่อนได้รับการอนุมัติจากคณะกรรมการพิจารณาจริยธรรมการวิจัยฯ
2. หากใบรับรองโครงการวิจัยหมดอายุ การดำเนินการวิจัยต้องหยุด เมื่อต้องการต่ออายุต้องขออนุมัติใหม่ล่วงหน้าไม่ต่ำกว่า 1 เดือน พร้อมส่งรายงานความก้าวหน้าการวิจัย
3. ต้องดำเนินการวิจัยตามที่ระบุไว้ในโครงการวิจัยอย่างเคร่งครัด
4. ใช้เอกสารข้อมูลสำหรับกลุ่มประชากรหรือผู้มีส่วนร่วมในการวิจัย ใบยินยอมของกลุ่มประชากรหรือผู้มีส่วนร่วมในการวิจัย และเอกสารเชิญเข้าร่วมวิจัย (ถ้ามี) **เฉพาะที่ประทับตราคณะกรรมการเท่านั้น**
5. หากเกิดเหตุการณ์ไม่พึงประสงค์ร้ายแรงในสถานที่เก็บข้อมูลที่ขออนุมัติจากคณะกรรมการ ต้องรายงานคณะกรรมการภายใน 5 วันทำการ
6. หากมีการเปลี่ยนแปลงการดำเนินการวิจัย ให้ส่งคณะกรรมการพิจารณารับรองก่อนดำเนินการ
7. โครงการวิจัยไม่เกิน 1 ปี ส่งแบบรายงานสิ้นสุดโครงการวิจัย (AF 03-12) และบทคัดย่อผลการวิจัยภายใน 30 วัน เมื่อโครงการวิจัยเสร็จสิ้น สำหรับโครงการวิจัยที่เป็นวิทยานิพนธ์ให้ส่งบทคัดย่อผลการวิจัย ภายใน 30 วัน เมื่อโครงการวิจัยเสร็จสิ้น

Figure 1. ETHICAL CONSIDERATION FORM

APPENDIX B

TUNA BREATHING TECHNIQUE

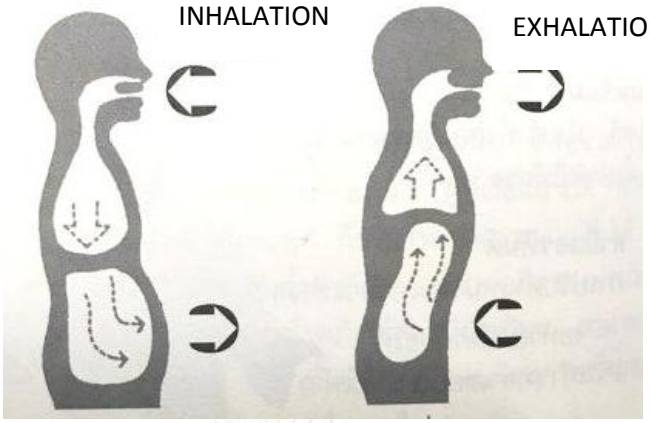

Figure 2 TUNA BREATHING TECHNIQUE

TUNA breathing was the basic breathing on Qigong practice (Guan Yin Zi Zai Gong level 1). It consisted the slow and deep breathing with the belly expansion when the end of inhalation, hold the breath for 3 seconds and following by the exhalation with belly contraction. When the end of exhalation, hold the breath for 3 seconds.

APPENDIX C

Luó hàn zhuāng PRACTICE

- 15 minutes of Luó hàn zhuāng (罗汉桩) practice

Posture: Standing in neutral position, 12 inches apart of feet, 90 degrees of elbow flexion, both shoulders relaxed, neck and trunk upright and back straight. Hold the posture for 15 minutes (Figure 3).

Imagine: The nature qi coming through the body when inhaling, the qi collects at CV 4. When exhaling, imagine the diseases in a body moving along meridians to ten fingers and go outside the body.

Breathing: Slow and deep breathing with the belly expansion when inhaling, hold the breath for 3 seconds, following by the exhalation with belly contraction. Hold the breath for 3 seconds.

Aims:

-To receive pure qi energy from the universe and discharge a disease from the organ and body.

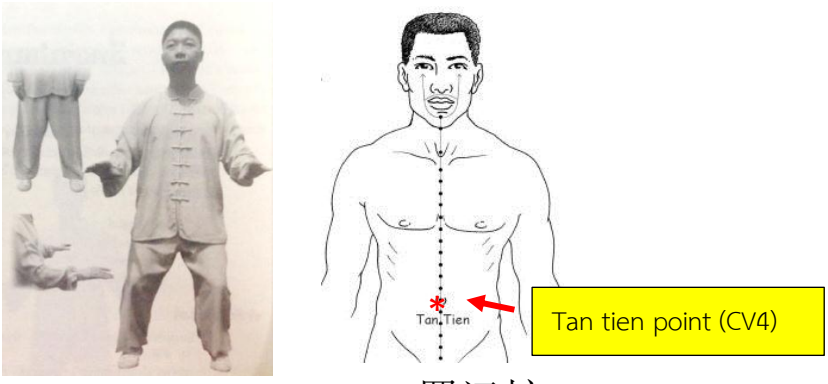

Figure 3: Luó hàn zhuāng PRACTICE (罗汉桩) (Yang 2005)

*CV 4 = Lower Tan Tien point, it is below a navel 1.5 inches. This point is sea of the qi energy in human body.

APPENDIX D

Lā qì zhu**ā**ng **PRACTICE**

- 5 minutes of L**ā** qì zhu**ā**ng (拉氣桩) practice

Posture: Standing in neutral position, 90 degrees of elbow flexion, both shoulders relaxed, neck and trunk upright, 12 inches apart of feet and back straight. Then, slowly move the palms close together when inhaling and move the palms apart when exhaling (Figure 4).

Imagine: Both palms have many resistance when inhaling and imagine the palms have a strong induction force when exhaling.

Breathing: Slow and deep breathing with the belly expansion when inhaling, hold the breath for 3 seconds, following by the exhalation with belly contraction. Hold the breath for 3 seconds.

Aims:

-To turn on the qi energy gate at CV4.

-To collect qi energy at CV4.

-To treat the disease of pelvic organ.

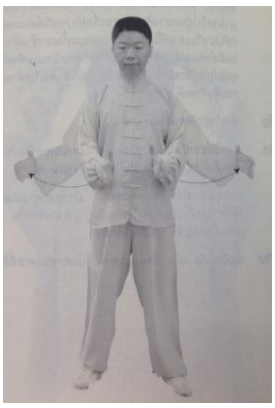

Figure 4: Lā qì zhuāng (拉氣桩) PRACTICE (Yang 2012)

APPENDIX E

Bào qiú zhuāng PRACTICE

- 10 minutes of Bào qiú zhuāng (抱球桩) practice

Posture: Standing in neutral position, 12 inches apart of feet, 90 degrees of elbow flexion, both shoulders relaxed, neck and trunk upright and back straight. Then, place both hands at front of CV4. (Figure 5).

Imagine: Hands are carrying the ball of qi energy in front of CV4, the ball of qi energy coming through the CV4 when inhaling.

Breathing: Slow and deep breathing with the belly expansion when inhaling, hold the breath for 3 seconds, following by the exhalation with belly contraction. Hold the breath for 3 seconds. (This posture can reverse the pattern of breathing: Contraction when inhaling and expansion when exhaling).

Aims:

-To collect qi energy at CV 4.

-To treat the disease of pelvic organ.

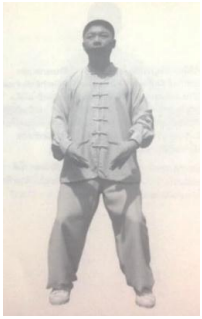

Figure 5: Bào qiú zhuāng (抱球桩) PRACTICE (Yang 2012)

*CV 4 = Lower Tan Tien point, it is below a navel for 1.5 inches. This point is the sea of qi energy in human body.

APPENDIX F

Wú jí MEDITATION

- 15 minutes of Wú jí (無極) meditation

Posture: Sit with relaxed posture on a chair. Neck, trunk and back upright. Put hands on both knees and open the palms to receive qi from universe (Figure 6).

Feeling: Emptiness, keep the mind clear from other thought.

Breathing: Slow and deep breathing with the belly expansion when inhaling, hold the breath for 3 seconds, following by the exhalation with belly contraction. Hold the breath for 3 seconds. Repeat it for 6-7 times. Keep the mind calm, don't concern about breathing pattern.

Aims:

-To help physical and mental relaxation.

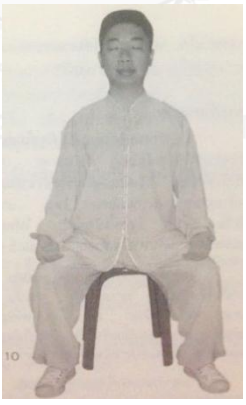

Figure 6: Wú jí (無極) MEDITATION(Yang 2012)

APPENDIX G

Pái zhuó jiàng xié PRACTICE

- 5 minutes of Pái zhuó jiàng xié (排浊降邪) practice

Starting position: Standing in neutral position with 12 inches apart of feet, elbow extension, shoulders relaxed. Neck, trunk and back upright.

Movement: Move both arms over the head when inhaling (Figure 7) and press down the arm along the central axis of the body when exhaling (Figure 8).

Imagine: The pure qi energy come into the center of head at GV20 when inhaling and the negative qi energy discharge from body to the ground when exhaling.

Breathing: Slow and deep breathing with the belly expansion when inhaling, following by the exhalation with belly contraction. Hold the breath for 3 seconds.

Aims:

-To pull the qi energy from the universe and discharge a disease from the body.

-To reduce the mental stress and improve breathing pattern.

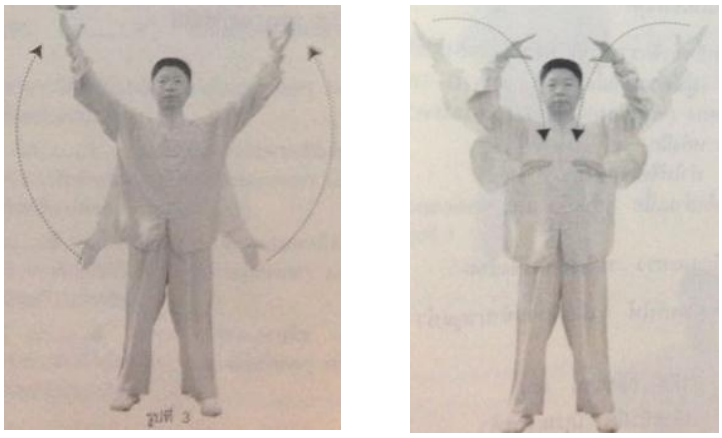

Figure 7, 8: Pái zhuó jiàng xié (排浊降邪) PRACTICE (Yang 2012)

APPENDIX H

JĪn gāng dǎo chǔ PRACTICE

- 5 minutes of JĪn gāng dǎo chǔ (金刚捣杵) practice

Starting position: Standing in neutral position with 12 inches apart of feet, elbow extension, shoulders relaxed. Neck, trunk and back upright.

Movement: Pull both hands up in front of the body from the hip to chest when inhaling and press hands down from the chest to hip when exhaling (Figure 9).

Imagine: Imagine the pure qi energy from the ground come through the body at CV4 when pulling the hand up. When pressing the hands down, imagine the disease in our body discharged to the ground.

Breathing: Slow and deep breathing with the belly expansion when inhaling, hold the breath for 3 seconds, following by the exhalation with belly contraction. Hold the breath for 3 seconds. (This posture can reverse the pattern of breathing: Contraction when inhaling and expansion when exhaling).

Aims:

-To receive energy from the earth.

-To stimulate the meridian line located in lower part of body.

-To relief pain at lower back, upper back, legs and knees.

Figure9: Jīn gāng dǎo chǔ (金刚捣杵) PRACTICE (Yang 2005)

APPENDIX I

Tiān chuán guàn dǐng PRACTICE

- **5 minutes of Tiān chuán guàn dǐng (天传灌顶) practice**

Starting position: Standing in neutral position with 12 inches apart of feet, elbow extension, shoulders relaxed. Neck, trunk and back upright.

Movement: Move arms over the head when inhaling. When both palms touch each other over the head. Then, slowly move down in front of the body (Figure 10).

Imagine: The pure qi energy from the ground come through the body at GV20 when inhaling. When exhaling, imagine the qi collects at CV 4.

Breathing: Slow and deep breathing with the belly expansion when inhaling, hold the breath for 3 seconds, following by the exhalation with belly contraction. Hold the breath for 3 seconds.

Aims:

-To receive energy from the universe.

-To open the gate of qi energy at center of the head.

-To stimulate the brain function and improve sleep quality

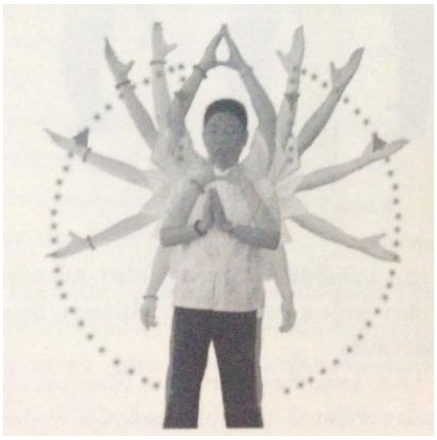

Figure 10: Tiān chuán guàn dǐng (天传灌顶) PRACTICE (Yang 2013)

APPENDIX J

Shào lín nèi jìng yī zhǐ chán qì gong PRACTICE

- 28 minutes of Shào lín nèi jìng yī zhǐ chán qì gong (少林内劲一指禅气功) practice

Starting position: Standing in neutral position, 12 inches apart of feet, 90 degrees of elbow flexion, both shoulders relaxed, neck and trunk upright and back straight.

Method: Stand in starting position for 5 minutes, move the index finger of both hands down and hold for 1 minute and change to other fingers (ring⟶ thumbs ⟶ little⟶ middle). Repeat it for 3 times (Figure 11). After 3 repetitions, subject stands in starting position 5 minutes.

Imagine:

Starting position: The nature qi coming through the body and collecting at CV4 when inhaling. When exhaling, imagine the disease in our body discharging from fingers to outside.

During finger movement: The nature qi coming through the body when inhaling and collecting at CV 4. When exhaling, imagine the disease in the body discharged from such fingers to outside.

Breathing: Slow and deep breathing with the belly expansion when inhaling, hold the breath for 3 seconds, following by the exhalation with belly contraction. Hold the breath for 3 seconds.

Aims:

-To remove the negative qi from 12 meridian line located along the arms and legs.

-To flow qi energy within the 12 meridian lines.

-To pull the pure qi energy come and collected in the body.

Figure 11: Shào lín nèi jìng yī zhǐ chán qì gong (少林内劲一指禅气功)

PRACTICE (Yang 2005)

APPENDIX K

Shuǎi shǒu gōng PRACTICE

- 10 minutes of Shuǎi shǒu gōng (甩手功) practice

Starting position: Standing in neutral position with 12 inches apart of feet, elbow extension, shoulders relaxed. Neck, trunk and back upright.

Method: Subject swing both arms forward and backward for 4 stroke repetitions (count 1, 2, 3, 4). In the fifth stroke (count 5) is divided to 2 steps with hip and knee slightly flexed while the arms are swinging (Figure 12).

Imagine: The disease in our body was discharge from the fingers to outside when swinging the arm.

Breathing: Normal breathing

Aims:

-To remove the negative qi from the 12 meridian lines.

-To improve circulation of lymph and blood in the body

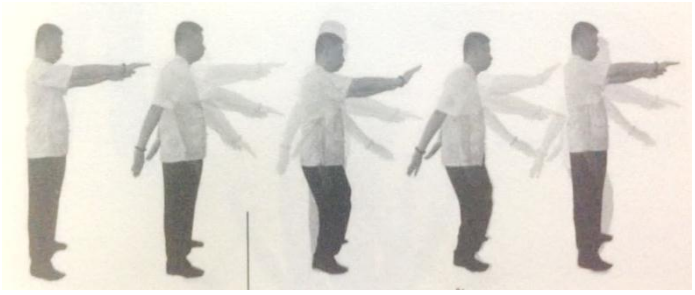

Figure 12: Shuǎi shǒu gōng (甩手功) PRACTICE (Yang Pei Xen, 2013) (Yang 2013)

APPENDIX L

END POSTUER

- **END POSTURE**

Starting position: Standing in neutral position with 12 inches apart of feet, elbow extension, shoulders relaxed. Neck, trunk and back upright.

Method: Both hands press on the CV4 and turn around for 36 times clockwise and counter-clockwise at CV4 (Figure 13). Then, Spread the qi energy to the every part of to body by using the hands to slap the every part of body coordinated with the movement back in full range of motion in all directions (flexion, extension, rotation to left and right and side bending to left and right).

Imagine: The qi energy from both hands was collected at CV4.

Breathing: Normal breathing

Aims:

-To relax the whole body.

-To collect qi energy at CV4 and circulated it to whole part of body.

Figure 13: END POSTURE (Yang 2005)

APPENDIX M

ACUPRESSURE POINT

❖ 4 minutes of Nèi guān (内 关) (PC6) acupressure

Method: Press the tip of thumb at the point for 3 seconds and release pressure for 2 seconds.

Point: It locates on the forearm, 1.5 inches above the transverse crease of wrist and between the tendons of Palmaris longus and Flexor carpi radialis (Figure 14).

Aims: -To maintain cardiopulmonary system.

-To improve sleep quality.

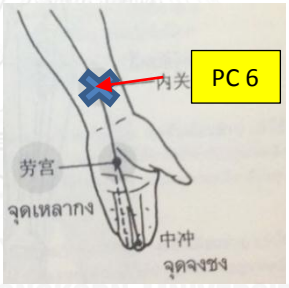

Figure 14: Nèi guān (内 关) (Yang 2009)

❖ 4 minutes of Zú sān lǐ (足三里) (ST36) acupressure

Method: Press the tip of thumb at the point for 3 seconds and release pressure for 2 seconds.

Point: It locates on the lateral side of the shank, 2 inches below Dubi point (ST 35), one finger breadth (middle finger) from the anterior creast of the tibia (Tibilis anterior muscle) (Figure 15).

Aims: -To maintain blood and qi.

-To treat stomachache problem.

-To improve internal organ function such as stomach, small and large intestines.

-To improve immune system.

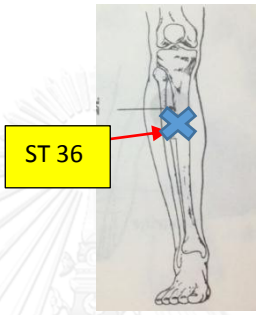

Figure 15: Zú sān lǐ (足三里) (Yang 2009)

❖ 2 minutes of Bǎi huì (百会) (GV20) acupressure

Method: Press the tip of middle finger at the point for 3 seconds and release pressure for 2 seconds or Tap the tip of middle finger at the point for 2 minutes.

Point: It locates on the midline of the head, 6 inches directly above the midpoint of the anterior hairline, approximately on the midpoint of the line connecting the apex of both ears (Figure 16).

Aims:

-To improve headache and migraine symptoms.

-To stimulate and open the gate for receiving qi energy from the universe.

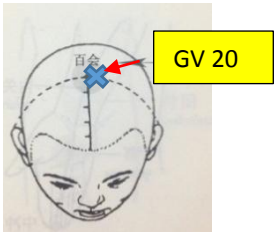

Figure 16: Bǎi huì (百会) (Yang 2009)

❖ 4 minutes of Yǒng quán (涌泉) (KI1) acupressure

Method: press the tip of thumb at the point for 3 seconds and release pressure for 2 seconds.

Point: It locates on the sole of foot, between the second and third metatarsal bones, approximately one third of the distance between the base of the second toe and the heel (Figure 17).

Aims:

-To treat kidney disease.

-To stimulate and open the gate for receiving and transmitting qi energy from the ground.

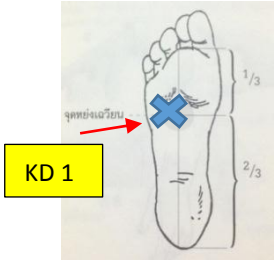

Figure 17: Yǒng quán (涌泉) (Yang 2009)

❖ 4 minutes of Hé gǔ (合谷) (LI4) acupressure

Method: Press the tip of thumb at the point for 3 seconds and release pressure for 2 seconds.

Point: It locates on the dorsum of hand, between the first and second metacarpal bones, at the midpoint of the second metacarpal bone and close to its radial border (Figure 18).

Aims:

-To improve many pain conditions such as headache, eye pain and toothache

-To prevent cerebrovascular thrombosis

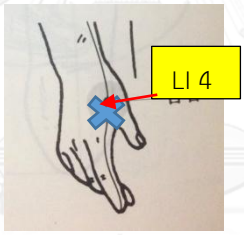

Figure 18: Hé gǔ (合谷) (Yang 2009)

❖ 4 minutes of Shén mén (神门) (HT7) acupressure

Method: Press the tip of thumb at the point for 3 seconds and release pressure for 2 seconds.

Point: It locates on the wrist joint, at the radial side of Flexor carpi ulnaris tendon and in the depression at the proximal border of the Pisiform bone (Figure 19).

Aims:

-To stimulate the heart meridian.

-To improve the balance of Yin and Yang energy in the body

-To improve insomnia

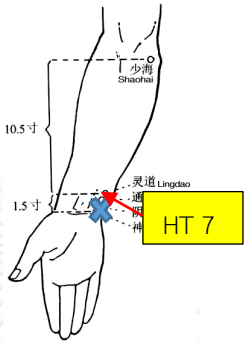

Figure 19: Shén mén (神门) (Yang 2009)

APPENDIX N

SELF-ADMINISTERED QUESTIONNAIRE

โครงการวิจัยเรื่อง ผลเฉียบพลันของการฝึกชี่กง (กวงอิมจี้อไจ้กง ขั้นที่ 1) ในผู้ที่ทำงานสำนักงานที่มีอาการปวดหลังส่วนล่างเรื้อรังแบบธรรมดา

แบบสอบถามข้อมูลส่วนตัว

รหัสผู้เข้าร่วมงานวิจัย..... วันที่.....เดือน.....พ.ศ.....

แบบสอบถามนี้เป็นส่วนหนึ่งของการวิจัย ผลของการออกกำลังกายแบบชี่กงในผู้ที่ทำงานสำนักงานที่มีอาการปวดหลังส่วนล่างเรื้อรัง ข้อมูลของท่านจะเป็นประโยชน์อย่างยิ่งต่องานวิจัย ดังนั้นกรุณาตอบแบบสอบถามตามความเป็นจริง ข้อมูลที่ได้จากการตอบแบบสอบถามนี้ จะไม่เปิดเผยต่อบุคคลหรือหน่วยงานใด หากมีข้อสงสัยหรือข้อซักถามประการใด สามารถสอบถามผู้วิจัยได้ทันที

ภาควิชากายภาพบำบัด คณะสหเวชศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย

เพศ ( ) ชาย ( ) หญิง

อายุ.....ปี น้ำหนัก.....กิโลกรัม ส่วนสูง.....เซนติเมตร

<u>คำชี้แจง</u> โปรดทำเครื่องหมาย X ลงใน☐และ/หรือเติมข้อความที่เป็นจริงลงในช่องว่างให้สมบูรณ์

ประวัติส่วนตัว

1. ท่านใช้เวลาส่วนใหญ่อยู่ในสำนักงาน และทำงานที่เกี่ยวข้องกับการใช้เครื่องคอมพิวเตอร์ การเข้าประชุม การอ่านเอกสาร และการคุยโทรศัพท์ มีการยืน เดิน หรือยกของบ้างเล็กน้อย ใช่หรือไม่

☐ ใช่ ☐ ไม่ใช่

2. ท่านทำงานในตำแหน่งปัจจุบัน มาอย่างน้อยต่อเนื่องนานเท่าใด

☐ น้อยกว่า 1 ปี ☐ เท่ากับ หรือ มากกว่า 1 ปี

3. ใน 1 วันท่านนั่งทำงานนานต่อเนื่อง นานเท่าใด

☐ น้อยกว่า 4 ปี ☐ เท่ากับ หรือ มากกว่า 4 ปี

ประวัติด้านสุขภาพ

4. ท่านเคยเข้ารับการผ่าตัดบริเวณกระดูกสันหลัง ใช่หรือไม่

☐ ใช่ ☐ ไม่ใช่

5. ท่านเคยได้รับอุบัติเหตุรุนแรงบริเวณกระดูกสันหลังหรือกล้ามเนื้อ ใช่หรือไม่

☐ ใช่ ☐ ไม่ใช่

6. (สำหรับผู้หญิง) ท่านกำลังตั้งครรภ์ ใช่หรือไม่

☐ ใช่ ☐ ไม่ใช่

7. ท่านเคยได้รับการวินิจฉัยจากแพทย์ว่าเป็นโรคใดดังต่อไปนี้บ้างหรือไม่ (ตอบได้มากกว่า 1 ข้อ)

☐ ไม่มี ☐ โรคหมอนรองกระดูกสันหลังทับเส้นประสาท

☐ โรคไต ☐ โรคข้ออักเสบรูมาตอยด์

☐ โรคข้อเสื่อม ☐ โรคติดเชื้อที่กระดูกสันหลัง

☐ โรคมะเร็ง หรือ เนื้องอก ☐ โรคกระดูกสันหลังเคลื่อน (Spondylolisthesis)

☐ โรคเกาต์ ☐ โรคกระดูกสันหลังอักเสบชนิดยึดติด (Ankylosing spondylitis)

☐ โรคอื่นๆ ที่เกี่ยวข้องกับกระดูกสันหลัง (โปรดระบุ.....)

8. อาการปวดหลังส่วนล่างของท่าน มีอาการปวดต่อเนื่องกัน หรือมีอาการปวดเป็นๆ หายๆ เป็นเวลาตั้งแต่ 3 เดือน โดยมีอาการปวดอย่างน้อย 1 ครั้งต่อสัปดาห์ ใช่หรือไม่

☐ ใช่ ☐ ไม่ใช่

9. ท่านมีอาการปวดหลังส่วนล่าง ร่วมกับมีอาการชา, อ่อนแรง หรือปวดร้าวลงขาร่วมด้วย ใช่หรือไม่

☐ ใช่..... ☐ ไม่ใช่

10. ในช่วง 3 เดือนที่ผ่านมา ท่านได้เข้ารับการรักษาอาการปวดหลังส่วนล่าง ใช่หรือไม่

☐ ใช่ (โปรดระบุวิธีการรักษาที่ท่านได้รับ)..... ☐ ไม่ใช่

ประวัติการออกกำลังกาย

11. ปัจจุบันท่านออกกำลังกายด้วยวิธีใด (ตอบได้มากกว่า 1 ข้อ)

☐ เดิน ☐ เต้นแอโรบิก

☐ ว่ายน้ำ ☐ ชี่กง

☐ ปั่นจักรยาน ☐ อื่นๆ (โปรดระบุ.....)

12. ท่านออกกำลังกายอย่างน้อยสัปดาห์ละกี่ครั้ง

☐ 1 ครั้ง ☐ 2-3 ครั้ง

☐ 4-5 ครั้ง ☐ มากกว่า 5 ครั้ง

13. ระยะเวลาที่ท่านออกกำลังกายแต่ละครั้ง

☐ น้อยกว่า 30 นาที ☐ 30-60 นาที

☐ 61-90 นาที ☐ มากกว่า 90 นาที

14. รูปแบบการออกกำลังกาย

☐ ออกกำลังกายเพียงคนเดียว ☐ กำลังกายเป็นกลุ่มมากกว่า 2 คน

15. ท่านเคยเข้ารับการรักษาอาการปวดหลังโดยวิธีดังต่อไปนี้ (ตอบได้มากกว่า 1 ข้อ)

☐ ซื้อยาทานเอง ☐ พบแพทย์แผนปัจจุบัน

☐ รักษาทางกายภาพบำบัด ☐ ฝังเข็ม

☐นวดแผนโบราณ ☐ อื่นๆ.....

16. ท่านเคยออกกำลังกายแบบชี่กงหรือไม่

☐ เคย ☐ ไม่เคย ☐ ไม่แน่ใจ

17. ท่านมีความชื่นชอบในการออกกำลังกายแบบชี่กงหรือไม่

☐ ชอบ ☐ ไม่ชอบ ☐ ไม่รู้จัก ☐ เฉยๆ

APPENDIX O

VISUAL ANALOG SCALE (VAS)

โครงการวิจัยเรื่อง ผลเฉียบพลันของการฝึกชี่กง (กวงอิมจี้อไจ้กง ขั้นที่ 1) ในผู้ที่ทำงานสำนักงานที่มีอาการปวดหลังส่วนล่างเรื้อรังแบบธรรมดา

แบบสอบถามระดับความเจ็บปวด

Visual analog scale (VAS)

รหัสผู้เข้าร่วมงานวิจัย..... วันที่.....

กรุณาเขียนเครื่องหมาย X ลงบนเส้นตรงด้านล่าง ณ ตำแหน่งที่ท่าเห็นว่าตรงกับอาการปวดหลังที่ท่านรู้สึกในวันนี้ โดยเส้นตรงจะแทนระดับอาการปวด เริ่มจากด้านซ้ายมือของเส้น จากระดับ 0 คือ “ไม่ปวดเลย” และระดับอาการปวดจะเพิ่มขึ้นเรื่อยๆ ไปจนถึงเส้นด้านขวาสุด ระดับ 10 คือ “ปวดมากที่สุดจนทนไม่ได้”

<u>ระดับอาการปวดหลังในขณะนี้</u>

ไม่ปวดเลย ปวดมากที่สุดจนทนไม่ไหว

0 10

APPENDIX P

ROLAND AND MORRIS DISABILITY QUESTIONNAIRE (RMDQ)

โครงการวิจัยเรื่อง ผลเฉียบพลันของการฝึกชี่กง (กวงอิมจี้อไจ้กง ขั้นที่ 1) ในผู้ที่ทำงานสำนักงานที่มีอาการปวดหลังส่วนล่างเรื้อรังแบบธรรมดา

แบบสอบถามทุพพลภาพโรแลนด์ – มอริส สำหรับประเมินในผู้ป่วยปวดหลัง

รหัสผู้เข้าร่วมงานวิจัย..... วันที่.....

เมื่อปวดหลังท่านอาจพบว่าท่านปฏิบัติกิจวัตรประจำวันได้ค่อนข้างลำบาก ข้อความด้านล่างนี้ผู้ป่วยปวดหลังทั่วไปมักพูดเพื่อบอกอาการเมื่อเขาปวดหลัง ถ้าข้อความใดต่อไปนี้ตรงกับอาการที่ท่านมีอยู่ในวันนี้ กรุณาเขียนเครื่องหมาย√ ลงใน □ หน้าข้อความนั้น และถ้าข้อความใดไม่ตรงกับอาการของท่านในวันนี้ โปรดเว้นว่างไว้ และอ่านข้อความถัดไป

□1. ฉันต้องพักอยู่บ้านเกือบตลอดเวลาเพราะอาการปวดหลัง

□2. ฉันต้องเปลี่ยนท่าทางบ่อยๆ เพื่อช่วยให้หลังของฉันสบายขึ้น

□3. ฉันเดินช้าลงกว่าปกติเพราะปวดหลัง

□4. ฉันหยุดทำงานต่างๆ ที่ฉันมักทำในบ้านเพราะปวดหลัง

□5. ฉันต้องยึดเกาะราวบันไดขณะเดินขึ้นบันไดเพราะปวดหลัง

□6. อาการปวดหลังทำให้ฉันต้องลงนอนพักบ่อยๆ

□7. อาการปวดหลังทำให้ฉันต้องหาที่จับยึดเพื่อพยุงตัวลุกจากที่นั่ง

□8. ฉันแต่งตัวช้ากว่าปกติเพราะปวดหลัง

□9. ฉันต้องอาศัยผู้อื่นทำสิ่งต่างๆ ให้เพราะฉันปวดหลัง

□10. ฉันยืนได้ไม่นานเพราะปวดหลัง

□11. ฉันลุกจากเก้าอี้ลำบากเนื่องจากปวดหลัง

□12. เนื่องจากปวดหลัง ฉันพยายามไม่ก้มตัวไปข้างหน้า

□13. ฉันรู้สึกปวดหลังมากเกือบตลอดเวลา

□14. ฉันพลิกตัวบนเตียงลำบากเพราะปวดหลัง

□15. ฉันรู้สึกไม่อยากกินอาหารเพราะปวดหลัง

□16. ฉันใส่ถุงเท้า รองเท้าลำบากขึ้นเพราะปวดหลัง

□17. ฉันเดินได้ไม่ไกลเพราะปวดหลัง

□18. ฉันนอนไม่ค่อยหลับเพราะปวดหลัง

□19. เนื่องจากปวดหลัง ฉันต้องขอให้ผู้อื่นช่วยฉันแต่งตัว

☐20. ฉันนั่งเกือบตลอดทั้งวันเพราะปวดหลัง

☐21. ฉันพยายามไม่ทำงานบ้านที่หนักๆ เพราะปวดหลัง

☐22. เนื่องจากปวดหลัง ฉันหงุดหงิดและอารมณ์เสียกับผู้คนรอบข้างง่ายกว่าปกติ

☐23. ฉันเดินขึ้นบันไดช้ากว่าปกติเพราะปวดหลัง

☐24. ฉันต้องนอนอยู่บนเตียงเกือบตลอดเวลาเพราะปวดหลัง

APPENDIX Q

GLOBAL PERCEIVE EFFECT QUESTIONNAIRE (GPE)

โครงการวิจัยเรื่อง ผลเฉียบพลันของการฝึกชี่กง (กวงอิมจื้อไจ้กง ขั้นที่ 1) ในผู้ที่ทำงานสำนักงานที่มีอาการปวดหลังส่วนล่างเรื้อรังแบบธรรมดา

แบบสอบถามเพื่อประเมินอาการของผู้เข้าร่วมการวิจัยโดยภาพรวม

Global Perceive Effect questionnaire (GPE)

รหัสผู้เข้าร่วมงานวิจัย.....วันที่.....

โปรดระบุว่าหลังจากที่ท่านได้รับการรักษาโดยการออกกำลังกายเพื่อเพิ่มความยืดหยุ่นจนถึงวันนี้ อาการปวดหลังของท่านเป็นอย่างไร โดยการขีด √ ลงใน ( ) ซึ่งตรงกับคำตอบที่ท่านเลือก

( ) อาการปวดหลังหายไปโดยสิ้นเชิง

( ) อาการปวดหลังลดลงมาก

( ) อาการปวดหลังลดลงเล็กน้อย

( ) อาการปวดหลังเหมือนเดิม ไม่เปลี่ยนแปลง

( ) อาการปวดหลังแย่ลงเล็กน้อย

( ) อาการปวดหลังแย่ลงมาก

( ) อาการปวดหลังแย่ลงเต็มที่

APPENDIX R

SRITHANYA STRESS TEST

โครงการวิจัยเรื่อง ผลเฉียบพลันของการฝึกชี่กง (กวงอิมจื้อไจ้กง ขั้นที่ 1) ในผู้ที่ทำงานสำนักงานที่มีอาการปวดหลังส่วนล่างเรื้อรังแบบธรรมดา

แบบสอบถามความเครียด (ST-5)

คำชี้แจง: ในช่วง 2 -4 สัปดาห์ ที่ผ่านมา ท่านมีอาการต่อไปนี้บ่อยครั้งแค่ไหน โปรดทำเครื่องหมาย √ ลงในช่องว่างที่ตรงกับคำตอบของท่านมากที่สุด

อาการหรือความรู้สึกที่เกิด	แทบไม่มี	เป็นบางครั้ง	บ่อยครั้ง	เป็นประจำ
1. มีปัญหาการนอน นอนไม่หลับหรือนอนมาก				
2. มีสมาธิน้อยลง				
3. หงุดหงิด/กระวนกระวาย/ว้าวุ่นใจ				
4. รู้สึกเบื่อ เซ็ง				
5. ไม่อยากพบปะผู้คน				

APPENDIX S

PEDro SCALE

โครงการวิจัยเรื่อง ผลเฉียบพลันของการฝึกชี่กง (กวงอิมจื้อไจ้กง ขั้นที่ 1) ในผู้ที่ทำงานสำนักงานที่มี

อาการปวดหลังส่วนล่างเรื้อรังแบบธรรมดา

PEDro scale

1.	eligibility criteria were specified	no ❑ yes ❑ where:
2.	subjects were randomly allocated to groups (in a crossover study, subjects were randomly allocated an order in which treatments were received)	no ❑ yes ❑ where:
3.	allocation was concealed	no ❑ yes ❑ where:
4.	the groups were similar at baseline regarding the most important prognostic indicators	no ❑ yes ❑ where:
5.	there was blinding of all subjects	no ❑ yes ❑ where:
6.	there was blinding of all therapists who administered the therapy	no ❑ yes ❑ where:
7.	there was blinding of all assessors who measured at least one key outcome	no ❑ yes ❑ where:
8.	measures of at least one key outcome were obtained from more than 85% of the subjects initially allocated to groups	no ❑ yes ❑ where:
9.	all subjects for whom outcome measures were available received the treatment or control condition as allocated or, where this was not the case, data for at least one key outcome was analysed by "intention to treat"	no ❑ yes ❑ where:
10.	the results of between-group statistical comparisons are reported for at least one key outcome	no ❑ yes ❑ where:
11.	the study provides both point measures and measures of variability for at least one key outcome	no ❑ yes ❑ where:

APPENDIX T

INTER-AND INTRA RATER RELIABILITY OF THE BACK RANGE OF MOTION INSTRUMENT (BROM II) FOR MEASURING LUMBAR MOBILITY IN PERSONS WITH SEDENTARY LIFESTYLE

ABSTRACT

The study was aimed to examine the inter-rater, intra-rater reliability, standard error of measurement (SEM) and minimum detectable change at 95% confidence level (MDC95) of the Back range of motion device (BROM II) for measurement of active lumbar spine range of motion in persons with sedentary lifestyle. Single-group repeated measures for inter-rater, intra-rater reliability and SEM, as well as the MDC95 were computed for BROM II. Ten sedentary lifestyle persons (Gender: 2 men and 8 women; Age range: 22-31 years; Period of sitting per day: 6-10 hours) participated in this study. Two raters, who were a physical therapist with at least 5 years of clinical experience, measured lumbar mobility in all directions by using the BROM II instrument for 4 trials (each rater measured for 2 trials). Intra class Correlation Coefficients (ICC3,3) were used to determine inter-rater and intra-rater reliability. The SEM and MDC95 were also calculated. The Intra-rater reliabilities for all directions of lumbar movement were high to good (ICC for lumbar flexion = 0.94-0.95, lumbar extension = 0.98-0.99, right side bending = 0.98-0.99, left side bending = 0.97-0.99), right trunk rotation = 0.95-0.97 and left trunk rotation = 0.96-0.97). The inter-rater reliabilities were high (ICC for lumbar extension = 0.91, right trunk bending = 0.91), good (ICC for left trunk bending and right trunk rotation = 0.88), fair (ICC for

forward flexion = 0.79) and poor (ICC for left trunk rotation = 0.66). The SEMs for all directions ranged from 0.51 to 1.02 degrees. The MDC95s for all directions ranged from 1.40 to 2.83 degrees. The BROM II supplies a reliable means of measuring lumbar motion in persons with sedentary lifestyle when measured by the same examiner.

Keywords: BROM II, lumbar spine, range of motion, reliability, sedentary lifestyle

บทคัดย่อ

เพื่อศึกษาค่าความน่าเชื่อถือภายในตัวผู้ประเมิน, ความน่าเชื่อถือระหว่างผู้ประเมิน, ค่าความคลาดเคลื่อนมาตรฐานในการวัด (standard error of measurement, SEM), ค่าชี้วัดการเปลี่ยนแปลงที่น้อยที่สุด (minimal detectable change, MDC95) ของเครื่อง Back range of motion (BROM II) เพื่อวัดช่วงการเคลื่อนไหวของหลังส่วนล่าง ในผู้ที่มีรูปแบบการดาเนินชีวิตแบบอยู่กับที่ หาค่าความน่าเชื่อถือภายในตัวผู้ประเมิน และระหว่างผู้ประเมิน ในการใช้เครื่อง BROM II, หาค่าความคลาดเคลื่อนมาตรฐานในการวัด, หาค่าชี้วัดการเปลี่ยนแปลงที่น้อยที่สุด ประชากรที่ศึกษาในงานวิจัยนี้ เป็นผู้ที่มีรูปแบบการดาเนินชีวิตแบบอยู่กับที่ จานวน 10 คน เป็น ผู้ชาย 2 และผู้หญิง 8 คน อายุระหว่าง 22-31 ปี โดยนั่งนาน 6-10 ชั่วโมงต่อวัน ซึ่งจะมีการวัดช่วงการเคลื่อนไหวของหลังส่วนล่างใน 6 ทิศทาง โดยผู้ประเมินผู้ซึ่งเป็นนักกายภาพบาบัด ที่มีประสบการณ์การทางานเป็นระยะเวลาอย่างน้อย 5 ปี จานวน 2 คน ผู้เข้าร่วมงานวิจัยจะได้วัดช่วงการเคลื่อนไหวจานวน 4 ครั้ง ในแต่ละทิศทางโดยผู้ประเมินคนที่ 1 และ 2 คนละ 2 ครั้ง นาค่าที่ได้มาคำนวณโดยโปรแกรม SPSS 17.0 เพื่อหาค่าความน่าเชื่อถือโดยใช้สถิติ ICC3,3 เพื่อคำนวณหาค่าความน่าเชื่อถือภายในตัวผู้

ประเมิน, ความน่าเชื่อถือระหว่างผู้ประเมิน, ค่าความคลาดเคลื่อนมาตรฐานในการวัด และค่าชี้วัดการเปลี่ยนแปลงที่น้อยที่สุด ค่าความน่าเชื่อถือภายในตัวผู้ประเมินมีค่าอยู่ในเกณฑ์สูงถึงดี ในทุกทิศทาง ดังนี้ ทิศทางก้มหลัง มีค่าเท่ากับ 0.94-0.95, แอ่นหลัง มีค่าเท่ากับ 0.98-0.99, เอียงตัวไปทางขวา มีค่าเท่ากับ 0.98-0.99, เอียงตัวไปทางซ้าย มีค่าเท่ากับ 0.97-0.99, หมุนตัวไปทางขวา มีค่าเท่ากับ 0.95-0.97 และหมุนตัวไปทางซ้าย มีค่าเท่ากับ 0.96-0.97 ความน่าเชื่อถือระหว่างผู้ปะเมินมีค่าสูง ในท่าแอ่นหลัง และท่าเอียงตัวไปทางขวา โดยมีค่าเท่ากับ 0.91, มีค่าดีทิศทางเอียงตัวไปทางซ้าย และท่าหมุนตัวไปทางขวา โดยมีค่าเท่ากับ 0.88 ความน่าเชื่อถือระหว่างผู้ประเมินมีค่าปานกลาง ในทิศทางก้มหลัง โดยมีค่าเท่ากับ 0.79 ความน่าเชื่อถือระหว่างผู้ประเมินมีค่าต่ำใน ท่าเอียงตัวไปทางซ้าย โดยมีค่าเท่ากับ 0.66 นอกจากนี้ค่าความคลาดเคลื่อนมาตรฐานในการวัดของเครื่องมือในทุกทิศทางมีค่าระหว่าง 0.51 – 1.02 และค่าชี้วัดการเปลี่ยนแปลงที่น้อยที่สุดของเครื่องมือ มีค่าระหว่าง 1.40 ถึง 2.83 องศาการเคลื่อนไหว เครื่อง BROM II มีค่าความน่าเชื่อถืออยู่ในระดับสูง โดยเฉพาะอย่างยิ่งค่าความน่าเชื่อถือภายในตัวผู้ประเมิน เหมาะสาหรับการนามาใช้วัดช่วงการเคลื่อนไหวของหลังของผู้ที่มีรูปแบบการดาเนินชีวิตแบบอยู่กับที่

คำสำคัญ: เครื่อง BROM II กระดูกสันหลังส่วนเอว ช่วงการเคลื่อนไหว ค่าความน่าเชื่อถือ ผู้ที่มีรูปแบบการดาเนินชีวิตแบบอยู่กับที่

INTRODUCTION

A sedentary lifestyle was defined as a type of lifestyle having excessive sitting and lack or irregular amounts of physical activity in daily life (Owen, Sparling et al. 2010). A sedentary lifestyle was found around the world both in the developing, and

developed countries. Approximately 60-86% of all worldwide populations have a sedentary behavior ((WHO) 2011). People with sedentary lifestyle have an excessive sitting, lying down and little energy expenditure (approximately ≤1.5 metabolic equivalents (METS) in one day (Owen, Sparling et al. 2010, Pate, O'Neill et al. (2008). Sedentary activities (i.e. sitting, using computer, reading, watching television, driving personal vehicles socializing, reading and playing video games) is a commonly found in all around the world, especially in the developed countries. They spend the enormous amounts of time watching the screen (mobile device, computer monitor, and television) (Owen, Sparling et al. 2010). The lack of physical activity, exercise, and prolonged sitting are the risk factors which contributed to the mortality and many conditions such as obesity, cardiovascular disease, type 2 diabetes, metabolic syndrome, mental health, osteoporosis, some cancers, chronic illness and musculoskeletal pain. These conditions may lead to disability (Hamilton, Healy et al. 2008, Williams and Hopper 2015, (ACSM) 2016). The sedentary lifestyle can also cause back pain (Pope, Goh K. L. et al. 2002, Jones and Macfarlane 2005, Corlett 2006). It is because the prolonged sitting time decreases core stability muscles strength, reduces posterior lumbar stability (Hedman and Fernie 1997, Beach, Parkinson et al. 2005, Corlett 2006) and increases intradiscal load (Nachemson 1981). These circumstances lead to a reduction of flexibility, mobility, and endurance. Moreover, the prolonged sitting can cause back stiffness, back muscle tightness and decrease back range of motion (Beach, Parkinson et al. 2005)

The back range of motion in the person can measure by many measurements such as radiography techniques, tape measurement, flexible curve device, inclinometer, goniometer and back range of motion instrument (BROM II) (Kachingwe and Phillips 2005, Atya 2013). Radiographic techniques (Stokes, Bevins et al. 1987, Evick and Yucel 2003, Portek, Pearcy et al. 1983) are the standard measurement for the lumbar sagittal plane. However, the ability to measure other planes of motion is limited (Stokes, Bevins et al. 1987, Evick and Yucel 2003, Portek, Pearcy et al. 1983). Also, the radiographic is an expensive, time-consuming, unapproachable for many clinicians and the subjects who received the radiation from this procedure (Evick and Yucel 2003, Kachingwe and Phillips 2005). A ruler or tape measure (Waddell and Main 1984) is used to measure lumbar motion in two directions (forward flexion and trunk bending) by recording the distance between the subject's fingertips to the floor (Kachingwe and Phillips 2005). It is easy to use, but the degrees of lumbar motion in this method cannot be separated from combined thoracic and hip movement (Kachingwe and Phillips 2005). The flexible curve device or the flexible ruler (Waddell, Somerville et al. 1987) measure is used to measure lumbar lordosis and the motion in a sagittal plane. A tracing of the subject's lumbar curve in this device is made with the flexible ruler on paper after that the flexible ruler measure has been molded to the subject's lumbar spine (Salisbury and Porter 1987, Stokes, Bevins et al. 1987, Youdas, Suman et al. 1995). Then, the degrees of lumbar spine curve were calculated from the mathematical calculation (Walker, Rothstein et al. 1987, Youdas,

Suman et al. 1995). This measurement is high to good intra-rater reliability, but it was complicated method and time consuming (Mayer, Gatchel et al. 1985). Inclinometer (Rainville, Sobel et al. 1994) can measure lumbar motion that separated from the combined thoracic and hip movement, but it can measure in the only sagittal plane of motion (i.e. forward flexion and extension) (Loebl 1967). Goniometer or protractor can measure the lumbar motion in the frontal and sagittal plane (Kachingwe and Phillips 2005) but it difficult to locate anatomical reference points for measurement. Whenever the subjects have a small oscillation in the position of measurement, it can impair the levels of analysis using the goniometer (Fitzgerald, Wynveen et al. 1983, Kachingwe and Phillips 2005, Chaves, Nagamine et al. 2008)

A back range of motion (BROM II) device (Figure 1) was developed by the Performance Attainment Associates, United States of America in 1992. It was developed for measuring the lumbar spine mobility. BROM II device (Performance Attainment Associated 1992) is a less well-known method for measuring a lumbar mobility. BROM II is a combination inclinometer and goniometer; it can measure lumbar motion in all planes and separates the lumbar motion from thoracic and hip motion (Paul 1992, Nitchke, Nattrass et al. 1999). Furthermore, this measurement is easy to use and time-saving. BROM II is a reliable instrument of lumbar mobility in the sagittal and coronal planes in asymptomatic subjects (Breum, Wiberg et al. 1995, Madson, Youdas et al. 1999, Kachingwe and Phillips 2005) as well as chronic low

back pain persons (Atya 2013). Nevertheless, no study has used BROM II to measure back movement in the individuals with a sedentary lifestyle.

From the current literature, the reliability of BROM II is still inconclusive. Besides, no study has investigated the standard error of measurement (SEM) and minimum detectable change at the 95% confidence interval (MDC95). To the best of our knowledge, no study has involved in the persons with a sedentary lifestyle. Hence, our study was designed to investigate the interrater and intrarater reliability of the BROM II for measuring lumbar mobility in individuals with a sedentary lifestyle.

OBJECTIVE

To examine the inter-rater, intra-rater reliability, standard error of measurement (SEM) and minimum detectable change at 95% confidence level (MDC95) of the BROM II for measurement of active lumbar spine range of motion in persons with a sedentary lifestyle

MATERIALS AND METHODS

PARTICIPANTS

The sample size (N=10) was calculated based on sample size calculator version 1.7.1 update on October 2015 (Significance level (α) = 0.05, Power (1-β) = 0.80, Acceptable reliability ($\rho 0$) = 0.70, Expected reliability ($\rho 1$) = 0.90 and Drop- out

= 10%) (Arifin, 2015 and Walter et al.,1998). Ten volunteers (2 men and 8 women) were recruited from sedentary lifestyle graduate students. The participants ages ranged from 22-31 years (mean±SD = 27.1 ± 3.70 years). Exclusion criteria included recent back and pelvic surgeries, traumatic injury to the back and complained of mechanical low back pain at the time of the study. All participants read and signed an informed consent document approved by the Ethics Review Committee for Research Involving Human Research Subjects, Health Science Group, Chulalongkorn University.

INSTRUMENTATION

The Back range of motion device (BROM II; Performance Attainment Associates, 1992) was used to measure a lumbar range of motion (ROM) in all six directions, i.e., lumbar flexion, extension, right lateral bending, left lateral bending, right trunk rotation and left trunk rotation. The BROM II device (Figure 1A) consists of two plastic units: a modified inclinometer (Figure 1C) for measuring sagittal plane motions and a combination gravity goniometer (Figure 1B) for measuring side bending and trunk rotational movements. For measuring lumbar flexion and extension ROM, the modified inclinometer (Figure 1C) fixed on a base unit was placed on the skin over the participant's sacrum (S1 spinous processes). The L-shaped movable arm (Figure 1D) was extended and placed at T12 spinous process (Figure 2A). The participants were asked to stand in an upright position. The pelvis was not fixed and

the feet were placed apart for shoulder width. The unit was then positioned so that the level is centered and recorded the initial reading in degrees. During flexion (Figure 2B) and extension (Figure 2C) movements, the L-shaped movable arm was held at T12 to guide the plastic protractor while the device places over S1. Then, the examiner read and recorded the final degree (marked in 1° increment) from the scale on the protractor side of the device.

The second unit was composed of a combination gravity goniometer and the BROM R/L unit (Figure 1B). During lumbar rotation, the subjects sat on a non-rotating bench, place the belt between S1 and T2 and suspend the magnetic at the level over the sacrum (below S1). Then, the BROM R/L unit was placed on the horizontal line of T12, hold the center of the unit firmly against the patient's back, then zero the compass and check that the scale on the superior part of the BROM R/L was still zero. When the subjects moved to the full range of rotation (Figure 2D), the range of rotation (marked in 2° increments) was read and recorded. During lateral bending (Figure 2E), the ROM was read posteriorly from the gravity goniometer (marked in 2° increments).

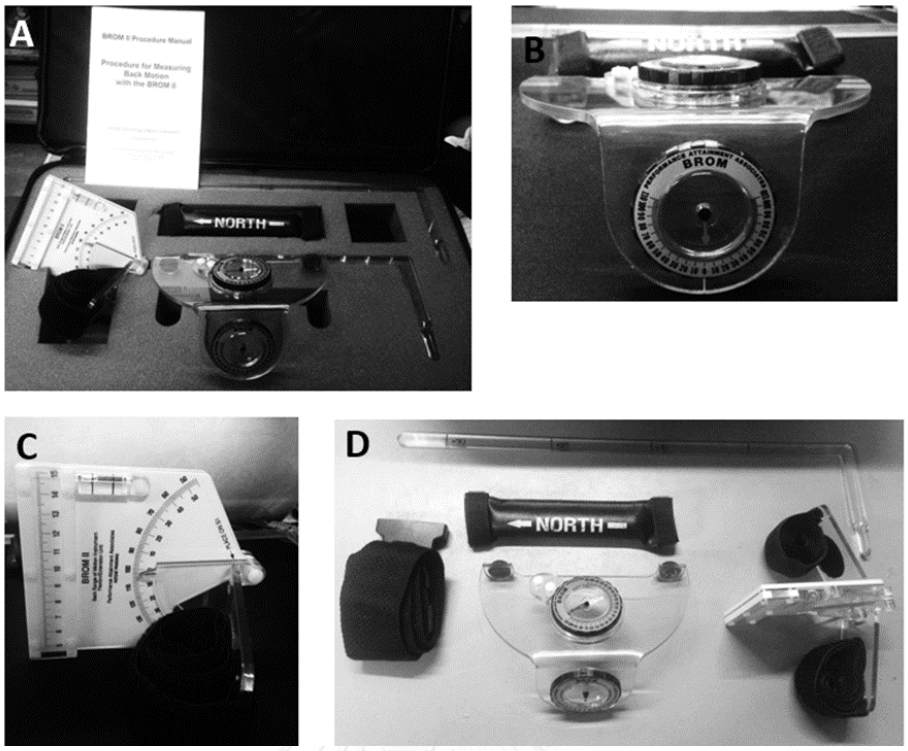

Figure 1 Back range of motion device (BROM II): A) BROM II, B) a combination gravity goniometer and the BROM R/L unit, C) a modified inclinometer and a plastic protractor D) a modified inclinometer, the L-shaped movable arm , a combination gravity goniometer and the BROM R/L unit, belt and magnetic

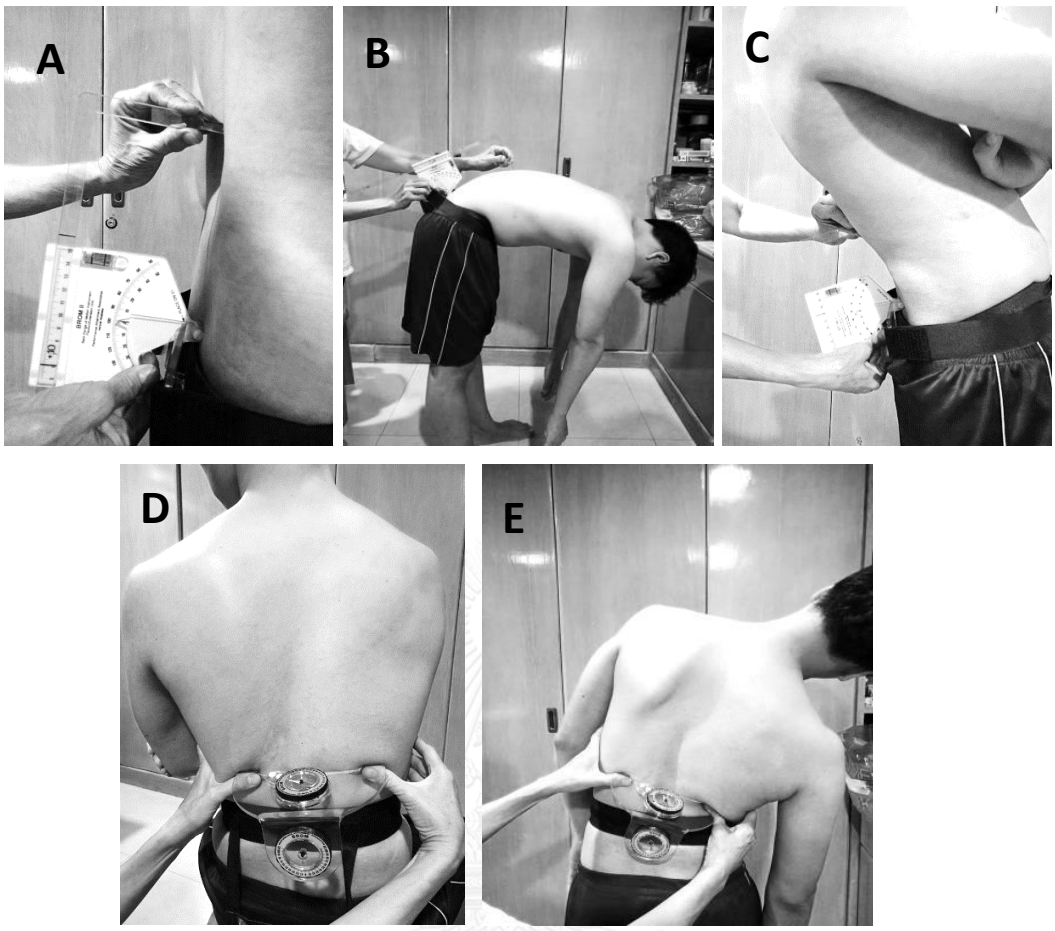

Figure 2 Measuring positions for BROM II: A) neutral position, B) flexion, C) extension, D) trunk rotation and E) trunk lateral bending

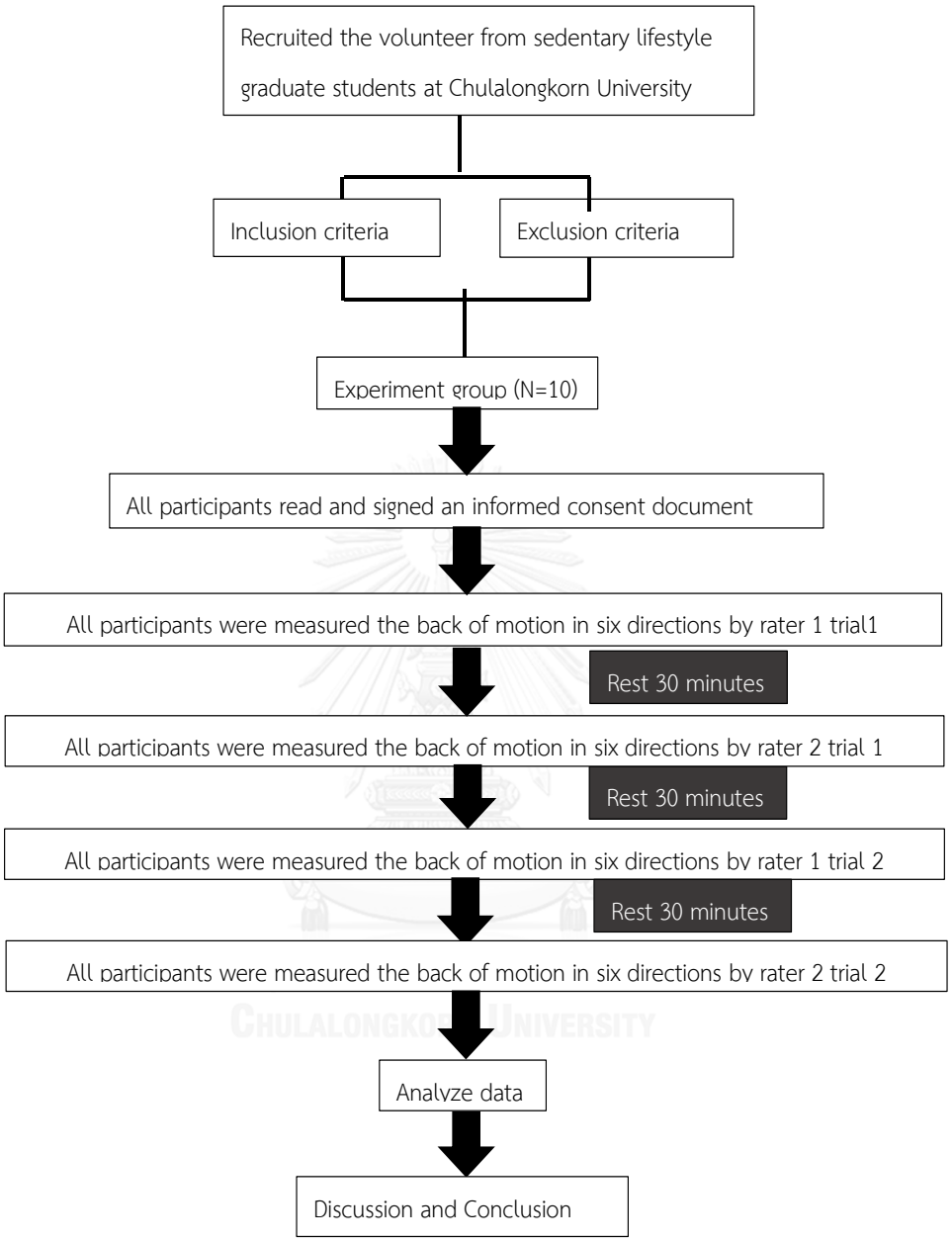

Figure 3 Flow Chart of Methodology

PROCEDURE

Two examiners in this study were a physical therapist (5 years of physical therapist clinical experience). Both examiners read the instrument manual and practiced using the BROM II until familiar with the testing instrument. Participants were asked to answer the self-administered questionnaire. After that, they performed the three repetitions of a warm-up session in all testing motions before the beginning data collection. All movements were tested in standing position except lumbar rotation, in which subjects were seated on a non-rotating bench with the feet flat on the floor. Each examiner palpated and marked the spinous processes of T12 and S1 with a non-permanent marker for instrument placement at the beginning of every trial and removed the mark after each trial. Each participant has measured four trials on the same day. The first trial by examiner A (EP) or B (MP), then by another examiner, followed by examiner A or B again and then by another examiner again. The resting times between trial was at least 30 minutes. This study was investigated on November 2016 to January 2017.

DATA ANALYSIS

Data were analyzed by using the Statistical Package for the Social Sciences (Version 17.0). Descriptive statistic including mean, standard deviation and ranges were computed for participant characteristics. Means, 95% confidence intervals (95%CI), and ranges were computed for a lumbar ROM in all directions. Test-retest

reliability of the BROM II was calculated using ICC3,3 (Two-way mixed model), a measure of relative reliability. The standard error of measurement (SEM) was calculated. The SEM is a measure of absolute reliability expressing measurement error in the same units as the original measurement (Shrout and Fleiss 1979, Stratford and Goldsmith 1997). The following formula was used, SEM = SD x √(1-ICC3,3) (Goldberg, Chavis et al. 2012) while SD is the highest SD of all trials, and ICC3,3 is the test-retest reliability coefficient. The MDC at the 95% confidence level (MDC95) was computed as 1.96 x SEM x √2 (Goldberg, Chavis et al. 2012). SEM and MDC95 were also expressed as a percentage (SEM% and MDC95%) to enhance interpretation of the absolute values of measurement error and minimum change. The following formulas were used: 1) SEM% = (SEM x 100)/mean and 2) MDC95% = (MDC95 x 100)/mean (Wagner, Rhodes et al. 2008, Goldberg, Chavis et al. 2012). Statistical significance was set at $p \leq 0.05$. The Scheme for defining the amount of reliability with ICCs has the following values: 0.90-0.99 is high reliability; 0.80-0.89 is good reliability; 0.70-0.79 is fair reliability; and 0.69 and below is poor reliability (Madson, Youdas et al. 1999).

RESULT

CHARACTERISTICS

Table 1 presents the characteristics of the participants. The periods of sitting of all participants was 7.4 $\pm$ 1.17 (range from 6 - 10 hours per day).

Table 1 Demographic data

Characteristic	Mean (SD)	Range
Age (yr.)	27.20 (3.70)	22-31
Height (cm.)	163.30 (3.30)	158-170
Weight (Kg.)	60.32 (7.91)	51-75
Body Mass Index (Kg/m^2)	22.67 (3.42)	18.73-27.88
The period of sitting/day (Hrs.)	7.4 (1.17)	6-10

INTRA-AND INTER-RATER RELIABILITY

For a sagittal plane of motion, the intra-rater reliability for lumbar forward flexion and lumbar extension were high (ICC range = 0.94-0.95 and 0.98-0.99, respectively). For a frontal plane of the movement, the intra-rater reliability was also high (ICC range for right trunk bending = 0.98-0.99 and for left trunk bending = 0.97-0.99). Whereas for the transverse plane of motion, the intra-rater reliability for right and left trunk rotation were high (ICC range = 0.95-0.97 and 0.96-0.97, respectively) (Table 2).

Inter-rater reliability for lumbar extension and right trunk bending were high (ICC = 0.91 and 0.91, respectively). Inter-rater reliability for left trunk bending and right trunk rotation were good (ICC = 0.88). Inter-rater reliability for lumbar forward

flexion was fair (ICC = 0.79). Inter-rater reliability for left trunk rotation was poor (ICC = 0.66) (Table 2).

Table 2 Intra and Inter rater reliability of rater 1 and 2 of BROM II device for lumbar motion measurement

Movements (Degrees)	Rater 1		Intrarater reliability of rater 1 ICC (95%CI)	Rater 2		Intrarater reliability of rater 2 ICC (95%CI)	Interrater reliability ICC (95%CI)
	Mean trial 1 Mean ± SD (Range)	Mean trial 2 Mean ± SD (Range)		Mean trial 1 Mean ± SD (Range)	Mean trial 2 Mean ± SD (Range)		
Flexion	24.87±4.57 (19.34-34.67)	25.17±3.87 (19.00-32.67)	0.95 (0.79-0.99)	22.93±3.18 (19.00-27.67)	23.37±2.83 (19.34-27.00)	0.94 (0.76-0.98)	0.79 (0.12-0.94)
Extension	9.77±5.60 (2.34-20.34)	9.50±5.26 (3.67-20.67)	0.98 (0.91-0.99)	10.97±4.94 (5.00-18.34)	10.77±5.21 (5.00-20.00)	0.99 (0.95-0.99)	0.91 (0.65-0.98)
Right trunk bending	24.74±4.43 (16.67-30.00)	25.87±4.68 (18.00-32.00)	0.98 (0.93-0.99)	25.64±5.13 (18.67-34.00)	25.67±4.78 (18.67-30.00)	0.99 (0.96-0.99)	0.91 (0.64-0.98)
Left trunk bending	23.27±4.92 (16.00-32.67)	23.40±5.06 (16.67-33.34)	0.99 (0.94-0.99)	23.87±4.27 (18.67-30.67)	23.77±4.14 (18.67-30.00)	0.97 (0.89-0.99)	0.88 (0.52-0.97)
Right trunk rotation	6.33±4.19 (2.00-15.34)	6.20±3.49 (2.00-13.34)	0.97 (0.89-0.99)	5.93±3.15 (2.67-13.34)	5.60±3.11 (2.67-11.34)	0.95 (0.79-0.99)	0.88 (0.51-0.97)
Left trunk rotation	5.60±2.65 (2.00-10.67)	5.73±2.67 (2.67-11.34)	0.97 (0.85-0.99)	4.80±2.88 (2.00-10.00)	4.93±2.83 (2.00-10.00)	0.97 (0.88-0.99)	0.66 (-0.37-0.91)

SEM, MDC_{95}, SEM% and MDC_{95}%

Table 3 presents the SEM, MDC_{95}, SEM%, MDC_{95}%. The SEM was 0.78-1.02 degrees, and MDC_{95} was 2.16-2.83 degrees for lumbar forward flexion. SEM was 0.59-0.83 degrees, and MDC_{95} was 1.64-2.30 degrees for a lumbar extension. SEM was 0.51-0.63 degrees, and MDC_{95} was 1.42-1.74 degrees for right side bending. SEM was 0.62-0.71 degrees, and MDC_{95} was 1.72-1.98 degrees for left side bending. SEM was 0.69-0.71 degrees, and MDC_{95} was 1.90-1.98 degrees for right trunk rotation. SEM was 0.51 degrees, and MDC_{95} was 1.40 degrees for left trunk rotation. SEM% was 3.40-4.11, and MDC_{95}% was 9.42-11.39 for lumbar flexion. In extension, SEM% was 5.52-8.50, and

MDC_{95}% was 15.29-23.57. SEM% was 2.00-2.43, and MDC_{95}% was 5.55-6.73 for right trunk bending. Left trunk bending, SEM% was 2.65-3.00, and MDC_{95}% was 7.34-8.30. In right trunk rotation, SEM% was 10.87-12.00, and MDC_{95}% was 30.15-33.24. Left trunk rotation, SEM% was 8.83-10.57, and MDC_{95}% was 24.51-29.27.

Table 3 Standard error of measurement and minimum detectable change at the 95% confidence interval

Movement	Rater	Intrarater reliability ICC	SEM (degree)	%SEM (percent)	MDC_{95} (degree)	MDC_{95}% (percent)
Flexion	Rater 1	0.95	1.02	4.11	2.83	11.39
	Rater 2	0.94	0.78	3.40	2.16	9.42
Extension	Rater 1	0.98	0.83	8.50	2.30	23.57
	Rater 2	0.99	0.59	5.52	1.64	15.29
Right trunk bending	Rater 1	0.98	0.63	2.43	1.74	6.73
	Rater 2	0.99	0.51	2.00	1.42	5.55
Left trunk bending	Rater 1	0.99	0.62	2.65	1.72	7.34
	Rater 2	0.97	0.71	3.00	1.98	8.30
Right trunk rotation	Rater 1	0.97	0.69	10.87	1.90	30.15
	Rater 2	0.95	0.71	12.00	1.98	33.24
Left trunk rotation	Rater 1	0.96	0.51	8.83	1.40	24.51
	Rater 2	0.97	0.51	10.57	1.40	29.27

DISCUSSION

The BROM II device can measure the lumbar motions independent of the combined thoracic and hip movements. Moreover, it has high intra-rater reliability. Intra-rater reliability of the BROM II device in this study was high for all lumbar direction (ICC range, 0.94-0.99), which was substantially better than the study of (Madson, Youdas et al. 1999, Kachingwe and Phillips 2005, Atya 2013). Madson et al. (1999) reported

the intra-rater reliability of lumbar motion is fair to poor for sagittal plane measurement (ICC range, 0.67-0.78) and high to good for the coronal plane (ICC range, 0.88-0.95). Kachingwe and Phillips (2005) reported the intra-rater reliability of lumbar motion is fair to poor for sagittal plane measurement (ICC range, 0.55-0.74) and fair to poor for the coronal plane (ICC range, 0.60-0.79). Azza M. (2013) reported the intra-rater reliability of lumbar motion is high to good for sagittal plane measurement (ICC range, 0.84-0.91) and good for the coronal plane (ICC range,0.81-0.88) (Atya 2013). Intra-rater reliability was found to be better than intra-rater reliability for measurements in all planes.

Inter-rater reliability of the BROM II in this study was high reliability (ICC= 0.91) in lumbar extension and right trunk bendiong, which was substantially better than the findings of Kachingwe and Phillips (2005). The inter-rater reliability when measuring left trunk bending and right trunk rotation is good (ICC=0.88) and was better than the findings of Kachingwe and Phillips (2005). Inter-rater reliability in flexion is fair (ICC=0.79), it is similar to the previous study (Kachingwe and Phillips 2005). Inter-rater reliability in left trunk rotation is poor reliability (ICC=0.66). One explanation for lower reliability may be due to the different command and the difference of ability to maintain hand pressure in two examiners. Moreover, when the subjects were measured repetitively, it may stretch back muscles which in turn increase its flexibility (Shellock and Prentice 1985, Abelson and Abelson 2005) Thus, the results of 2 examiners may be different from these reasons.

BROM II has a little error of measurement and small measurement error percent values (SEM%) in all lumbar motions especially in lumbar flexion, extension and lateral bending (SEM range, 0.51-1.02) and (SEM% range, 2.00-8.50). It suggests excellent absolute reliability of BROM II device in persons with a sedentary lifestyle. Moreover, MDC95 and MDC95% in this study are small in all directions of lumbar motion (MDC95 range, 1.40-2.83 and MDC95% range, 5.55-33.24), suggesting that the BROM II may possibly be sensitive to detecting a real change in the back range of motion in persons with a sedentary lifestyle.

Suggestions for further studies of inter-rater, intra-rater reliability, measurement error and minimum change in BROM II device should blind testers to decrease tester bias. Further studies should be randomized the subject to measure to increase the constancy of protocol. Furthermore, the further studies should be focused on individuals who have symptomatic low back pain with a sedentary lifestyle.

CONCLUSION

The results of this study suggest that intra-rater reliabilities were high in all directions. In contrast, the inter-rater reliabilities range from high to poor. The back range of motion device (BROM II) may be a better clinical choice because it has high reliability for measuring the active back range of motion in all directions in the persons with a sedentary lifestyle when performed by the same examiner. So the

benefit is directly for the same rater such as doctor or physical therapist to detect the improvement of back motion after a period of treatment. Furthermore, it is uncomplicated for using and lowering error of measurement.

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