Effectiveness of the Self Static Stretching Strengthening program on physical performances in market vendors: A Quasi-experimental study

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ผลของโปรแกรม ยืด-เหยียด-ขยับ-หยุด ต่อสมรรถภาพทางกายในคนค้าขาย:การศึกษากึ่งทดลอง

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บทนำ: ภาวะความผิดปกติของระบบกระดูกและกล้ามเนื้อมักพบได้บ่อยในกลุ่มพ่อค้าแม่ค้าที่ทำงานในตลาด การศึกษานี้ได้ออกแบบโปรแกรม “ยืด-เหยียด-ขยับ-หยุด”สำหรับการออกกำลังกายเพื่อลด และป้องกันภาวะความผิดปกติของระบบกระดูกและกล้ามเนื้อ วัตถุประสงค์: เพื่อศึกษาผลของโปรแกรม “ยืด-เหยียด-ขยับ-หยุด” เปรียบเทียบกับการให้ความรู้ทางการยศาสตร์ต่อสมรรถภาพทางกายในพ่อค้า แม่ค้าในตลาด *วิธีการศึกษา:* รูปแบบการศึกษาคือการศึกษากึ่งทดลองโดยมีกลุ่มควบคุม โดยการศึกษานี้ได้เลือกให้ตลาดสดสามย่านเป็นกลุ่มทดลอง และตลาด อตก.เป็นกลุ่มควบคุม พ่อค้า แม่ค้าที่อาสาเข้าร่วมการศึกษาในครั้งนี้จะถูกขอให้ตอบแบบสอบถาม และได้รับการประเมินความเจ็บปวดของกล้ามเนื้อ, ความยืดหยุ่นของกล้ามเนื้อ และความแข็งแรงของแรงบีบมือ โดยข้อมูลของผู้เข้าร่วมงานวิจัยที่มีคุณสมบัติตามเกณฑ์การคัดเข้า และเกณฑ์การคัดออกจะถูกนำมาใช้ในการศึกษาครั้งนี้ โดยพ่อค้าแม่ค้าที่เข้าร่วมการศึกษานี้ในกลุ่มทดลองจะได้รับโปรแกรม “ยืด-เหยียด-ขยับ-หยุด” จากนักกายภาพบำบัด 3 วันต่อสัปดาห์เป็นระยะเวลา 4 สัปดาห์ และจะถูกขอให้ฝึกโปรแกรมนี้ด้วยตนเองอีก 6 เดือน ทั้ง 2 กลุ่มจะได้รับการตรวจประเมินทั้งหมด 5 ครั้ง สถิติ Repeated measures ANCOVA ถูกใช้เพื่อทดสอบผลของโปรแกรม “ยืด-เหยียด-ขยับ-หยุด” ต่อต่อสมรรถภาพทางกาย *ผลการศึกษา:* หลังสิ้นสุดการศึกษามีผู้เข้าร่วมทั้งหมด 131 คน (กลุ่มทดลอง 56 คน และกลุ่มควบคุม 75 คน) การศึกษานี้พบว่าในช่วงก่อนเริ่มการฝึก ลักษณะทั่วไปของผู้เข้าร่วมวิจัยทั้ง 2 กลุ่มไม่มีความแตกต่างกัน ผลการศึกษายังแสดงให้เห็นว่าโปรแกรม “ยืด-เหยียด-ขยับ-หยุด” สามารถช่วยลดอาการเจ็บปวดกล้ามเนื้อหลัง และขาในกลุ่มทดลองในช่วงระยะหลังการฝึก และระยะติดตามผลเดือนที่ 1 (p<0.05) นอกจากนี้การศึกษายังพบว่ามีความแตกต่างของความยืดหยุ่นของกล้ามเนื้อระหว่างกลุ่มในระยะหลังฝึกโปรแกรม “ยืด-เหยียด-ขยับ-หยุด” และระยะติดตามผลเดือนที่ 1 เดือนที่ 3 และเดือนที่ 6 (p<0.05) *สรุป:* โปรแกรม “ยืด-เหยียด-ขยับ-หยุด” สามารถลดอาการปวดของกล้ามเนื้อหลัง และขา และเพิ่มความยืดหยุ่นของกล้ามเนื้อเมื่อเปรียบเทียบระหว่างกลุ่ม ผลของการศึกษานี้สามารถนำไปปรับใช้ในกลุ่มพ่อค้า แม่ค้าในพื้นที่อื่นที่มีลักษณะคล้ายคลึงกัน

สาขาวิชา สาธารณสุขศาสตร์ ลายมือชื่อนิสิต .....

ปีการศึกษา 2562 ลายมือชื่อ อ.ที่ปรึกษาหลัก .....

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KEYWORD: WORK-RELATED MUSCULOSKELETAL DISORDERS, STRETCHING EXERCISE, STRENGTHENING EXERCISE, MUSCLE PAIN, MUSCLE FLEXIBILITY, GRIP STRENGTH, HEALTH RISK BEHAVIORS, MARKET VENDORS

Salila Cetthakrikul : Effectiveness of the Self Static Stretching Strengthening program on physical performances in market vendors: A Quasi-experimental study. Advisor: Asst. Prof. USANEYA PERNGPARN, Ph.D.

Introduction: Work-related musculoskeletal disorders (WRMDs) often occurs within the market vendor group. This study design is a Self-Static Stretching and Strengthening program for market vendors for reducing and/or preventing WRMDs. *Objective:* To determine the effectiveness of the Self-Static Stretching and Strengthening program (SSS program) compared with ergonomic knowledge on physical performances in market vendors. *Methods:* This study design was a quasi-experimental study with the control group. Base on convenience, the Samyan market was placed into the intervention group and the Ortorkor market was placed into the control group. The market vendors who volunteered were asked to complete the questionnaire and were measured muscle pain, muscle flexibility, and grip strength. As well, the market vendors who met the criteria were recruited to this study. The market vendors in the intervention group performed SSS program with physical therapists 3 times a week for 4 weeks and they were asked to perform this program by themselves for 6 months. Both groups were assessed at 5-time points. Repeated measures ANCOVA was used for determining the effects of SSS program on physical performances. *Result:* After final implementation, there were 131 participants attended the study (intervention group = 56, control group =75). There was no statistically significant difference in participant characteristics between both groups. After the intervention program was completed, there were significant differences in the degree of pain between both groups in the lower back area and at the left leg area at post-intervention and 1-month follow up ($p<0.05$). There were significant differences in muscle flexibility between groups at post-intervention and 1-month, 3-months and 6 months follow up ($p<0.05$). *Conclusion:* The Self-Static Stretching and Strengthening program has effective for reducing muscle pain at the lower back and legs and improving muscle flexibility when compared between both groups. The results of this study may be generalized to market vendors in other markets within a similar context.

Field of Study:	Public Health	Student's Signature .....
Academic Year:	2019	Advisor's Signature .....

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Chapter 1

Introduction

Work related musculoskeletal disorders (WRMDs) are a group of health problems involving movement structures i.e., muscles, tendons, ligaments, bones, cartilages and nerves (1) as a result of work based activities. The common symptoms of WRMDs include pain, muscle discomfort, muscle fatigue and loss of function (2). There are 3 factors of WRMDs: a) external factors such as too much repetition, poor posture and heavy lifting; b) internal factors such as smoking, obesity and related co-morbidities plus; c) psychosocial factors such as lack of influence in job settings, high pressure jobs and poor communication (2, 3). About 20% and 30% of people across the global live with painful musculoskeletal conditions (4). About 25% of workers in the Europe and 40% of workers in the United States of America reported musculoskeletal disorders (5). In Thailand, the Department of Labor Protection and Welfare (DLPW) reports that 1,838 cases were diagnosed with work-related illnesses. In addition, the DLPW, reports that as at 2017, 84.5% left work due to musculoskeletal disorders (6).

Markets in Thailand are an important part of the Thai community because they can be a central area to exchange either products or information. Thai markets are differentiated from shopping malls because they are open areas with many shops and stalls selling items such as cooked food, meats, seafood, fruit, vegetables, and consumer goods. A market vendor is the person who sells food or goods at a market. In Thailand, The Department of City Planning reported in 2015 that there were 364 markets in Bangkok (7). The Office of Permanent Secretary Ministry of Labor reported that there were 16.9% employed persons in Thailand who worked in wholesale and retail trade industries. The Thai National Statistical Office surveyed and reported there were 23.1% employed persons in Bangkok who worked in wholesale and retail trade industries (8). The market vendors always sit or stand at their shop and make contact directly with buyers in selling their products. WRMDs often present to market-vendors because of job characteristics such as prolonged sitting and standing, repetitive arm movement and lifting heavy loads. The common symptoms of WRMDs include muscle pain, muscle discomfort, muscle fatigue, muscle weakness, and loss of muscle flexibility (2). The most common factors associated with work related musculoskeletal disorders in market vendors was prolonged sitting and standing

(66.6% in males and 71.8% in females) (9). However, the prevalence of WRMDs among market vendors in Bangkok is still unclear.

Many previous studies (10-14) have surveyed musculoskeletal disorders in workers such as office workers, factory workers, handicraft workers, health providers and agricultural workers. Results showed different pain areas among different types of workers because of different job responsibilities. Table 1 displays the percentage of pain areas in different 5 different job sections in Thailand.

Table 1 Pain areas in different job sectors in Thailand

Job section	**Pain area**
Office workers (10)	Neck (53.5%)
	Lower back (53.2%)
	Shoulder (51.6%)
Factory workers (14)	Lower back (28%)
	Neck (24%)
	Shoulder (18.6%)
Handicraft workers (13)	Upper back (86.6%)
	Shoulders (78.8%)
	Neck (78.3%)
Health care providers (12)	Lower back (45.7%)
	Neck pain (28.5%)
	Shoulder pain (23.5%)
Agricultural workers (11)	Lower back (58.7%)
	Shoulder (42.9%)
	Wrist (36.9%)

WRMDs may be prevented via training such as exercise, education, ergonomic training, and massage. Different types of exercise for reducing muscle pain were stretching and strengthening exercises such as static-stretching exercise, dynamic-stretching exercise and isotonic exercise (15). A systematic review of 11 articles found there was moderate evidence to support effective exercise intervention in reducing pain as a result of work-related musculoskeletal disorders among sedentary workers (16).

Massage is a technique for increasing blood flow, reducing pain and releasing muscle tightness. A systematic review determined the effects of massage therapy for reducing symptoms of musculoskeletal disorders compared with other treatments or no treatments. Results revealed massage therapy had short-term effects for reducing pain when compared to no treatment in musculoskeletal disorders. However, the benefits of massage therapy were not clear when compared to other interventions for musculoskeletal disorders (17). A systematic review study showed the less effects of ergonomic training and education on prevention or treatment programs in WRMDs when compared with exercise programs (18). These literature reviews analyzed 20 randomized controlled trial experimental studies, 17 quasi-experimental studies with control groups, and 36 report case studies. The evidence revealed that common interventions for work-related musculoskeletal disorders were exercise, ergonomic training, and education. However, whilst exercise had significant positive effects on reducing low back pain, education and ergonomic training had less effect on the reduction of low back pain.

Health risk behaviors may be referred to as behaviors associated with the effects and consequences on the health of the individual (19), for example non-communicable diseases. Examples of common health risk behaviors in worker groups are alcohol consumption and smoking (20), including that of drug abuse which is a new, emerging trend. Drugs may be referred to the taking of medicine without a doctor's prescription. In Thailand, common medicines which are often abused are paracetamol, antibiotics, anti-depressants, cough and cold relievers and allergy medicines as they are easily obtained from drug stores. A study in the United Kingdom reported that the overuse of prescriptive medications can lead to drug abuse and addiction (21). However, there was no study to describe the prevalence of alcohol consumption, smoking and drug abuse among market vendors in Bangkok.

Many problems relate to work-related musculoskeletal disorders, alcohol consumption, smoking, and analgesic drug abuse among market vendors in Bangkok. WRMDs can decrease activity and absence work due to poor body function performances. Alcohol consumption can cause poor work performance and high risks of non-communicable diseases such as heart disease, stroke, and diabetes. Smoking can cause lung diseases such as chronic obstructive pulmonary disease and lung cancer that lead to limitation of activities because of dyspnea. Analgesic drug abuse can result in drug dependence or drug addiction. The market vendors always suffer from muscle pain or muscle discomfort and exhaustion due to their hard work. Their work conditions and financial reasons make them work all day. So, they use alcohol or smoke cigarettes or take an analgesic drug because they want to decrease physical and mental exhaustion. They should concern their health before they have an illness. However, there is no suitable intervention program for improving health which concerns the problems that relate to work-related musculoskeletal disorders, alcohol consumption, smoking, and analgesic drug abuse among market vendors. The intervention program should be easy and individual and spend a short time practicing.

The purpose of this study was to design and administer a Self-Static Stretching and Strengthening program for market vendors focusing on the arms, trunk, and muscles of the legs. A 600-cc water bottle will be used for weight training as an exercise tool to strengthen the upper extremities. This type of intervention program was designed by physical therapists based on guidelines of American College of Sports Medicine (22). The program is designed for simplicity and ease of use for market vendors either at their shop or stall or at home who had no time for group exercise due to work conditions and the financial reasons.

1.1. Research gaps

1. Many problems relate to work-related musculoskeletal disorders, alcohol consumption, smoking and analgesic drug abuse among market vendors in Bangkok. However, there is no suitable program for improving their health which concerns the problems that relate to work-related musculoskeletal disorders, alcohol consumption, smoking and analgesic drug abuse among market vendors.

2. Market vendors often ignore regularly exercise. To raise their health awareness, easy and effective exercise program should be provided to them. Stretching exercise can be performed easily and it has well known that it can improve muscle performances in workers. So, stretching exercise can increase health awareness among market vendors.

3. There was no study that examined the effects of stretching combined with strengthening as an exercise intervention in reducing muscle pain and improving physical performance outcomes in market vendor groups in Bangkok, Thailand.

1.2. Objective:

To determine the effectiveness of the Self-Static Stretching and Strengthening program compared with ergonomic knowledge on physical performance outcomes in market vendors.

1.3. Specific objective

To examine the problems of WRMDs and health risk behaviors in market vendors in Bangkok, Thailand.

To determine effectiveness of the Self-Static Stretching and Strengthening program compared with a control group on muscle pain within the past 7 days including muscle flexibility, grip strength, work ability and health risk behaviors in market vendors.

To determine effectiveness of the Self-Static Stretching and Strengthening program before and after intervention in market vendors.

1.4. Operational definitions

- **WRMDs** are common health issues involving muscular pain, tightness, fatigue, and discomfort.
- **Market vendors**: workers who sell goods and services in the permanent markets, Bangkok, Thailand.
- **Self-Static Stretching and Strengthening program**: A specific program for market vendors that involves six stretching exercises combined with a 600-cc water bottle used as a tool strengthening tool.
- **Physical performance outcomes** are the ability of body to function involving muscle pain, muscle flexibility, grip strength and work ability.
- **Muscle flexibility** is the ability of muscles and joints to move over a full range of motion. It is measured by a chair sit-and-reach test and back a scratch test.
- **Health risk behaviors** are referred to as behaviors associated with the effects and consequences on market vendor's health as a result of alcohol consumption, smoking and drug abuse.

1.5. Hypothesis:

H_0: There is no effect of the Self-Static Stretching and Strengthening program compared with ergonomic knowledge on physical performance outcomes in market vendors.

H_a: There is an effect of the Self-Static Stretching and Strengthening program compared with ergonomic knowledge on physical performance outcomes in market vendors.

Specific hypothesis

H_0: There is no effect of the Self-Static Stretching and Strengthening program compared with the control group on muscle pain in market vendors.

H_a: There is an effect of the Self-Static Stretching and Strengthening program compared with the control group on muscle pain within the past 7 days including muscle flexibility, grip strength, work ability and health risk behaviors in market vendors.

H_0: There is no difference of the Self-Static Stretching and Strengthening program before and after intervention program in market vendors.

H_a: There is a difference of the Self-Static Stretching and Strengthening program before and after intervention program in market vendors.

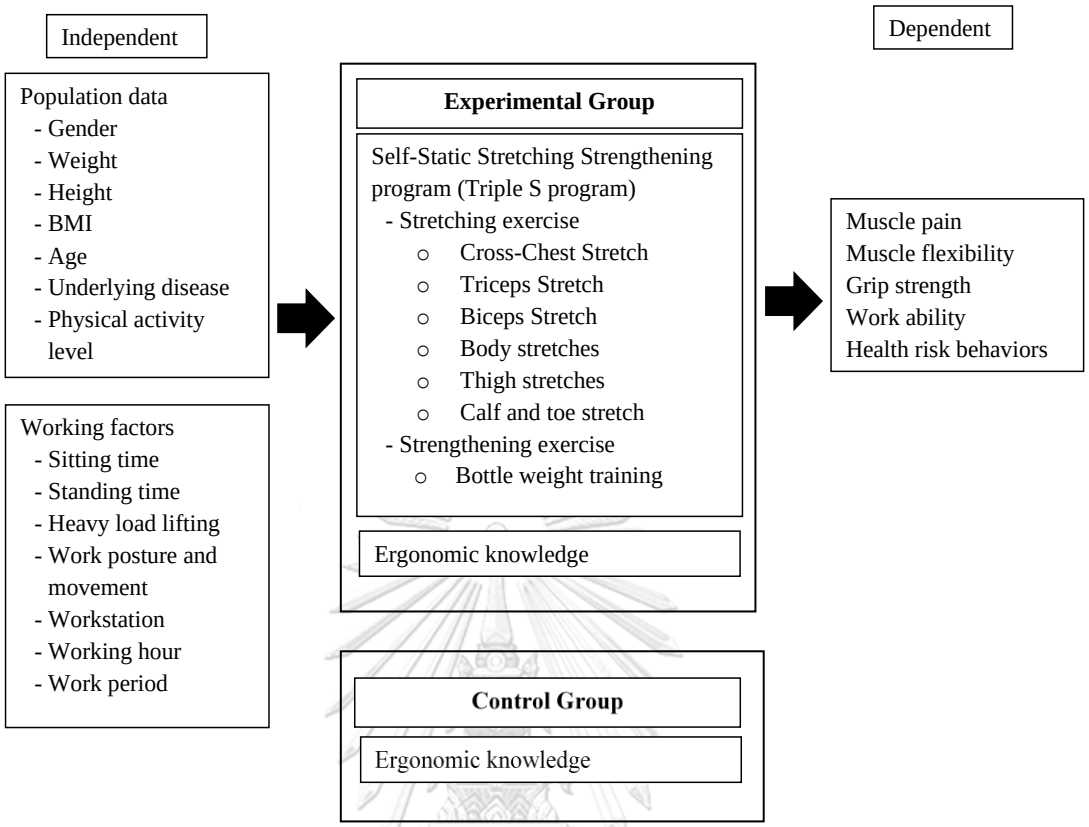


Figure 1 Conceptual framework

Chapter 2

Literature Review

This chapter reviews and details work-related musculoskeletal disorders (WRMDs) in different job sectors including presents various problems associated with market vendors working in Markets, Thailand. Moreover, we review common intervention programs for both the assessment of and the prevention and treatment of WRMDs.

2.1. Work Related Musculoskeletal Disorders

WRMDs are a group of health problems related to work, involving movement structures i.e., muscles, tendons, ligaments, bones, cartilages, and nerves (1). It is the main cause that affects workers (23). About 20% to 33% of people across the global live with a painful musculoskeletal condition (4). In Thailand, the Department of Labor Protection and Welfare (DLPW), reports that 1,554 cases left work due to musculoskeletal disorders in 2017 (6). WRMDs are classified under many terms such as (24):

- Repetitive motion injuries
- Repetitive strain injuries
- Cumulative trauma disorders
- Occupational cervicobrachial disorders
- Overuse syndrome
- Regional musculoskeletal disorders
- Soft tissue disorders

There are 3 characteristics of WRMDs:

1. WRMDs result from overuse. Muscle pain or muscle discomfort occur due to musculoskeletal structures abused repetitively over a workload.

2. WRMDs develop gradually over time. The disorder may be developed gradually from a slight discomfort through to serious pain that may stop a market vendor from working. The disorder may take from a few days through to weeks, months, or years. Interestingly, as WRMDs develop gradually, a prevention program may be applied before the symptoms progress too far. This may be viewed as a positive benefit due to the effectiveness of the program. However, the disadvantage is that the body gets used to the symptoms and pain, so patients often

ignore it. This increases the risk of chronic pain over time and great difficulty for complete recovery.

3. The cause of WRMDs is not single factor. Although overuse is one of the main causes of WRMDs, other factors are repetitive strain injury, poor posture, or overload. In combination, these factors may lead to multiple symptoms of WRMDs (2).

The common symptoms of WRMDs include pain, muscle discomfort, muscle fatigue and loss of function (2). It is a progressive in nature and may be divided into 3 stages (3):

1. Early stage: Patients feel muscle pain, muscle ache or muscle tightness during working periods. However, symptoms reduce after resting and does not interrupt work.

2. Intermediate stage: Patients feel muscle pain, muscle aches or muscle tightness during working periods. Symptoms do not reduce after resting and will interrupt work.

3. Final stage: Patients feel muscle pain, muscle aches or muscle tightness during day. Patients cannot sleep and may be absent from work.

WRMDs may be classified according to the International Classification of Functioning, Disability and Health (ICF). Both external and internal factors result in loss of activity and social participation due to a decrease in body functions (Figure 2).

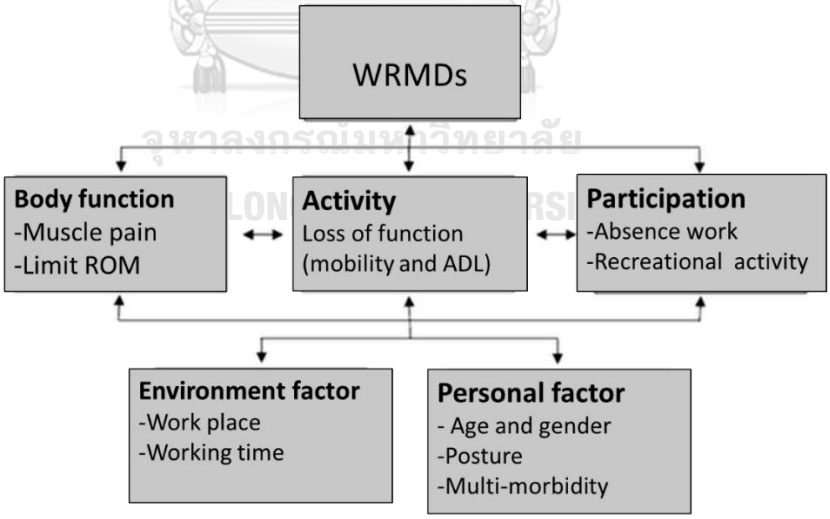


Figure 2 International Classification of Functioning, Disability and Health (ICF) of WRMDs

Risk factors associated with WRMDs may be divided into 3 categories:

1. External factors such as repetitive strain injury, poor posture, and heavy lifting.
2. Internal factors such as smoking, obesity, and other co-morbidities.
3. Psychosocial factors such as lack of influence in job autonomy, high pressure job environments and lack of communication (2, 3).

Moreover, the degree to which these risk factors present depend on 3 main modulators: intensity, frequency, and duration. The intensity is referred to as the amount of risk factor present. The frequency is the number of times the risk factor is present. The duration refers to the amount of time spent when the risk factor is present. For example, a list of risk factors related to WRMDs in market vendors is presented below:

1. Awkward posture with static muscular work:

Awkward posture is the unnatural posture adopted because of workplace or working processes that may lead to muscle strain, ligament sprain, muscle pain or fatigue. These injuries often occur because postures are near their limit in range of movement (ROM). For example, full neck flexion, full stretch of the arm, standing whilst bending forward, reaching above shoulder level, reaching behind the body, arm rotations or head forward postures leading to over stretching of muscles and high compression on the lumbar spine including low blood supply (3). Note that pain intensity may be due to poor posture and will depend on how far it ranges from an anatomical normal posture and duration (2).

2. Physiological distress associated with prolonged sitting and/or standing

Prolonged static positions can result in muscle discomfort or fatigue due to continuous muscular contraction in maintaining these positions (3). Constant muscular contraction requires a greater amount of blood supply due to muscle energy demands, however, muscular contraction also increases pressure inside the muscle that causes blood vessels to be constricted and thus a decrease in blood flow to working muscles resulting in muscle fatigue (2). Standing and sitting are common working positions for market vendors.

Prolonged sitting is a common risk factor for low back pain due to increased stress and pressure on back muscles and vertebral discs. Lumbar lordosis in a standing position is higher

than in a sitting position (25). An increase intervertebral disc pressure (25, 26) is caused as a result of a decrease in lumbar lordosis while sitting due to knee and hip flexion as well as posterior pelvic tilt rotation. A study revealed that an increase in intervertebral disc pressure and decreasing lordosis was associated with low back pain (27).

Prolonged standing increases stress on the leg and back muscles resulting in leg muscle and back muscle pain. A study showed that prolonged standing can cause muscle discomfort, muscle fatigue and muscle pain relating to the back, leg and foot regions. Moreover, a standing position when working could lead to leg edema because of muscle fatigue and discomfort (28). A study evaluated mechanisms of lower back pain that developed during standing. Results indicated that 50% of healthy participants complained of low back discomfort after 2 hours standing due to a changing of inter vertebral disc pressure and joint shear at L4 and L5. This change leading to facet joint separation and ligament length because of moderate spine flexion (29).

3. Repetition and lack of variability in working tasks

Repetitive movement and lack of variability in work related tasks is associated with the same motion sustain over a long period leading to injury on working muscles, tendons, ligaments, and joints. This may result in muscle fatigue and injury (2, 3).

4. Long working hours

Long working hours is a risk factor for WRMDs. A previous study investigated the relationship between working hours and musculoskeletal disorders among 2,617 nurses who answered questions about their work schedules and any symptoms of musculoskeletal pain (30). The longitudinal study revealed that work schedule independently increased the risk of developing a musculoskeletal disorder. Moreover, odd ratio showed nurses who worked an extra hour over a 13 hour day were 1.94, 1.87, and 1.87 times more likely to be exposed to a risk factor relating to neck, shoulder and back disorders, respectively, than nurses who had no an extra hour over a 13 hour day.

A study in Korea surveyed 24,783 wage workers aged 20 and over: 11,890 (48.8%) were female and 12,893 (52.0%) were male, 53.5% had working less than 40 hours/week, 28.1% had working hours between 41-52 hours/week, and 18.4% had working hours greater than 52 hours/week. This study found that 26.4% male workers and 33% female workers reported upper limb pain while 16.4% male workers and 23.4% female workers reported lower limb pain within the past 12 months. After adjusting for confounding factors, the odds ratios for upper limb pain in male and female workers who worked more than 52 hours/week were 1.40 and 1.66 times more likely to be exposed to upper limb pain than male and female workers who worked less than 40 hours/week. Odds ratios for lower limb pain showed that male and female workers who worked more than 52 hours/week were 1.47 and 1.47 times more likely to be exposed to lower limb pain than male and female workers who worked less than 40 hours/week (31).

2.2. Work-related musculoskeletal disorders in job sectors

Office workers showed a high prevalence in these disorders. About 24% of workers in the Europe and 40% of workers in the US reported musculoskeletal disorders due to prolonged sitting and computer use (5). Common symptoms were neck pain, lower back pain and shoulder pain (5, 10, 32, 33). A study used cross-sectional data to examine musculoskeletal disorders among office workers aged 38.55±9.79-year-olds in Iran. This study used the general Nordic Musculoskeletal Questionnaire (NMQ) to evaluate symptoms of musculoskeletal disorders (10). Result showed that 48.8% participants did not feel comfortable with their workstations, 73.6% felt exhausted during the workday, 6.3% had hypertension and 11.2% had hyperlipidemia. Furthermore, pain area among office workers were neck (53.5%), lower back (53.2%) and shoulder (51.6%). Another study determined the association between job satisfaction and musculoskeletal disorders in university office workers (5). Findings revealed that 89% of participants reported musculoskeletal pain within 12 months. There was a negative, moderate correlation between pain intensity and job satisfaction ($r = -0.58$, $p=0.00$) (5).

Factory workers: In China, a study surveyed the frequency of work-related injuries and musculoskeletal disorders in factory workers in Shenzhen (34). This cross-sectional study recruited 3,479 frontline workers in 60 factories during 2008 and 2009. The average age was 28.7 ± 7.2 years old. Results showed 290 workers reported 416 injury events at work in the previous

12 months. About 50% of participants had muscle pain or muscle discomfort with less than one-month duration. Common body parts were lower back (28%), neck (24%), shoulder (18.6%) and upper back (15.5%). Moreover, 12.8% to 26.7% suffered from muscle pain and discomfort everyday within 12 months and 25.5% to 36.5% reported work absence because of musculoskeletal disorders. A logistic regression model showed the factors associated with musculoskeletal disorders over the past 12 months were female workers (OR: 1.58; 95% CI: 1.34–1.87), high education (OR: 2.13; 95% CI: 1.37–3.32), working time $\geq$ 55 hours per week (OR: 1.56; 95% CI: 1.28–1.90), high stress at work (OR: 1.89; 95% CI: 1.30–2.75 for medium stress and OR: 3.16; 95% CI: 2.04–4.89 for high stress) and past injury history (OR: 3.04; 95% CI: 2.14–4.32) (34). In Thailand, a recent study determined the factors related to musculoskeletal disorders among furniture factory workers in Eastern region. Results showed that workers who had at least 1 to 2 years of work, reported neck pain (adjusted Odds Ratios, aOR:12.01, 95% CI:1.82, 79.43) (14).

Handicraft workers are those workers who utilize their hands or simple tools to create useful and decorative objects in traditional ways. A systematic review in 2018 collected articles from three electronic databases and 30 articles were selected following inclusion and exclusion criteria (35). There were 27 with a cross-sectional study design, 2 with a case-control study design and one was a prospective cohort study. Results showed that the pain areas of the body were the neck, back, knees and arms among handicraft workers. Risk factors associated with pain, were prolong sitting, working posture, repetitive movements, and stressful work conditions. Other risk factors included daily working hours, forceful movements, work experience, age, and gender. However, workers who had higher education levels showed lower risk in developing WRMDs (35). A recent study determined musculoskeletal pain among 979 handicraft workers located in Chiangmai and Lumphun provinces, the northern part of Thailand (13). The kinds of handicraft were wood crafts, textiles and garments, leather crafts, plastic flower crafts, mulberry paper crafts, silver crafts, ceramics and pottery, bamboo crafts, souvenirs, and paintings. Results showed the highest areas of pain were upper back (86.6%), followed by shoulders (78.8%), neck (78.3%) and upper arm (79.1%). Risk factors associated with pain were improper working environments and poor workstation design. The workers often engage in static and awkward

postures such as bending the neck down and holding the arms upward or seated on the floor without back support (13).

Health care providers: Many studies have assessed the prevalence of WRMDs amongst registration nurses, doctors, and physical therapists. A cross-sectional study assessed the prevalence and distribution of WRMDs among the five groups of healthcare providers in tertiary hospitals. Dentists, laboratory technicians, nurses, physicians, and physical therapists in a tertiary hospital in Chennai, India were recruited from January to June 2013 (36). Results showed that risk factors relating to WRMDs among health care providers were working in the same position for long periods (37.10%), working in awkward and cramped positions (29.20%), and performing the same task over and over (29%). Moreover, among physical therapists, manual orthopedic techniques such as spine mobilization and manipulation and assisting patients in movement activities were major risk factors. For example, 50.7% of participants had symptoms in at least one part of their bodies. 56% nurses 55% physical therapists, 54% dentists, 39% lab technicians and 38% physicians reported musculoskeletal pain within 12 months. The highest pain area was lower back (45.7%) followed by neck pain (28.5%), shoulder pain (23.5%), leg pain (7.1%) and elbow pain (5%). Occupational risk factors in health care providers in Thailand were surveyed by the Bureau of Occupational and Environmental Diseases in the Ministry of Public Health for 253 hospitals in Thailand. This survey recruited 88,667 health care providers. The report revealed that 1.8% participants had musculoskeletal disorders (37). A survey of nurses in a public hospital in Bangkok reported that 61.5% had at least a onetime experience in pain or muscle strain of the lower back (12). Another study concluded that the main cause of musculoskeletal disorders in Thai health care providers were behaviors such as improper posture during heavy lifting, long duration of work activities, and the lack of physical exercise (37).

Agricultural workers are persons who work in farm or livestock. A cross-sectional study recruited 30 farm workers at an agricultural college in Zimbabwe (38). This study assessed the frequency of musculoskeletal symptoms among farm workers and reported that lower back pain was the most common musculoskeletal disorder. Risk factors included prolonged working periods in the same posture, squatting or kneeling. There were significant associations between overhead activities ($p = 0.029$), working in a trunk bending position ($p = 0.007$), pushing or

pulling heavy loads (p=0.014) and the occurrence of musculoskeletal disorders (38). A recent cross-sectional study explored the prevalence and risk factors among sugarcane farmers in North-Eastern Thailand. Results showed that the highest pain areas within 12 months was lower back (58.7%) followed by shoulder (42.96%) and wrist (36.85%). The risk factors associated with WRMDs were repetitive motions (AOR 1.90; 95% CI 1.05-3.43), working in awkward postures (AOR 1.95; 95% CI 1.01-3.77), forceful exertions (AOR 2.78; 95% CI 1.54-5.02), and stress about future income (AOR 1.80; 95% CI 1.02-3.16) (11).

2.3. Markets and market vendors in Bangkok, Thailand

Markets are where buyers can meet sellers and purchase goods and services in exchange for money. The market is part of an urban area and a community center for commercial activity or information exchange. A Thai market is unlike a shopping mall as it is an open area with many shops and stalls selling items such as cooked food, meats, seafood, fruits, vegetables, and consumer goods. According to a Ministerial Regulation of 2008, a market in Bangkok is divided into 2 types: Type 1 and Type 2.

Market Type 1 refers to a permanent market that houses permanent fixtures such as buildings including toilets, sinks, waste collection systems and parking. Market Type 2 refers to markets with no permanent fixtures. However, a Market Type 2 must set up toilets, sinks and waste collection systems. The Department of City Planning reported in 2015 that there are 364 markets in Bangkok, Thailand. This report divided the market into 6 areas. The first area is a Cultural conservation and promotion area, the second is a Business and commercial center, the third is a Residential area, the forth is a Suburban and eastern agriculture area, the fifth is a Suburban and upper western agricultural area and the last is a Suburban and lower western agricultural area (7). Table 2 shows the number and types of markets in each area in 2015.

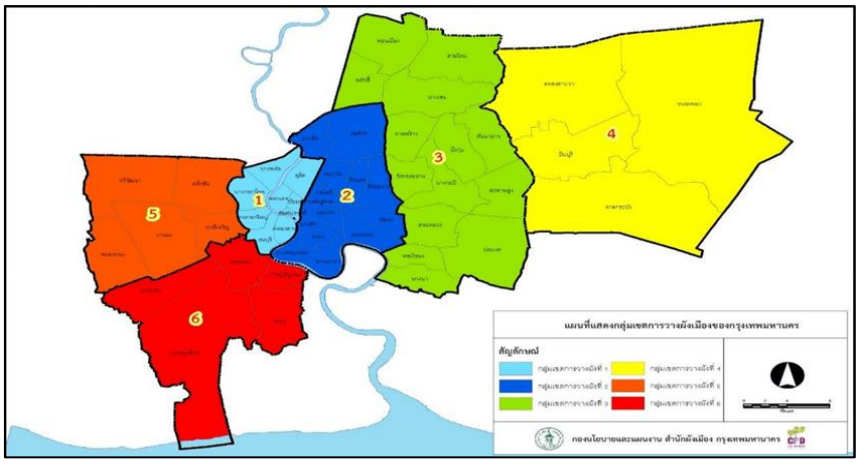


Figure 3 Map of the city area divided between the 1st to 6th districts

Source: http://cpd.bangkok.go.th

Table 2 The number and types of markets in each area, 2015

Area	The number of markets		
	Type 1	Type 2	Total
Area 1	30	16	46
Area 2	31	18	49
Area 3	41	67	108
Area 4	9	56	65
Area 5	12	35	47
Area 6	15	34	49
Total	**138**	**226**	**364**

Source: Department of City Planning. The Market in Bangkok (Report 2014-2015)

A market vendor is the person who sells food and other goods and services in the market. The Office of Permanent Secretary Ministry of Labor reported that there are 16.9% (6,320,800 persons) employed people in Thailand who work in the wholesale and retail trade industry, whilst The Thai National Statistical Office surveyed and reported that there are 23.13% (1,238,500 persons) employed people in Bangkok (Figure 4) (39).

Thai market vendors have many job responsibilities such as selling, shop arrangement, cooking food, serving food, and lifting heavy loads. There are a greater number of females than males working as market vendors. There are 2-4 market vendors within each shop or stall. They often sit or stand and make contact directly with buyers when selling their products.

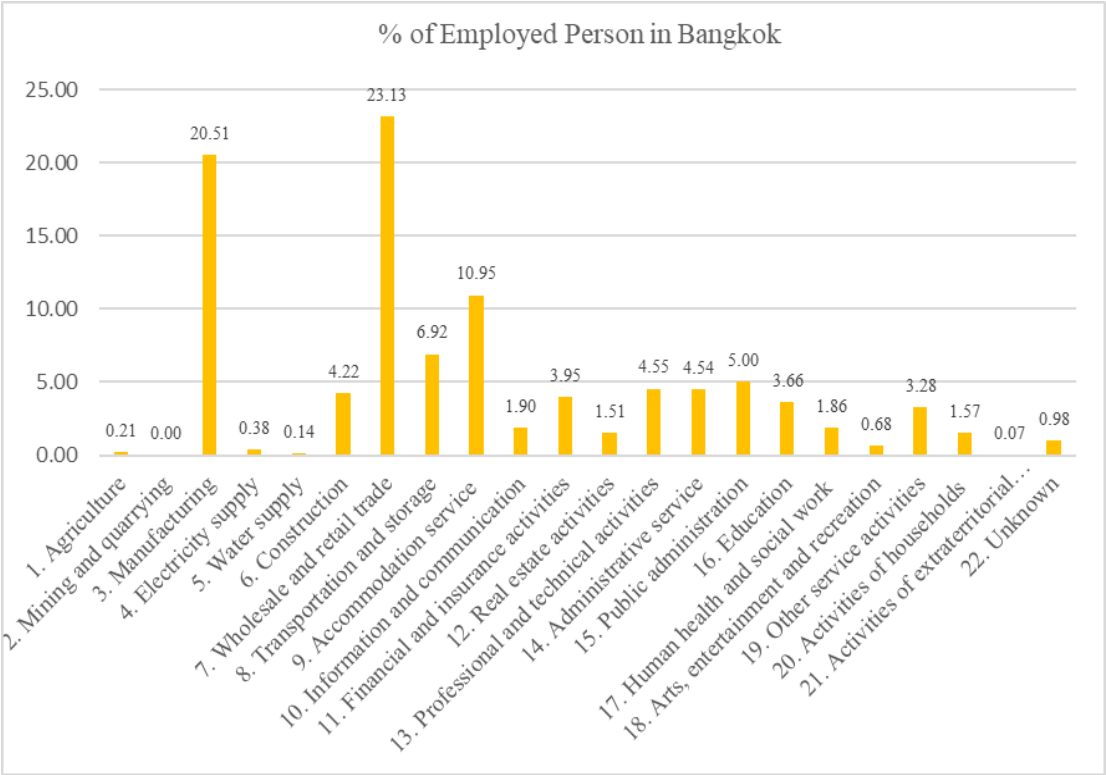


Figure 4 Percentage of employed persons in Bangkok

Source: National Statistical Office. The situation of Thai worker in February 2018

2.4. Work-related musculoskeletal disorders in market vendors

Only a few studies determined the prevalence of work-related musculoskeletal disorders (WRMDs) and associated risk factors in market vendors. A study surveyed WRMDs in different work settings (9). Results indicate that ergonomic risk factors in wholesale and retail workers were prolonged walking and standing, carrying heavy loads and repetitive arm movement. The most common factor associated with WRMDs in market-vendors is prolonged sitting and standing (66.6% in male and 71.8% in female). A cross-sectional study investigated factors associated with the depression in women workers at traditional markets in South Korea. Results showed that low back pain had a low positive correlation with depressive symptoms ($r=0.26$, $p<0.001$) (26). To our knowledge, no study has been conducted to determine the prevalence of WRMDs among market vendors in Bangkok, Thailand.

2.5. Health risk behaviors

Health risk behaviors are described as behaviors associated with the effects and consequences on health (19) such as non-communicable diseases. A study surveyed 19,294 workers in Germany with a mean age of 59.9 years old, 51.3% female and 48.7% male (40). Findings showed that common health risk behaviors were alcohol consumption, smoking, overeating and insufficient physical activity. In addition, 50% of participants in both genders presented with two or three health risk behaviors. Being younger had a higher prevalence of smoking and alcohol consumption than older in both genders but the older one had a higher prevalence in being overweight and being inactive than the younger one. These findings were similar in another cross-sectional study in Brazil, 2015 which determined the co-occurrence of major risk factors for chronic diseases in adults and older people (41). The survey findings showed risk factors among 35,448 adults and 18,726 older people were smoking, being overweight, physical inactivity, alcohol consumption and consuming unhealthy food. Furthermore, results showed at least two risk factors were present in 38.5% of the adults and 37.0% of the older people. The highest risk factors in adults and older people were smoking and alcohol consumption (adjusted OR = 3.52 and 2.94 respectively). Moreover, males presented with a greater percentage in risk factor behavior than females.

Drug abuse is a new emerging trend in health risk behavior. Drugs may be referred to as the taking of medicines without a doctor's prescription. In Thailand, common medicines which are often abused are paracetamol, antibiotics, anti-depressants, cough and cold relievers and allergy medicines as they are readily available from pharmacies. A study in the United Kingdom surveyed the general population (1,000) aged 18 years or older (21). The response rate was 43.4%. Findings revealed that drug abuse were using a higher dose than recommended, dosing more often than recommended and dosing for a longer period than recommended. There were associations between drug abuse and age, the presence of long-standing illnesses requiring regular non-prescription medicines and illicit drug use. Moreover, results also showed that overusing medicines can lead to drug abuse and addiction. An article reported on the risks of over the counter drugs, suggested that 80% of people will buy over the counter medicines for reducing the symptoms of headaches and that patients need education programs to understand the risks associated with over the counter medicines and subsequent abuse (35). More than two thirds of

community pharmacies reported the abuse of medicines such as antihistamines, opiates, mild stimulants, and laxatives suggesting that self-treatment for common illnesses in children and adults should also be considered when discussing the risks of drug abuse.

To our knowledge, no studies have been conducted to date in describing the prevalence of alcohol consumption, drug abuse, insufficient physical activity including determining the relationships between health risk behaviors and WRMDs among market vendors in Bangkok.

2.6. Learning processes

Learning is the process of receiving knowledge. It is the act of getting new, or modifying and reinforcing existing knowledge, behaviors, skills, values, or preferences and may involve synthesizing different types of information (42). There are 2 types of learning methods:

- Passive learning refers to the learner obtaining knowledge or information by presentation form from instructors or assigned readings. This process initiates convergent thinking, where a given question typically has only one right answer.
- Active learning refers to the learner in the instructional process using relevant activities and discussions. This method stimulates and reinforces the learner's conceptual understanding of course material by engaging them within the lesson process, as opposed to merely listing off facts and explaining topics through traditional lectures.

Edgar Dale's Cone of Experience is a model that incorporates several theories related to instructional design and learning processes. This cone shows the least effective method at the top, and the most effective method at the bottom (43).

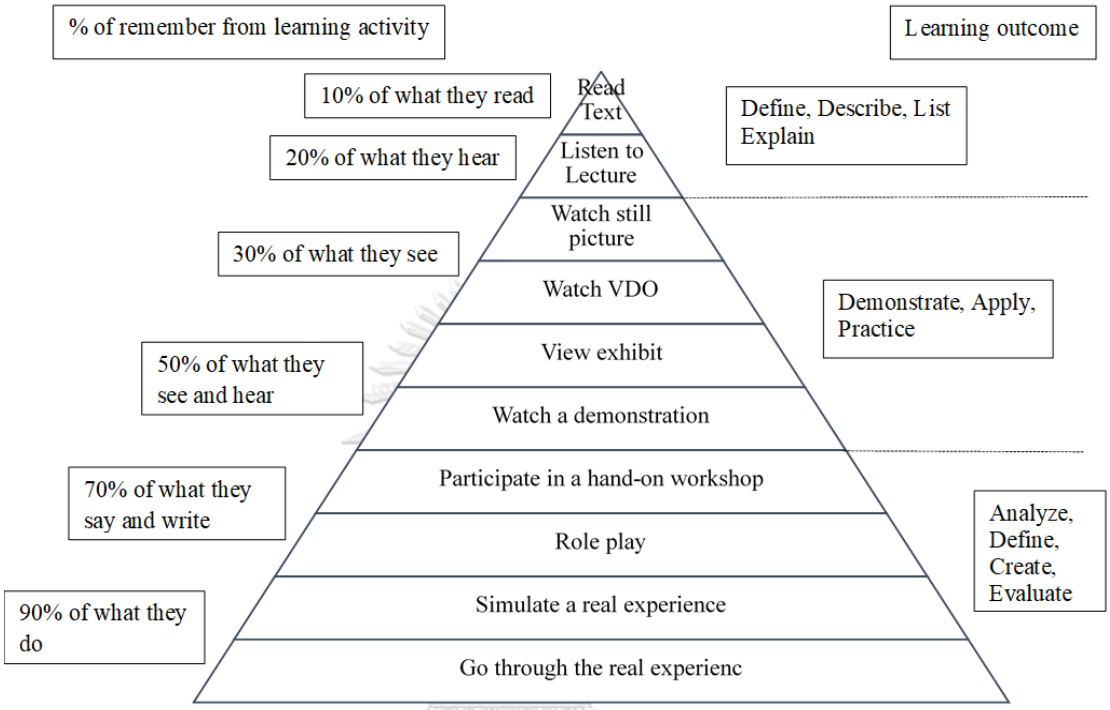


Figure 5 Dale's Cone of Experience

2.7. Stage of change theory

A previous study suggested that WRMDs did not only relate to physical risk factors such as work environment or tools, but also relate to certain health behaviors such as knowledge, attitudes and beliefs about health problems (44).

The Transtheoretical Model (TTM) describes the states of change in behavior outcomes and consists of 5 stages:

1. The first stage is the Precontemplation stage. There is no incentive or intention to change behavior. People are often resistant or unmotivated and tend to avoid changing their behavior associated health conditions.

2. The second stage is the Contemplation stage. At this stage, people plan to change their behavior in the next 6 months. They start to recognize their behavior may be problematic, requiring a more thoughtful and practical consideration of the pros and cons as to why the need for change.
3. The third stage is the Preparation stage. At this stage, people begin taking the small steps in an effort to change.
4. The fourth stage is the Action stage. At this stage people continuously take actions to change their behavior in an effort to keep moving forward with that behavior change.
5. The last stage is the Maintenance stage. This is stage which people have sustained their behavior change for a while (defined as more than 6 months) and they work to prevent any relapses to earlier stages (45).

The strategy for changing behavior may be summarized in 6 methods (46).

1. Superior exchange: Refers to new behaviors providing greater benefits than those of current behaviors. Changing behaviors may involve short or long-term benefits affecting the individual as the family or community.
2. Increased benefits: Provides new information on benefits that people have not been aware of including changing any perceptions of these benefits.
3. Decrease costs: Refers to changing conditions such as a decrease in financial or other type of costs, for example, time or transportation.
4. Decrease the desirability of competing alternatives: Refers to a reduction in desirability of bad behaviors.
5. Socially Desirable: Refers to the use of social pressures for behavior change.
6. Easily Done: Refers to new behaviors that are easy to practice. These methods are elimination of barriers, including the provision of tools and psychological support services, and new skills to make behavior changes.

A systematic review examined 100 articles and identified behavior change maintenance. Results showed that the changing roles of motives, self-regulation, habits, physical and psychological resources and environmental and social influences from the initial behavior can bring about successful maintenance (47).

- Role of motive: People trend towards behavior change, if the new behavior relates to their identity, beliefs, and values.
- Self-regulation: People tend to maintain the new behavior if they can overcome barriers to the performance of the new behavior and they can perform the new behavior successfully.
- Physical and psychological resources: Physical and psychological resources is an important role for maintaining new behaviors. If resources are limited or decreased because of stress, tiredness, exhaustion and intoxication, new behaviors cannot be maintained.
- Habits: these develop after successful self-regulation of a new behavior and may help maintain new behaviors. However, strong previous habits lapse to previous behaviors.
- Environmental and social influences: Environmental and social support are important for behavior change maintenance. People tend to maintain behavior according to relevant social changes.

2.8. Muscle pain/Muscle discomfort assessment

Visual Analog Scale (VAS) is used to assess pain levels. A score of 0 refers to “no pain” and a score 10 refers to “cannot tolerate this pain”. Participants are asked to assess their pain levels by this question “How much you score your pain level,? if a scale of 0 (zero) refers to no pain while a scale of 10 (ten) is severe pain.” (48).

A study recruited 52 chronic pain patients and used a test-retest design to examination reliability. Spearman's correlation coefficients showed values that varied from 0.60 to 0.77 and concluded there was moderate to good reliability in measuring chronic musculoskeletal pain (49). This type of assessment is common in pain level studies as it is easy and quick to administer at the participants community level

The Nordic Musculoskeletal Questionnaire (NMQ) is a questionnaire for assessing musculoskeletal problems. It is useful in epidemiological studies. This questionnaire is not developed for clinical diagnosis (50). There are 2 main parts in the NMQ. The first part is a general questionnaire to identify areas of the body which present with musculoskeletal problems. The second part is a questionnaire that relates to the neck, shoulders, and lower back pain. Reliability and validity tests of the NMQ was assessed by using a test–retest study. Results showed that the number of different answers ranged from 0 to 23% for reliability while validity showed that the number of non-identical answers varied between 0 and 20%, concluding that the NMQ is an acceptable tool for screening purposes (51). The present study used NMQ body mapping combined with VAS assessment to evaluate pain areas and pain intensity.

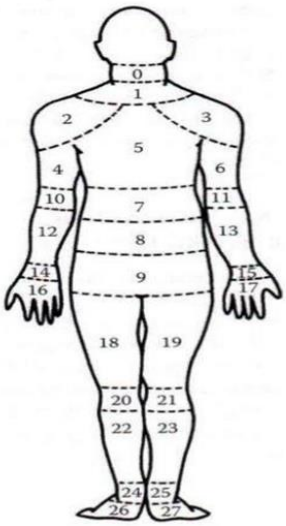


Figure 6 NMQ Body Chart

Table 3 identifies the number and body regions from NMQ Body Chart. It divides the body into six areas further subdivided into 27 areas. The divisions and subdivision combinations are shown below:

1) Neck and upper back area (combined area: 0, 1 and 5)

2) Lower back area (combined area: 7, 8 and 9)

3) Right arm area (combined area: 3, 6, 11, 13, 15 and 17)

4) Left arm area (combined area: 2, 4, 10, 12, 14 and 16)

5) Right leg area (combined area 19, 21, 23, 25 and 27)

6) Left leg area (combined area 18, 20, 22, 24 and 26)

Table 3 Body regions

Number	Body region	Number	Body region
0	Upper neck	14	Left wrist
1	Lower neck	15	Right wrist
2	Left shoulder	16	Left hand
3	Right shoulder	17	Right hand
4	Left upper arm	18	Left thigh
5	Back	19	Right thigh
6	Right upper arm	20	Left knee
7	Waist	21	Right knee
8	Buttock	22	Left calf
9	Bottom	23	Right calf
10	Left elbow	24	Left ankle
11	Right elbow	25	Right ankle
12	Left lower arm	26	Left foot
13	Right lower arm	27	Right foot

2.9. Assessing muscle strength

There are many methods to evaluate muscle strength. The American College of Sports Medicine's guidelines concluded muscle strength testing into 3 groups; laboratory epidemiologic and self-assessment (52). This table show the name of muscle strength test.

Table 4 Muscle strength test

	Laboratory	Epidemiologic	Self-assessment
Muscular strength	Isokinetic tests	-Handgrip dynamometer -Leg dynamometer	Upper-lower trunk lift Hanging leg lift

The isokinetic test uses a computer exercise machine that measures muscle strength with constant speed and angular motion. Results obtained may be used for designing individual athlete programs. Hand grip and leg dynamometers are portable equipment for testing grip and leg strength, respectively. Both instruments are portable, and tests are easy to perform. The hanging leg lift tests core muscle testing requiring a bar for hanging. It is a serious athletic exercise and not for market-vendors. Guidelines from the Sports Authority of Thailand and the American College of Sports medicine were used for muscle strength test assessments (52, 53).

Grip strength is assessed by a handgrip dynamometer (Takei 5401 Digital Dynamometer, Japan). The test will apply to both arms. This test is regularly used to measure overall muscle strength in medical and sports practices. A cross-sectional study recruited 384 healthy children aged 8 to 20 years old (54). Results showed a high, positive correlation between total muscle strength and grip strength (r=0.736 and 0.890, p<0.01).

Figure 7 Hand grip dynamometer

The procedure of measuring is as follows:

- The assessor explains and demonstrates to the participants the test protocol and equipment used.
- Participants are in a standing position holding the handgrip dynamometer.
- Elbow is bent slightly and does not touch the body.
- The assessors ask the participants to squeeze the dynamometer with their hand as hard as they can.
- The participants performed each test 3 times a 10-20 seconds pause between each test to avoid the effects of muscle fatigue.

- The results were measured and recorded in kilogram for each test.
- The maximum number (in kilogram) was divided by weight (in kilogram). Results were compared with the table below for interpretation.
- Interpretation of results are based from the Sports Authority of Thailand (Table 5 for females and Table 6 for males). The number in table was presented in kilogram per weight (in kilogram). It can represent as a level of strength.
- The levels of strength are divided into 5 groups: very good, good, moderate, low, and very low.

Age is a factor that relates to grip strength. Thus, the table shows 4 groups of ages and 5 levels of grip strength for females and males.

Table 5 Interpretation for handgrip dynamometer in females

	Level of strength	**Age groups (years)**			
		20-30	31-40	41-50	≥51
Female	Very good	≥0.65	≥0.55	≥0.52	≥0.43
	Good	0.59-0.64	0.51-0.54	0.47-0.51	0.40-0.42
	Moderate	0.45-0.58	0.43-0.50	0.35-0.46	0.32-0.39
	Low	0.39-0.44	0.39-0.42	0.30-0.34	0.29-0.31
	Very low	≤0.38	≤0.38	≤0.29	≤0.28

Table 6 Interpretation for handgrip dynamometer in males

	Level of strength	**Age groups (years)**			
		20-30	31-40	41-50	≥51
Male	Very good	≥0.89	≥0.81	≥0.70	≥0.67
	Good	0.83-0.88	0.74-0.80	0.66-0.69	0.62-0.66
	Moderate	0.67-0.82	0.60-0.73	0.56-0.65	0.52-0.61
	Low	0.60-0.66	0.54-0.59	0.51-0.55	0.47-0.51
	Very low	≤0.59	≤0.53	≤0.50	≤0.46

A previous study reviewed 3 databases to find out the minimum clinically important difference (MCID) in grip strength. It has suggested that 5-6.5 kilograms might be reasonable estimates for meaningful change in grip strength (55). In this study, handgrip dynamometer test was used to assess hand grip muscle strength as it is suitable for current study objectives.

Leg muscle strength is assessed with the use of a leg dynamometer (The Takei 5402, Japan).

Figure 8 Back and leg dynamometer

The procedure for measuring is as follows:

- The assessor explains and demonstrates to the participants the test protocol and equipment used.
- The participants stand on the leg dynamometer and hold the handle.
- Participants knees are bent slightly, and back is straight.
- The assessors ask the participants to pull the handle as hard as possible.
- The participants performed each test 3 times with 10-20 seconds pause between each test to avoid the effects of muscle fatigue.
- Results were measured (in kilogram) and recorded for each test.
- The maximum number (in kilogram) was divided by weight (in kilogram). The result was compared with the table below for interpretation.

- The interpretation of results is based on the table from the Sports Authority of Thailand (Table 7 for females and Table 8 for males). The number in table was presented in kilogram per weight (in kilogram). It can represent as a level of strength.

- The levels of strength are divided into five groups: very good, good, moderate, low, and very low.

Age is a factor that relates to back and leg strength. Thus, the table shows five groups of ages and five levels of fitness/leg strength for females and males.

Table 7 Interpretation for leg dynamometer in females

	Level of strength	**Age groups (years)**			
		20-30	31-40	41-50	≥ 51
Female	Very good	≥1.51	≥ 1.20	≥ 1.09	≥ 1.25
	Good	1.28-1.50	1.03-1.19	0.95-1.08	1.03-1.24
	Moderate	0.81-1.27	0.68-1.02	0.65-0.94	0.57-1.02
	Low	0.58-0.80	0.52-0.67	0.51-0.64	0.35-0.56
	Very low	≤ 0.57	≤0.51	≤0.50	≤0.34

Table 8 Interpretation for leg dynamometer in females

	Level of fitness	**Age groups (years)**			
		20-30	31-40	41-50	≥ 51
Male	Very good	≥ 2.42	≥2.11	≥1.84	≥1.84
	Good	2.21-2.41	1.90-2.10	1.64-1.83	1.66-1.83
	Moderate	1.79-2.20	1.44-1.89	1.24-1.63	1.28-1.65
	Low	1.50-1.69	1.22-1.43	1.04-1.23	1.09-1.21
	Very low	≤1.49	≤1.21	≤1.03	≤1.08

2.10. The assessment of muscle flexibility performance

There are many methods to evaluate muscle flexibility. The American College of Sports Medicine's guidelines concluded muscle flexibility testing into three groups; laboratory epidemiologic and self-assessment (52).

Table 9 Muscle flexibility test

Flexibility	Laboratory	Epidemiologic	Self-assessment
	Goniometer test	Sit-and-reach test Back scratch test	Sit-and-reach test

The goniometer is a test that measures the range of motion in joints such as shoulder joints, elbow joints, wrist joints, hip joints, knee joint and ankle joints, and spine movement. This test is useful for measuring joint stiffness. Back scratch test and sit and reach test or chair sit and reach test are tests for measuring the general flexibility of shoulders and hamstrings of the legs and lower back, respectively

Back scratch test was used to evaluate the general flexibility of the shoulders. This test is simple and is designed to test how close the hands can be brought together behind the back. Guidelines for upper extremities in muscle flexibility measures are extracted from the Sports Authority of Thailand (53).

- The assessor explained and demonstrated to the participants the test protocol and the equipment.
- Participants are standing in anatomical position.
- The participants place one hand over the shoulder behind the head and back, palm touching the body with the fingers directed downwards and try to move as far as possible down the middle of the back.
- The other hand is placed behind the back, palm facing outward and fingers upward and try move upwards as far as possible in an attempt to touch the middle fingers of both hands.
- The assessor measures the distance between the tips of the middle fingers (in centimeter). If the middle fingertips touch, the score is zero.
- If middle fingertips do not touch, the score is negative score but if fingertips overlap, the score is a positive score.

Participants will practice twice, and then test three times. The results are averaged and recorded in the data collection form.

Sit and reach test is used for flexibility evaluation of lower extremity. It is a common measure of flexibility, and specifically measures the flexibility of the lower back and hamstring muscles. Guidelines for lower extremities muscle flexibility measures are extracted from the Sports Authority of Thailand (53).

- The assessor explains and demonstrates to the participants the test protocol and the equipment.
- Test used sit and reach box (Baseline Sit n' Reach Flexibility Box, USA). It is a solid box 30-centrimeters (cm) tall. The measuring line is on top of the box. The length of the measuring line is 23 centimeters. The scale is calibrated to zero at the level of the feet. A score less than the level of the feet is negative and any score greater than the level of the feet is recorded as positive.
- The participants sit on the floor with back straight, knees extended to the front and feet together. The soles of the feet are placed flat against the box and both knees pressed flat to the floor.
- Participants reach forward along the measuring line as far as they can.

Participants practice twice and then perform the test three times with results (in centimeter) averaged and recorded in the data collection form.

Chair sit and reach test is similar to the sit and reach test, and measures lower body flexibility. In this test, participants sit on the chair. Guidelines for lower extremities muscle flexibility measures are extracted from the Sports Authority of Thailand (53)

- The assessor explains and demonstrates to the participants the test protocol and the equipment.
- This test begins with participants sitting on the edge a chair with one leg placed on the floor and another leg extended forward, with heel on the floor, and ankle bent at 90°.
- Participants reach forward with two arms as far as possible and try to touch their toes.
- Participants practice twice, and then perform the test three times with results averaged and recorded in the data collection form.

A study examined a test-retest reliability of senior fitness tests in older people with cognitive impairment (56). A minimal detectable change (MDC) threshold was used to assess reliability. Results indicate a MDC threshold at 90% CI of the chair sit and reach test = 6.0 cm and back scratch test = 4.6 cm (56). For the current study, the back scratch test, chair sit and sit and reach tests were chosen due to their simplicity and ease of use in the market place.

2.11. Assessing Physical Function

Physical function is the ability to perform basic and complex activities such as activities of daily living (ADL), carrying items and engaging in sport. This may be assessed by questionnaires or physical function tests.

Physical Function questionnaire

The Short Form 36 (SF-36) is a questionnaire that evaluates physical and mental components of health. It consists of 36 questions which assesses 8 health concepts and health transitions (HT). The eight health concepts are physical function (PF), role limitations due to physical problems (RP), role limitations due to emotional problems (RE), emotional wellbeing (MH), body pain (BP), energy or fatigue (VT), social functioning (SF) and general health (GH). Eight domains can be summarized into 2 groups; a Physical Component Summary (PCS) which includes PF, RP, BP, GH and VT and a Mental Component Summary (MCS) which comprises GH, VT, SF, RE and MH. All questions are scored on a scale from 0 to 100, with 100 representing the highest levels of functioning possible (57).

Short form 12 (SF-12) is developed from SF-36. There are 12 items for measuring 8 health concepts. The eight health concepts are physical function (PF), role limitations due to physical problems (RP), role limitations due to emotional problems (RE), emotional wellbeing (MH), body pain (BP), energy or fatigue (VT), social functioning (SF) and general health (GH). Table 10 shows the number of SF-36 compared with SF-12 in each item (58).

Table 10 The number of SF-36 compares with SF-12 in each item

Health concept	SF-12	SF-36
Physical function	2	10
Role limitation due to physical problems	2	4
Body pain	1	2
General health	1	5
Energy of fatigue	1	4
Social function	1	2
Role limitation due to emotional problems	2	3
Mental health	2	5
Health transition	-	1

Reliability was evaluated by a test-retest method. Data showed the reliability of the physical component summary and mental component summary was 0.89 and 0.77 respectively (58).

Work Ability Index (WAI) is a questionnaire that was developed in Finland. It is used for identifying the stages of health of employees. WAI showed Index of Item-Objective Congruence (IOC) is acceptable at levels between 0.81-0.91 (59). It consists of 7 dimensions:

- Current work ability compared with the lifetime best
- Work ability in relation to the demands of the job
- The number of current diseases diagnosed by a physician
- Estimated work impairment due to diseases
- Sick leave during the past year
- Personal prognosis of work ability two years from current
- Mental resources

Each dimension has total score. For work ability interpretation, the sum of total score in each dimension is calculated. The minimum score is 7, the maximum score is 49. The WAI is classified into 4 work ability levels; poor (7–27), moderate (28–36), good (37–43), and excellent (44–49) (60, 61).

Important factors associated with a poor WAI were lack of leisure-time, vigorous physical activity, poor musculoskeletal capacity (muscular strength of the trunk flexors and extensors, maximal isometric grip strength), older age, obesity, high mental work demands, lack of autonomy, poor physical work environment, and high physical work load (60). The current study modified the questionnaire from the WAI for work performance assessment due to a focus on work ability compared with the SF-12 and SF-36 questionnaires which focus on quality of life.

2.12. Intervention Protocols for work related musculoskeletal disorders

Many techniques exist that may prevent and/or treat in the symptoms for WRMDs. Common techniques are exercise, education, ergonomic training, and massage.

1. Exercise: 2 types of exercise are used for reducing muscle pain and improve muscle performance**:** stretching exercises and strengthening exercises.

1.1. Stretching exercises are exercises where an increase in length of muscles and/or tendons are acquired to improve muscle flexibility as well as increase the range of motion. There are 2 types of stretching exercises:

1.1.1. Dynamic stretching exercises are a gradual change from one body position to another and involves a progressive increase in the reach and range of motion as the movement is repeated several times. This method increases heart rate and raises blood flow to muscles that also prepares the body for demands of exercise. Dynamic stretching may also decrease muscle stiffness.

1.1.2. Static stretching exercises is slow movement to the end point of tension. The muscle is stretched enough to feel light to moderate discomfort, but not feel pain. The American College of Sports Medicine (ACSM) recommends holding each stretch for 10 to 30 seconds. In addition, the elderly should hold a stretch for 30 to 60 seconds in order to accumulate the benefits of these types of stretches (52).

Static stretching allows for a passive stretch of the elastic components of muscles (62, 63). Table 11 displays stretching exercise prescription protocols according to ACSM's guidelines.

Table 11 Static stretching exercise prescription

Exercise prescription	Recommendation
Type	Static stretching exercise
Frequency	≥2-3 days/week of stretching the major muscles groups
Intensity	Stretch to the point of slight discomfort or feeling of tightness in muscle
Duration	Hold for 10-30 seconds and repeat 2-4 times

In static stretching held for 10 to 60 seconds, muscle spindles habituate to changes in new lengths of the muscle and a reduction in neurons afferent signals to the spine and brain. This results in a muscle with an increase in flexibility and reduced tension. Moreover, the Golgi tendon organ is stimulated and sends the signals to inhibit muscle contraction. Thus, holding a stretch for a prolonged period of time allows lengthening reaction caused by the Golgi tendon organ to occur, helping the stretched muscles to relax (64). Static stretching exercise is a common type of muscle stretching. Previous studies have shown that static stretching exercises have a positive effect on range of motion (65, 66).

2. Strengthening exercises or resisted exercise use external or internal loads to increase muscle mass or muscle strength. Three types are described (67);

2.1. Isotonic exercises or dynamic exercises are strengthening exercises generated by muscle contraction in order to produce movement. There are two types of Isotonic contractions:

2.1.1. Concentric contraction is where the agonist muscle group causes the muscle to shorten as it contracts. Concentric contractions are the most common types of muscle contractions and occur frequently in daily and sporting activities.

2.1.2. Eccentric contractions are the opposite of concentric contractions and occur when the muscle lengthens as it contracts. It is the antagonist muscle group that works during these actions.

2.2. Isometric exercise or static exercise are the result of muscle or groups of muscle contractions for 10-20 seconds. During isometric contraction, the muscle does not change its length and the joint does not move and can maintain or improve the strengthening of a muscle.

2.3. Isokinetic exercises refer to muscle length changes during the contraction, where the speed of lengthening is constant. This type of strengthening exercise is used in therapeutic settings. Using a dynamometer to control the contraction. Table 12 displays strengthening exercise prescription according to the ACSM's guidelines (52, 67).

Table 12 Strengthening exercise prescription

Exercise prescription	**Recommendation**
Type	Dynamic strengthening exercise
Frequency	$\geq$ 2-3 days/week
Intensity	10 repetition maximum for muscle strength (75% of 1 Repetition Maximum (RM))
Duration	8-12 repetition

3. Massage: Massage is a technique for increasing blood flow, reducing pain and releasing muscle tightness (68). Common massage techniques are deep friction massage and deep stroke massage. *Deep friction massage* is a specific connective tissue massage for maintaining the function of ligaments, tendons, and muscles. The principle protocols with this massage technique is to identify problem spots such as pain, tenderness or scars and then deep pressing that spot in a longitudinal direction parallel to the blood vessels which helps to increase circulation and return of fluids (68). *Deep stroke massage* is a technique which may improve muscle lengthening and muscle relaxation. The principle protocol is the use of the palm, hand or the forearm along the same direction as the muscle fibers. Pressure during the deep stroke massage should be deep and reaching underlying muscle structures.

A systematic review determined the effects of massage therapy for reducing the symptoms of musculoskeletal disorders compared with other treatments or no treatments with 26 randomized controlled trials on the effects of massage therapy on reducing pain or improving physical function performance in WRMDs (17). There were 10 studies which showed a low risk of bias. Results revealed low-to-moderate-level evidence indicating that massage therapy had

short term effects in the reduction of shoulder pain and pain in knee osteoarthritis, but there was no effect in lower back pain or neck pain. Moreover, low-to-moderate-level evidence indicated that massage therapy had short term effects in improving physical function performance in the lower back, knee osteoarthritis and shoulder. There is an underlying assumption that massage therapy had short-term effects for reducing pain when compared to no treatment in musculoskeletal disorders. However, the benefits of massage therapy are not clear when compared to other interventions for musculoskeletal disorders (17).

4. Ergonomic training and education: Ergonomic training is the learning process in providing the knowledge and tools in order to prevent certain risk factors in the workplace. Training includes the principles of ergonomics and their applications, the proper use of equipment, tools, and machine controls, proper lifting techniques, an awareness of work tasks that may lead to pain or injury, the early symptoms of WRMDs and an understanding on the importance of reporting and addressing early indications of WRMDs before serious injuries develop. The Back School protocol is a common intervention for lower back pain patients (69). The concept of the Back School assumes that people have a high risk of back injury due to lack of education and knowledge on body mechanics and stress. The goal of the Back-School protocol is to increase knowledge, which in turn may alter a person's behavior. The protocol consists of knowledge on the spine, a back-exercise program, lifting technique and ergonomic training.

Many systematic review studies have shown positive effects of ergonomic training and education on the prevention or treatment in WRMDs when compared with other exercise programs. A systematic literature review analyzed 20 randomized controlled trials, 17 quasi-experimental studies with control groups, and 36 report case studies (18). Findings revealed that common interventions for WRMDs were exercise, ergonomic training, and education. In addition, exercise had significant, positive effects on low back pain but education and ergonomic training had less effect on low back pain (18). In contrast, a systematic review in 2001 determined the effectiveness of interventions which were used to prevent back and neck pain problems (70). Twenty-seven studies were analyzed in this review and found that Back School protocols and lumbar support were not effective in the prevention of back pain. In addition, there is poor evidence for risk factor modification and ergonomic training for back and neck pain prevention (70).

2.13. Previous studies as they relate to the independent variables of the current study

This study concerned the independent variables that effect on outcome variables because this study design was a quasi-experimental study. So, the confounding factors that associated with outcome variables were showed below.

Gender

There were many previous studies examined the effect of gender on work-related musculoskeletal disorders. However, the results still were controversy. Hagberg and Wegman (71) found that gender had effect on neck and shoulder muscle pain frequency. Female showed higher frequent of neck and shoulder muscle pain among worker populations. This result was similar to a previous study in Korea. Yu-Chang Kim and Yong-Seok Shin (72) who surveyed the gender differences work-related musculoskeletal disorders among agriculture workers in Korea. They found that female showed higher rate of work-related musculoskeletal disorders than male. However, the recent study showed the different result. Helenice and Isabel compared work-related musculoskeletal disorders symptoms for female and male workers who had repetitive industrial tasks. They found that there was no significant difference in symptoms between male and female workers in repetitive tasks.

The gender had influence was a risk factor for alcohol consumption. John surveyed health risk behavior patterns in a national adult population in Germany. The result showed that male had a higher relative risk than female for alcohol consumption (RR=1.50 95%CI 1.19-1.90) (40).

Weight, Height and BMI

Obesity is the internal factor of work-related musculoskeletal disorders especially lower back pain and leg and foot pain. The previous study reviewed the literatures and the finding suggested that there was relationship between weight increasing and musculoskeletal disorders especially lower back pain (73). In American, the prevalence of lower back pain increased when BMI increased. The report showed 20% of overweight adult faced to chronic pain (74). Laura and Evert (75) determined the relationship between BMI and musculoskeletal symptoms in worker populations in Netherland. They found that 1.13 times for overweight people and 1.28 times for obese people had a chance to increase of 12-month prevalence of musculoskeletal disorders. Moreover, obesity had 1.37 times of a chance to developing musculoskeletal disorders.

Age

Aging is the internal factors of work-related musculoskeletal disorders. The main cause is the degeneration of muscle functions, such as, loss of muscle strength and power. These can reduce activities of daily living performance and easy to get muscle injury (76). Holmstrom conducted in construction workers to study the prevalence of musculoskeletal disorder and describe the relationship between age and musculoskeletal disorder. The result shown increasing age related to increasing prevalence of musculoskeletal disorder (77).

Alcohol consumption and smoking tended to be lower among older when compared to the younger. A 38.5% and 41.3% of the ages of 18 to 29 reported current smoking and alcohol drinking. Between the ages of 70 to 79, the respective figures were 13.5% and 29.4%.(40).

Underlying disease

Underlying disease can refer to a chronic medical condition for example, hypertension, diabetes, high cholesterol, heart disease, cancer, and kidney disease. Some of underlying disease can cause refer pain such as cancer can cause body pain and kidney disease can cause lower back pain.

The participants in this study who reported the underlying disease was cancer or kidney disease or musculoskeletal disorder involving fibromyalgia, rheumatoid arthritis, lumbar disc prolapsed, or other serious traumatic injury were excluded from this study.

Physical activity level

The physical activity level is an external factor of work-related musculoskeletal disorders. Suneetha Koneru and Rambabu Tanikonda (78) compared 3 groups :yoga practicing, physical activity practicing and no physical activity in dentist in India. They found that yoga had more effective than other modes of physical activities and there was significant role of physical activity on work-related musculoskeletal disorders. The result was similar to the preliminary cross-sectional study in twenty-one computer workers in Thailand. Kanya Wongwitwichote (79) aimed to examine physical activity level, sitting time at work and work-related musculoskeletal disorders. The result showed there was relationship between physical activity level, sitting time at work and work-related musculoskeletal disorders. Participants without work-related musculoskeletal disorders showed more physical activity and less sitting time at work than the participants who had work-related musculoskeletal disorders.

Working factors

Working factors consisted of sitting time, standing time, heavy load lifting, work posture and movement, workstation, working hour and work period. These were a direct factor of work-related musculoskeletal disorders.

Awkward posture is the unnatural posture that is adopted because of workplace or working process. It can lead to musculoskeletal disorder. The injury often occurs because these postures are near the limit of range of motion (ROM) e.g. full neck flexion, full stretch of arm. The unnatural body positions, for example, standing with bending forward, reaching above shoulder level, reaching behind the body, the arm rotation or neck forward cause musculoskeletal disorder because of over stretching of muscle, high compression on vertebral or low blood supply (3).

Park, Kim and Han (9) surveyed work-related musculoskeletal disorder in different work types. The result showed the ergonomic risk factors in wholesale and retail workers were prolonged walking and standing, carrying heavy load and repetitive arm movement. Like as the literatures review which showed that prolonged standing more than 2 hours can cause muscle discomfort, muscle fatigue and muscle pain that relate to back, leg and foot region (28). Gregory and Callaghan evaluated mechanisms of lower back pain that developed during standing. The result showed 50% of healthy participants remarked low back discomfort after 2 hours standing. It resulted from the changing of inter vertebral disc pressure and joint shear at L4 and L5. This changing lead to facet joint separation and ligament length because of moderate spine flexion (29).

Trinkoff (30) investigated the relationship between working hour and musculoskeletal disorders among nurses. The result showed working hour more than 13 hours/day was one of the risk factors significantly related to neck, shoulder, and back disorders in nurses (OR 1.94, OR 1.87, and OR 1.87 for neck, shoulder and back, respectively). Another previous study in 2018 showed the consistency result to confirm the relationship between long working duration and WRMDs. Lee (31) surveyed 24,783 wage workers who aged from 20 or more. The result showed male and female workers who worked more than 52 hours/week was 1.47 and 1.47 time more likely to be exposed to lower limb pain than the male and female workers who work less than 40

hours/week. Moreover, the evidence showed the indicators of alcohol consumption in workplace were long working hour, shift work, high risk of injury at work, and high work load (80)

2.14. Previous studies as they relate to the intervention program of the current study

To our knowledge, there is no study to determine the effects of combined exercises such as stretching and strengthening exercises on market vendors and related WRMDs. The current study designed an exercise program that consists of stretching and strengthening exercises due to poor muscle flexibility and muscle strength of market vendors.

Below is a review of studies showing the effects of stretching exercise programs on muscle pain, muscle flexibility and work performance in workers. Bruno R. analyzed 7 studies to examine the effectiveness of stretching exercises on WRMDs. Results indicate that stretching exercises can reduce discomfort and pain in employees involved in computer work, manufacturing, firefighters, and military employees. All articles were of a low methodological quality and required control groups with clear stretching exercise programs and appropriate follow up periods (15). Han, Hyun. studied the effects of hamstring stretch with pelvic control on pain and work ability in standing workers. One hundred healthcare workers in the Republic of Korea who had low back pain and work in a standing position at least 8 hours per day were recruited. They were divided into 3 groups: pelvic control hamstring stretch group (PCHS), general hamstring stretch group (GHS) and home program (control). The stretching protocol consisted of stretching exercises 3 days/week for 6 weeks. Results indicate thatthe PCHS and GHS groups showed significant differences in pain scores during work and rest when compared pre-test and post-test (60). T.M. Moore. applied 36 stretching sessions, 5 times /day and lasting 5 to 8 minutes in the workplace. The objective was to determine if stretching exercises can prevent muscle strain in the workplace. Results indicate that there was an increase in muscle flexibility after all 36 stretching sessions. However, a control group was not utilized (81). *Jose M. Muyor.* determined the effects of a stretching program performed in the workplace on hamstring muscle extensibility and sagittal spinal posture of adult women. This was a randomized controlled trial study. The stretching protocol consisted of a hamstring stretch held for 20 seconds, 3 sessions/week for 12 weeks. Results indicate there was a significant increase in the toe-touch test (82). Jung-Ho Lee studied the effects of stretching exercise on the work-related symptoms such as neck and shoulder pain in bus drivers. The stretching protocol consisted of stretching exercises at

maximum stretch for 25 seconds, 3 times/set, 3 days/week for 4 weeks. Utilizing the Visual Analog Scale (VAS) scale results indicate a statistical significant increase in the reduction of pain at neck and shoulder (83). In Thailand, Punjama Tunwattanapong focused on neck and shoulder stretching exercises to reduce neck pain in office workers. This was a randomized controlled trial study and utilized both the VAS scale and the SF-35 questionnaire. The stretching protocol consisted of stretching exercises 2 times/day, 5 days/week for 4 weeks. Results indicate that there was a reduction in neck muscle pain and an increase in quality of life. The study concluded that the frequency of exercise administered 3 times/week or greater can improve neck function and quality of life due to muscle pain reduction (84).

Few studies have examined the effects of strengthening exercise programs on WRMDs, however, a few studies have shown there is a relationship between improving muscle strength and reducing muscle pain. Lars Andersen determined the effects of progressive resistance training for relieving neck and shoulder pain in healthy adults. Participants were women and men who worked at least 30 hours per week and reported neck or shoulder pain intensity with at least 2 on a scale of visual analog scale within the previous 3 months, with at least 30 days of pain during the previous year. Participants were divided into 3 groups: a 2 minute resisted exercise group, a 12 minute resisted exercise group and a control group. The 2-minute resisted group exercised with elastic tubing for 2 minutes per day, 5 days per week. The 12 minutes resisted group exercised with elastic tubing 5-6 sets of 8-12 repetitions for 12 minutes per day, 5-7 days per week. Results indicate that neck or shoulder pain decreased 1.4 points ($p < 0.0001$) and 1.9 points ($p < 0.0001$) in the 2-minute resisted exercise group and the 12 minute resisted exercise group respectively when compared with the control group. Tenderness pain decreased 4.2 points ($p < 0.0001$) and 4.4 points ($p < 0.0001$) in the 2 minute resisted exercise group and the 12 minute resisted exercise group respectively when compared with the control group (85).

All outcome variables relating to WRMDs are muscle pain, muscle flexibility and work ability and as shown above, the studies cited have almost exclusively focused on the effects of stretching exercises on muscle pain in specific areas such as hamstring stretching, neck and shoulder stretching. In addition, the studies were of low methodological quality requiring a clarification of the optimal dosage of the exercise program and delivery method.

The purpose of the current study is to design and administer an exercise intervention program which consists of stretching and strengthening exercises due to poor muscle flexibility, poor muscle strength and specific musculoskeletal issues as a result of a lack of exercise in market vendors.

2.1.5. Others related studies

There is no study to examine the relationship between work related-musculoskeletal disorders and health risks behaviors in market vendors. But there were studies to determine relationship between increase muscle pain and high alcohol consumption. National Institute on Alcohol Abuse and Alcoholism (NIAAA.) reported people often use alcohol to relieve body pain (86). In the same way of the previous longitudinal study, the 401 older community-residing adults were divided into two groups: problem drinkers and non-problem drinkers. The finding reveled the samples who had chronic pain or were limited activities from pain showed more frequent use of alcohol for pain management. Moreover, the result suggested that more pain was related to more use of alcohol (87). As well as the previous community survey study showed a similar result. This study determined the occurrence of alcohol use to manage pain in community-dwelling adults with tooth pain, jaw joint/face pain, and arthritis. The result revealed that both male and female preferred to use alcohol for body pain management (88).

Chapter 3

Research methodology

This chapter focuses on the methodologies of the Self Static Stretching and Strengthening program and considers the program's effectiveness on muscle pain, muscle flexibility, grip strength and work ability among market vendors who work at Type 1 Markets Area 2 in Bangkok, Thailand. This chapter will present the details of the study design, study area, study population, sample size, sampling technique, measurement tools, ethical considerations, an intervention program, data collection plan and statistical analysis.

3.1. Study design

This study design is quasi-experimental involving two groups, an experimental group, and a control group, to compare the effects of the Self Static Stretching Strengthening program on muscle pain, muscle flexibility, grip strength and work ability. This intervention program was performed only in the experimental group and both groups received information about correct postures of sitting, standing, and lifting heavy loads.

This study began in June 2019 and concluded in February 2020, a total time period of 7 months. After a baseline assessment was conducted, the Self-Static Stretching and Strengthening program was performed on the intervention group for 4 months. At the first month, the research team consisting of the author and physical therapist administered the program to the intervention group 3 times/week for 4 weeks, after which, the participants in the intervention program were asked to perform the program by themselves with along with a booster program every week for 3 months. The last 3 months, the participants in intervention group performed the program by themselves without the booster. The assessment was performed 5 times: baseline, post-intervention, 1-month follow up, 3-month follow up and 6-month follow up. Figure 9 shows the data collection timeline.

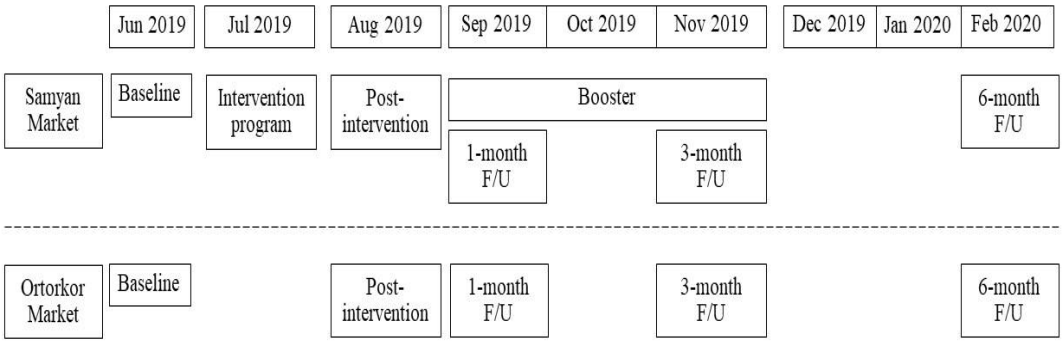


Figure 9 The study period

3.2. Study areas and population group

Data were collected between June 2019 to February 2020 in the Samyan and Ortorkor markets of Bangkok. Both are permanent, government-controlled markets and in a business and commercial urban center. The Samyan market was placed into the intervention group and Ortorkor market was placed into the control group.

Both the Samyan and Ortorkor markets are centrally located in Bangkok. Both markets open between 6-7am daily with the Samyan market closing around 4 pm and the Ortorkor market closing around 7 pm. Both markets are house within permanent buildings that include toilets, sinks, waste collection systems and parking. The shop areas in both markets are 25-30 square meters consisting of 100-centrimeter high cement counters for placing merchandise, 4-5 chairs and 1-2 shelves. According to the shop zone, there are 6 shop types in each market: 1) meats, 2) seafood, 3) fruits and vegetables, 4) cooked food, 5) dried foods and 6) consumer goods. The Samyan market has 126 shops and Ortorkor market has 608 shops. The highest number of shops consist of fruits and vegetables, followed by cooked food and consumer goods. The layout of both markets is similar. The shops are divided according to merchandise and zone.

The inclusion criteria of the market vendors as participants were as follows:

1. Both male and female
2. Aged between 18-64 years (WHO) (89).
3. They had muscle pain or muscle discomfort at upper or lower extremities (VAS $\geq$ 3) or muscle flexibility tests showed negative results in at least one limb.
4. They have worked in a market for at least one year.
5. They were willing to participate.
6. They could read and write Thai.

The exclusion criteria were as follows:

1. They had chronic illness that limited exercise such as heart disease, lung disease and neurological problems.
2. They had musculoskeletal disorders involving fibromyalgia, rheumatoid arthritis, lumbar disc prolapses or other serious traumatic injuries.
3. They have uncontrolled hypertension or diabetes mullites.
4. They were pregnant or suspected they were pregnant.

3.3. Sample size calculation

The G-power program version 3.1 was used to calculate sample size. It is designed for statistical tests used in social and behavioral research (90).The effect size was calculated by using the previous study that determined the effect of hamstring muscle stretching on visual analog scale (60). A power of 0.8 is based on an effect size of 0.64 for differences in pain score between groups. The sample size was 39 participants per group and over a period of 7 months for data collection and a loss of follow up in participants. Therefore, 30% of participants were added in the calculation. The sample size was adjusted to 51 participants per group and the total number of participants was 102.

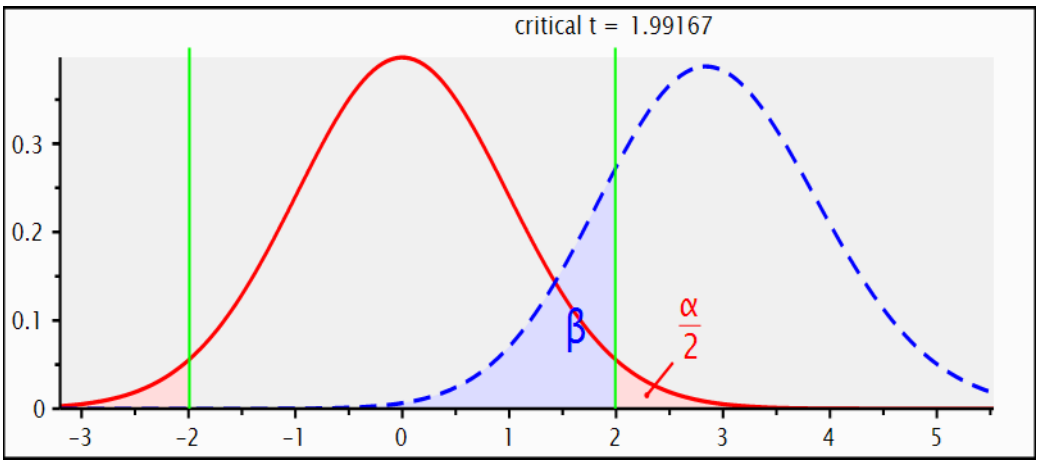


Figure 10 Sample size calculation

3.4. Sampling technique

A voluntary sampling technique was used to recruit market vendors who met the inclusion criteria. The steps in the sampling technique are presented below:

1) The researcher and team explained the objectives and study protocols to the market vendors and invited them to participate in this study.

2) The volunteers (market vendors) were asked to measure muscle pain, muscle flexibility and grip strength and complete relevant questionnaires.

3) Market-vendors who met the inclusion criteria were recruited for this study.

4) In all, 51 participants were recruited in each group.

3.5. Measurement Tools

This study evaluated muscle pain within the past 7 days, muscle flexibility, grip strength and working performance. The procedure and measurement tools were as follows:

1. Questionnaires

There were 2 questionnaires for this study. The first questionnaire was used for baseline data and the second questionnaire was used for post-intervention and follow up data. Both questionnaires were self-administered. The questionnaires were modified, and the contents of each questionnaire consisted of:

1.1. Participant's characteristics

- Demographic data.
- Health information including height, weight, blood pressure, pulse rate, underlying diseases (for example, hypertension, diabetes, and high cholesterol), and physical activity levels.
- Working related factors including job characteristics, the duration of work and working hours per day.
- Health risk behaviors including alcohol consumption, smoking and drug abuse.

1.2. Work performance was assessed by a questionnaire that was modified from the Work Ability Index (WAI). In the questionnaire, the participants were asked the following: how they think about their work ability, how many days were they absent in 1 month due to WRMDs and do they think that muscle pain or muscle discomfort limits their work or not.

2. Muscle pain within the past 7 days

Visual Analog Scale (VAS), used to evaluate the degree of pain in each area. At the endpoint, the score zero is refer to as "no pain" and a score of ten refers to "cannot tolerate this pain". The participants were asked to report their pain level (48). This study used 4 degrees of pain level dependent on the VAS score: no pain (VAS=0), mild pain (VAS=1-3), moderate pain (VAS=4-6) and severe pain (VAS=7-10)

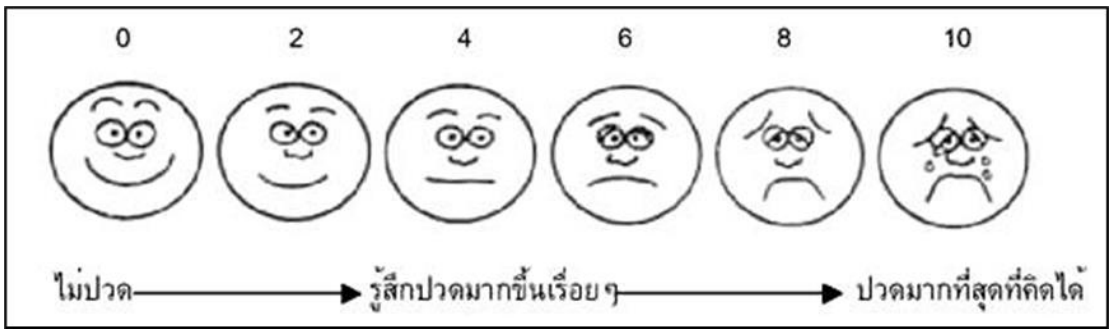


Figure 11 Visual analog scale

The Nordic Musculoskeletal Questionnaire body chart was used to indicate the location of each pain area. The author asked the participants identify areas of the body that presented with musculoskeletal problems. A Body Chart presented below defines 6 body sections combined into different areas:

1) Neck and upper back (combined area: 0, 1 and 5)

2) Lower back (combined area: 7, 8 and 9)

3) Right arm (combined area: 3, 6, 11, 13, 15 and 17)

4) Left arm (combined area: 2, 4, 10, 12, 14 and 16)

5) Right leg (combined area 19, 21, 23, 25 and 27)

6) Left leg (combined area 18, 20, 22, 24 and 26)

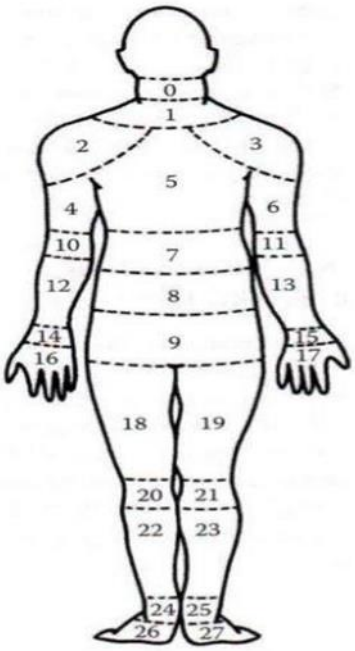


Figure 12 NMQ Body Chart

3. Grip strength

This test was assessed using a handgrip dynamometer (Takei Hand Grip Dynamometer, TKK 5401, Japan). The test was administered to both arms. This test is regularly used to represent forearm muscle strength in medical and sport practices (54).

Figure 13 Hand grip dynamometer

The procedure for measuring is as follows:

1) The assessor explained and demonstrated to the participants the test protocol and equipment used.
2) Participants were in a standing position holding the handgrip dynamometer, elbow bent slightly and does not touch the body.
3) The assessors asked the participants to squeeze the dynamometer with their hand as hard as they can.
4) Participants performed each test 3 times with a 10-20 second pause between each test to avoid the effects of muscle fatigue.
5) Results were measured and recorded in kilogram.
6) The maximum number was divided by weight.

4. Back scratch test

This test is used to evaluate the general flexibility of the shoulders. This test is simple and is designed to test how close the hands can be brought together behind the back. This test is simple to administer. Upper extremities muscle flexibility measurements used guidelines from the Sports Authority of Thailand (53).

1) The assessor explained and demonstrated to the participants the test protocol and the equipment.
2) Participants were standing in anatomical position.
3) The participants placed one hand over the shoulder behind the head and back, palm touching the body with the fingers directed downwards and try to move as far as possible down the middle of the back.
4) The other hand was placed behind the back, palm facing outward and fingers upward and tried move upwards as far as possible in an attempt to touch the middle fingers of both hands.
5) The assessor measured (in centimeter) the distance between the tips of the middle fingers. If the middle fingertips touch, the score was zero.
6) If middle fingertips do not touch, the score was negative score but if fingertips overlap, the score was a positive score.
7) Participants practiced twice, and then tested three times. The results were averaged and recorded in the data collection form.

Figure 14 Back scratch test

5. Chair sit and reach test

This test measures lower body flexibility in the lower back and hamstring muscles. Lower extremities muscle flexibility measurements used guidelines from the Sports Authority of Thailand (53).

1) The assessor explains and demonstrates to the participants the test protocol and the equipment.
2) This test begins with participants sitting on the edge a chair with one leg placed on the floor and the other leg extended forward, with heel on the floor, and ankle bent at 90°.
3) Participants reach forward with two arms as far as possible and try to touch their toes.
4) The assessor measured the distance between the tips of the middle fingers and big toe. If the fingertips touch, the score was zero.
5) If fingertips do not touch, the score was negative but if fingertips overlap, the score was a positive.
6) The participants practiced two times, and then tested three times. The results were averaged and recorded in the data collection form.

Figure 15 Chair sit and reach test

3.6. Intervention program

3.6.1. Self-Static Stretching and Strengthening program

Self-Static Stretching Strengthening program is a specific program for market vendors who presented with WRMDs It includes 6 stretching exercises that focus on the upper and lower extremities and a 600-cc water bottle as a tool to strengthen the arms. The exercise postures and the procedures of this program is shown in Table 13:

Table 13 Exercise postures and procedures of Self Static Stretching Strengthening program

Exercise posture	Procedure	Picture
Cross-Chest Stretch	Place one arm across the chest and push on the elbow to chest with the other arm. Hold for 10 – 15 seconds. Repeat 3 times in each arm. Perform at least 2 times a day, every day.	
Triceps Stretch	Raise one arm over the head with elbow pointing upwards. Grasp elbow with another arm and pull down. Hold for 10 – 15 seconds. Repeat 3 times in each arm. Perform at least 2 times a day, every day.	
Biceps Stretch	Reach arms behind your back and interlock fingers. Then raise arms and pull them away from the back. Hold for 10 – 15 seconds. Repeat 3 times in each arm. Perform at least 2 times a day, every day.	

Exercise posture	Procedure	Picture
Body stretch	Raise hands over head, stretching as high as possible and hold for 5-10 seconds. Bend trunk to lateral side and hold for 5-10 seconds. Then move to other side and hold for 5-10 seconds. Repeat this cycle 3 times. Perform at least 2 times a day, every day.	 
Hamstring and lower back stretch	Sit on the chair, one leg place on the floor and another leg is stretched forward with the knee straight, heel on the floor, and ankle bent at 90°. Try to move forward as far as possible. Hold for 10 – 15 seconds. Repeat 3 times in each leg. Perform at least 2 times a day, every day.	

Exercise posture	Procedure	Picture
Calf and foot stretch	Stand with foot against a wall. Try to move the body toward. Hold for 10 – 15 seconds. Repeat 3 times in each leg. Perform at least 2 times a day, every day.	
Arm exercise	Sit or stand Hold a small bottle (0.5kg) of water in each hand.	
	There are 4 steps in performing this exercise. 1. Bend elbows slowly	
	2. Raise arms as high as you can overhead.	

Exercise posture	Procedure	Picture
	3. Bend elbows behind the head slowly and then straighten arms. 4. Put arms down Repeat 10 times. Perform at least 2 times a day, every day.	

3.6.2. Ergonomic knowledge

The ergonomic knowledge was applied to both markets. The brochure of ergonomic knowledge is presented Appendix F. It consists of information on correct postures of sitting, standing, and lifting heavy loads at the first time of baseline assessment. And it was distributed to both markets with the explanation at only the first time of baseline assessment.

3.7. Data Collection

Data collection was conducted between June 2019 to February 2020. The Self-Static Stretching and Strengthening program was administered to the intervention group at the Samyan market. Both the Samyan and Ortorkor markets received a brochure on specific ergonomic knowledge consisting of correct postures of sitting, standing, and lifting heavy loads. The data collection procedures were as follows:

1. Before starting data collection, all research assistances were trained about how to use measurement tools and the questionnaires by the researcher. All physical therapists were trained the Self-Static Stretching and Strengthening program and how to conduct this program to the intervention group at the market by the researcher.

2. The researcher invited the market vendors to participate in this study.

3. A total of 223 market vendors (Samyan market = 65 from 126 shops, Ortorkor market = 153 from 608 shops) volunteered for this study. The market vendors who met the inclusion criteria were recruited for this study (Samyan market = 59, Ortorkor market = 80). After finishing the data collection, a total 131 of market vendors (intervention n=56 and control n=75) remained.

4. The market vendors were approached by research assistances that had received considerable training by the researcher. After successful training on the interview and measurement technique, 3 research assistances began the field process. They used questionnaires to evaluate muscle pain, muscle flexibility, grip strength and working ability resulting in baseline data.

5. The Self-Static Stretching and Strengthening program was administered to the intervention group by 4 trained physical therapists at the market with a public radio broadcast between 2pm to 2.30 pm (practicing time). The program was administered by the physical therapists 3 times/week for 4 weeks. Because the job conditions, some participants could not practice at 2pm. If they could not at practicing time, they were conducted individually during participant's free time by the physical therapists at their shop.

6. The intervention market and the control market received a brochure of ergonomic knowledge that consists of information on correct postures of sitting, standing, and lifting heavy loads at the first time of baseline assessment.

7. After 4 weeks of intervention, the participants in both groups were asked to complete a questionnaire and evaluate muscle pain, muscle flexibility, grip strength and working ability after 4 weeks of completing the program for post-intervention data.

8. The researcher conducted a public radio broadcast at Samyan market (intervention group) every week for 3 months. The participants in the intervention group received a booklet of the Self Static Stretching and Strengthening program with instructions and a checklist for recording exercise numbers and problems experienced during exercise.

9. Both groups were asked to complete questionnaires and evaluate muscle pain, muscle flexibility, grip strength and working ability for follow up data at the end of the first, third and sixth month follow up.

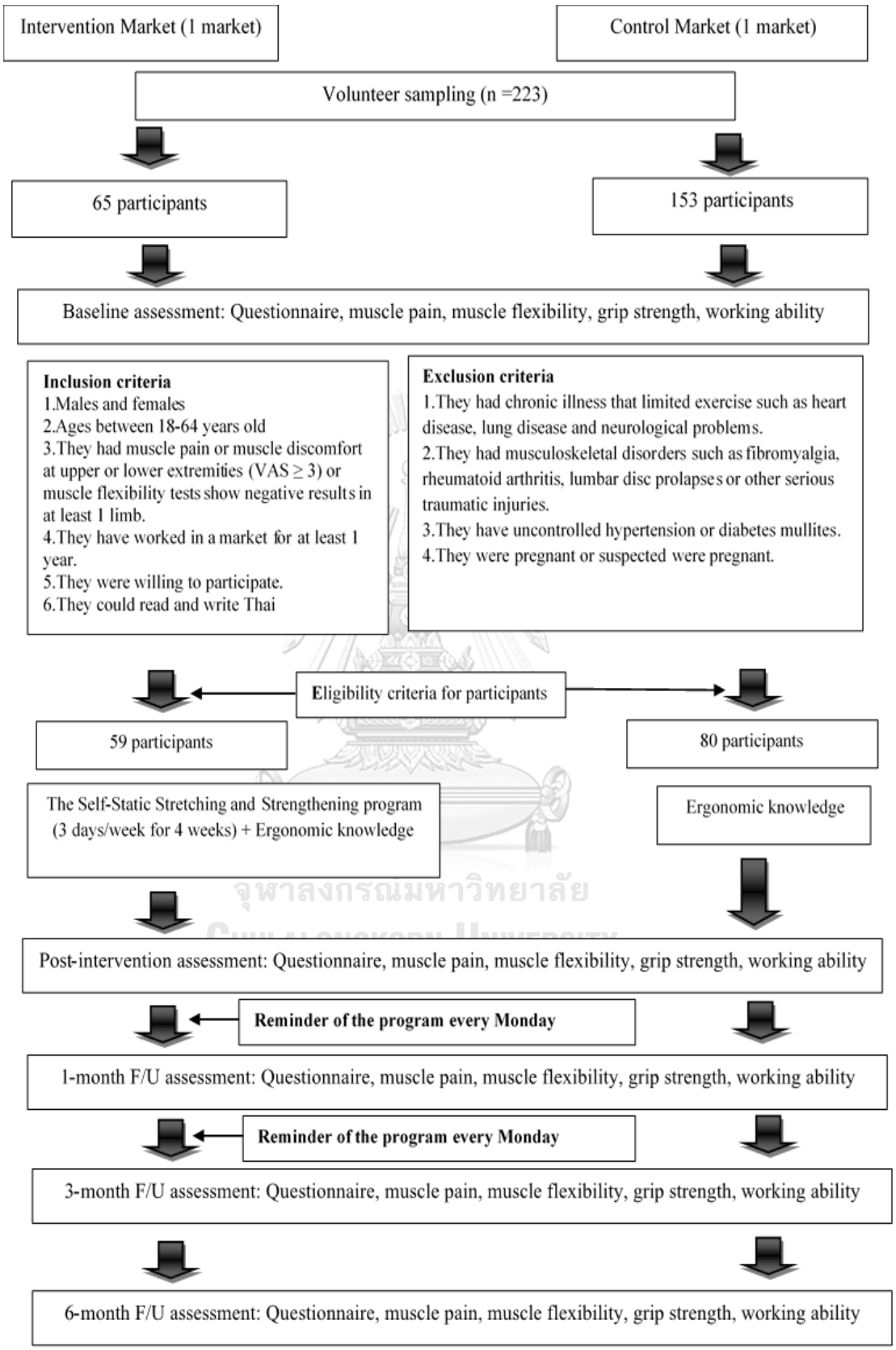


Figure 16 Data collection flow chart

3.8. Data Analysis

After examination and correction of each questionnaire, unsuitable answers for data analysis were excluded. The author coded all items in the questionnaire before entering into the SPSS program. All results with $p \leq 0.05$ are considered statistically significant. The data analysis was performed using SPSS 22.0 for Windows.

Baseline characteristics

Baseline characteristics for both groups were described in frequency, percentage, mean and standard deviation (SD).

The Kolmogorov-Smirnov Goodness of Fit Test was used to normalize the test. Results showed that age, weight, muscle flexibility and grip strength were normally distributed but height, BMI working period, working hours, sitting time, standing time, walking time, last time of using and the amount of using were not normally distributed. An independent t-test was used to test the difference between the means in two unrelated groups. The Mann–Whitney U test was used to test differences between 2 groups in continuous variables with the assumption that values were not normally distributed. Chi-square tests were used to test differences in categorical data between 2 groups.

Effectiveness of the Self-Static Stretching and Strengthening program

The result showed that working hours per day and degree of pain in left leg area at baseline had significant differences between intervention and control group. To prevent any confounding factors: unbalanced working hours per day and degree of pain in left leg area, these were adjusted using covariate of repeated measures ANCOVA for determining the effects of the Self Static Stretching and Strengthening program on physical performances to summarize the effect of this program across time in the intervention group and control group. Bonferroni was used to analyze the differences between groups.

Friedman test was used to test the difference within groups over time of ordinal scale data. In addition, if results showed differences between time of data collection, the Wilcoxon Sign-rank Test was used for comparing in each time of data collection.

Table 14 Statistic analysis and reasons

Variables	Type of measure	Statistic used	Reasons
Participant characteristics			
Gender	Nominal scale	Frequency and percent	To describe the characteristics
		Chi-square test	To test the difference between groups
Age Height Weight Body Mass Index (BMI)	Ratio scale	Mean and SD Independent t-test Mann–Whitney U test	To describe the characteristic To test the difference between groups
Health risk behaviors			
Had health risk behaviors (yes/no)	Nominal scale	Frequency and percent	To describe the characteristics
Reason of using alcohol, smoking and drug Type of alcohol		Chi-square test ($n \geq 5$) Fisher's exact test ($n < 5$)	To test the difference between groups
Last time of using The amount of using	Ratio scale	Mean and SD	To describe the characteristics
		Mann–Whitney U test	To test the difference between groups
Working factors			
Job responsibility	Nominal scale	Frequency and percent	To describe the characteristics
		Chi-square test	To test the difference between groups
Duration of working Working hours Sitting time Standing time Walking time	Ratio scale	Mean and SD Mann–Whitney U test	To describe the characteristics To test the difference between groups

Variables	Type of measure	Statistic used	Reasons
Physical performances			
Pain area	Nominal scale	Frequency and percent	To describe the characteristics
Degree of pain	Ordinal scale	Mann–Whitney U test	To test the difference between groups
Work ability Work limitation	Ordinal scale	Frequency and percent	To describe the characteristics
Absence day within 1 month	Ratio	Mann–Whitney U test	To test the difference between groups
		Friedman test	To test the difference within groups over the time
		Wilcoxon Signed-Rank Test	To compare variables within groups in each time of data collection when the test between groups showed differences
Muscle flexibility Grip strength	Ratio scale	Mean and SD	To describe the characteristics
		Independent t-test	To test the difference between groups
		Repeated measures ANCOVA	To describe mean over time and repeat measures to summarize or evaluate effects of the program across time.

BMI= body mass index

3.9. Ethical review

This study was approved by The Ethics Review Committee for Research Involving Human Research Subjects, Health Science Group, Chulalongkorn University. The certificate of approval number was COA. No. 151/2019. The research assistant explained to the participants about the study protocol and the risk of exercise before they signed a consent form.

Several risks during the study period may occur in the exercise sessions. These are exhaustion, muscle spasms, muscle soreness or over stretch. Previous evidence has shown that too much exercise may induce mild muscle or joint injury in healthy populations. To prevent any adverse risks to performing exercise, the Self-Static Stretching Strengthening program was designed by a physical therapist. To prevent any risk from exercising at home, the team of researchers explained the procedures of exercise and signs to stop exercise e.g. dyspnea before exertion, chest pain, muscle pain or muscle fatigue. If the participants presented with any signs as a result of exercise, they were instructed to stop exercising and visit their doctor as soon as possible. However, there were no known adverse events during the study period.

Chapter 4

Results

The current study is quasi-experimental, and the main objective is to determine the effectiveness of the Self-Static Stretching and Strengthening program compared with ergonomic knowledge on physical performances among market vendors in Bangkok, Thailand. Data collection and a subsequent intervention program with a 6-month follow up began in June 2019 until February 2020. This chapter presents four sections. The first section is baseline information of participants such as general characteristics, health risk behaviors, market environment and job characteristics, work factors and physical performances. The second section describes the outcomes and effectiveness of the Self-Static Stretching and Strengthening program on muscle pain in the past 7 days, muscle flexibility, grip strength, work ability and health risk behaviors among market vendors in Bangkok, Thailand.

4.1. Baseline information of participants

Participants in this study were market vendors from the Samyan market and Ortorkor market. Both are permanent government-controlled markets in a business and commercial center urban area. The distance between the two markets is approximately 9 kilometers. Based on convenience regarding location, the Samyan market was placed into the intervention group and the Ortorkor market was the control group. At the beginning of the current study, 65 market vendors at the Samyan market and 153 market vendors at the Ortorkor market volunteered to be participants. After baseline measures, 59 market vendors at the Samyan market and 80 market vendors at the Ortorkor market who met the inclusion criteria were selected for this study. At the end of the 6-month follow up, at total of 56 market vendors and 75 market vendors at the Samyan and Ortorkor markets completed measurements and questionnaires, respectively. The study population at baseline, post-intervention, 1-month, 3-months, and 6-months follow-up are displayed in figure 17

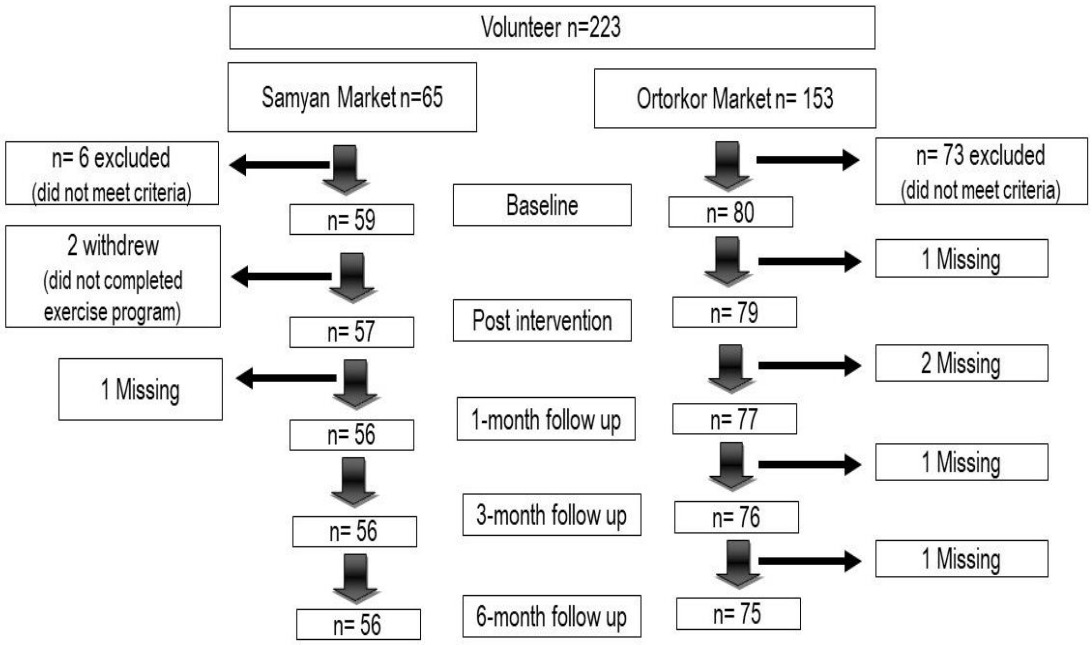


Figure 17 Study population

4.1.1. Participant characteristics

The participant characteristics consisted of gender, age, height, weight, body mass index (BMI), underlying disease and regular exercise. There were no significant differences of general characteristics between both groups at baseline (Table 15). There was a total of 131 market vendors (intervention n=56 and control n=75). The market vendors in both groups had similarities in terms of:

1. The percent of females were greater than males (females = 82.1% (n=46), males = 17.8% (n=10) in the intervention group and females =73.3% (n=55), males = 26.2% (n=20) in the control group)

2. More than 60% of participants in both groups were middle age to elderly. The average age of market vendors in the intervention group and control group were 50.07±12.79 and 46.65±13.56 years old, respectively.

3. More than 60% of the participants in both groups were overweight to obese. The average body mass index (BMI) in both groups was BMI =24.66±4.48 kg/m^2 in the intervention group and 24.77±4.38 kg/m^2 in the control group.

4. 35.7% of the participants in the intervention group and 22.7% of the participants in the control group had an underlying disease. Hypertension was the most common underlying disease among both groups followed by diabetes.

5. There were 64.3% of the participants in the intervention group and 80% of the participants in the control group did not exercise regularly.

Table 15 Participant characteristics of market vendors

Variables	Intervention (n=56)		Control (n=75)		*p*-value
	n	%	n	%	
Gender					
Male	10	17.9	20	26.7	0.23 (a)
female	46	82.1	55	73.3	
Age (year)					
20-29	6	10.7	7	9.3	
30-39	6	10.7	19	25.3	
40-49	11	19.6	18	24.0	
50-59	18	32.1	11	14.7	
≥60	15	26.8	20	26.7	
Mean±S.D.	50.07 ±12.79		46.65±13.56		0.14 (d)
Height (cm.)					
Mean±S.D.	158.51 ±6.72		159.48±7.63		0.59 (c)
Weight (kg.)					
Mean±S.D.	62.13±12.65		63.41±13.23		0.57 (d)
BMI (kg/m^2)					
Underweight (<18.5 kg/m^2)	2	3.6	2	2.7	
Normal (18.5-22.9 kg/m^2)	16	28.6	27	36.0	
Overweight (23.0-24.9 kg/m^2)	18	32.1	15	20.0	
Obesity (≥30 kg/m^2)	20	35.7	31	41.3	
Mean±S.D.	24.66 ±4.48		24.77 ±4.38		0.85 (c)

Variables	Intervention (n=56)		Control (n=75)		*p*-value
	n	%	n	%	
Underlying disease					
No	36	64.3	58	77.3	0.10 (a)
Yes	20	35.7	17	22.7	
Hypertension	14	25.0	15	20.0	0.65 (a)
Diabetes	3	5.4	8	10.7	0.27 (b)
High cholesterol (>200 mg/dl)	6	10.6	3	4.0	0.71 (b)
Regular exercise					
Yes	20	35.7	15	20	0.06 (a)
No	36	64.3	60	80	

(a) Chi-square (b) Fisher's exact test (c) Mann-Whitney Test (d) independent t-test and significant at *p*-value $\leq$0.05, BMI= body mass index

4.1.2. Health risk behaviors

Common health risk behaviors in market vendors are alcohol consumption and smoking. Additionally, drug abuse is an emerging trend in health risk behavior. Drug abuse may be referred to as the taking of medicine without a doctor's prescription absence of any signs and symptoms.

Alcohol consumption

Alcohol consumption, smoking and drug abuse are health risk behaviors leading to adverse health consequences in market vendors. In the intervention group, 16 participants (28.6%) and 31 participants (41.3%) in control group consumed alcohol at least 1 time in their life. Market vendors often take alcohol after working or before sleeping with friends and family. Beer was the most popular type of alcohol among market vendors, followed by spirits. A common reason for the consumption of alcohol in both groups was to relax (87.5%, intervention group and 71%, control group). The mean age for first-time consumption of alcohol was 25.00±7.24 years old in the intervention group and 23.61±3.85 years old in the control group. Table 16 shows that 6 participants in the intervention group and 25 participants in the control group reported they drank

alcohol within the past 30 days. The average of amount of alcohol consumed in intervention group was higher than the control group but there was no significant difference between both groups (p=0.20).

Table 16 Alcohol consumption

Alcohol consumption	Intervention (n=16)		Control (n=31)	
	n	%	n	%
Reason of drinking alcohol				
Relaxation	14	87.5	22	70.9
Social drinking	2	12.5	9	29.1
Last drinking with 30 days				
Current drinking	6	37.5	25	80.6
Within a week	5	83.3	24	96.0
Within two weeks	0	0.0	1	4.0
More than two weeks	1	16.7	0	0.0
Non-drinking	(50)		(50)	
Amount of alcohol per time (gram)*				
<14 grams	0	0.0	1	4.0
14-42 grams	4	66.7	21	84.0
43-69 grams	1	16.7	1	4.0
≥70 grams	1	16.6	2	8.0
N/A	(50)		(50)	
Mean±S.D.	37.74±38.01		25.18±26.54	
Type of alcohol				
Beer	5	83.3	22	88.0
Spirit	1	16.7	2	8.0
Spy wine cooler	0	0.0	1	4.0
N/A	(50)		(50)	

* grams of alcohol consumed= (Volume of drinks) x (% of alcohol of drink) x 0.789 (91)

Smoking

There were 7 participants (12.5%) in the intervention group and 13 participants (17.3%) in the control group that reported smoking at least once in their life. The mean age of first-time smokers was 20.00±1.52 years old years old in the intervention group and 23.30±3.94 years old in the control group. The reasons for smoking in both groups were relaxation and increasing energy. Table 17, shows that 4 participants in the intervention group and 10 participants in the control group reported they smoked within the past 30 days and the number of cigarettes smoked in the intervention group was similar to the number of cigarettes smoked in the control group.

Table 17 Smoking

Smoking	**Intervention(n=7)**		**Control (n=13)**	
	n	**%**	**n**	**%**
Reason of smoking				
Relaxation	7	100.0	8	61.5
Increasing energy	0	0.0	5	38.5
Smoking within 30 days				
Current smoking	4	57.1	10	76.9
Within a week	4	100.0	10	100.0
Non-smoke	(52)		(65)	
The number of cigarettes per day (cigarettes)				
1-5 cigarettes	1	25.0	6	60.0
6-10 cigarettes	3	75.0	4	40.0
N/A	(52)		(65)	
Mean±S.D.	6.75±4.27		7±2.58	

An analgesic drug abuses

There were 7 participants (12.5%) in the intervention group and 8 participants (10.7%) participants in the control group reported they took an analgesic drug at least once in their life. Analgesic drugs were the most commonly abused drugs among participants in both groups. The main reason for using analgesic drugs was to relieve illnesses. The mean age for first-time use of an analgesic drug was 24.00±6.35 years old in the intervention group and 25.62±10.83 years old in the control group. Table 18, shows that 7 participants in the intervention group and 8 participants in the control group reported they took an analgesic drug within the past 30 days and the number of pills taken in the intervention group was similar to the number of pills taken in the control group.

Table 18 Analgesic drug

An analgesic drug abuse	**Intervention(n=7)**		**Control (n=8)**	
	n	**%**	**n**	**%**
Reason for taking an analgesic drug				
Relieving pain	6	85.7	3	37.5
Decreasing illness	1	14.3	5	62.5
Last taking an analgesic drug within 30 days				
Current use	7	100.0	8	100.0
Within a week	7	100.0	7	87.5
Within two weeks	0	0.0	1	12.5
Non-use	(49)		(67)	
The number of pills per day (pills)				
1 pill	7	100.0	6	75.0
2 pills	0	0.0	2	25.0
N/A	(49)		(67)	
Mean±S.D.	1		1.25±0.46	

4.1.3. Job characteristics of market vendors

Job responsibilities among market vendors may be divided into 5 groups:

1) selling, 2) shop arrangement, 3) lifting heavy loads, 4) serving food, and 5) cooking food. Early morning (around 5-6 am.), market vendors are very busy with shop arranging, food preparation, and other merchandise sales during the day. The highest number of customers will shop between 8-9 am and 11 am-2 pm. Around 2 hours before markets close, the market vendors begin to pack up their shop. The majority of market vendors have responsibilities for selling and shop arrangement. In contrast to other shop types, market vendors who work in fruit and vegetable shops tend to lift heavy loads than other market vendors. During working hours, market vendors prefer sitting or standing still to walking and the majority tend to be awkward postures. For example, working overhead, bending neck, twisting trunk, overreaching, or lifting heavy loads.

Among 56 market vendors in the intervention group, (28.6%, n=16) worked in cooked food shops followed by fruit and vegetable shops (21.4%, n=12), dried food shops (19.6%, n=11), seafood shops (14.3%, n=8), consumer goods shops (8.9%, n=5) and meat shops (7.1%, n=4). Among 75 market vendors in the control group, (28.0%, n=21) worked in cooked food shops and dried food shops followed by fruit and vegetable shops (22.7%, n=17), consumer goods shops (20%, n=15) and seafood shops (1.3%, n=1).

67.7% of participant in the intervention group (n=38) and 97.7% of participant in control group (n=73) had more than 2 job responsibilities. For the intervention group, the greatest job responsibility was shop arrangement (83.9%, n=47), followed by selling (71.4%, n=40), cooking (12.5%, n=7), lifting heavy loads (10.7%, n=6) and serving food (7.1%, n=4). For the control group, the greatest job responsibility was selling and shop arrangement (96%, n=72), followed by lifting heavy loads (48%, n=36), serving food (21.3%, n=16) and cooking (17.3%, n=13).

4.1.4. Working factors which related to work-related musculoskeletal disorders

Working factors which related to work-related musculoskeletal disorders are the duration of working, working hours per day, sitting time, standing time, and walking time. Among 131 market vendors (56 in the intervention group and 75 in the control group), 94.6% of participants in the intervention group (n=53) and 85.3% of participants in the control group (n=64) work every day. There was no significant difference of the number of working days between both groups (p= 0.08) however, for the intervention group, the duration of working hours was greater than the control group, but the control group showed longer working hours per day than the intervention group. Table 19 shows that 50% of participants in both groups have worked in markets for 1-10 years, however with the control group, the duration of sitting time, standing time, and walking time greater than the intervention group. Table 19 also shows that 50% of participants in both groups reported they had sitting time between 1-3 hours/day. Both groups also reported standing time greater than 3 hours/day and both groups reported less walking time per day. The prevalence of prolonged sitting and standing during working hours was common in both groups. Other than working hours per day (p<0.001), there was no difference between both groups on working factors. To prevent any confounding factors such as unbalanced working hours per day, working hours per day was adjusted using covariate of repeated measures ANCOVA for the test effect on the Self-Static Stretching and Strengthening program.

Table 19 Working factors which related to work-related musculoskeletal disorders

Working factors	Intervention (n=56)		Control (n=75)		*p*-value
	n	%	n	%	
The duration of working (years)					
1-5	12	21.5	20	26.7	
6-10	15	26.8	23	30.7	
11-15	4	7.1	13	17.3	
16-20	12	21.4	13	17.3	
>20	13	23.2	6	8.0	
Mean±SD	16.21±11.94		11.98±8.72		0.07
Working hour per day (hour)					
<5	1	1.8	0	0.0	
5-8	24	42.8	13	12.3	
>8	31	55.4	62	87.7	
Mean±SD	9.02±1.95		10.48±1.78		**0.00**
Sitting time (hour)					
0	5	8.9	5	6.7	
1-3	26	46.4	37	49.3	
4-6	24	42.9	24	32.0	
>6	1	1.8	9	12.0	
Mean±SD	3.14±1.77		3.53±2.51		0.67
Standing time (hour)					
0	2	3.6	0	0.0	
1-3	7	12.5	18	24.0	
4-6	39	69.6	26	34.7	
>6	8	14.3	31	41.3	
Mean±SD	4.94±1.86		5.77±2.55		0.06

Working factors	Intervention (n=56)		Control (n=75)		*p*-value
Walking time (hour)					
0	35	62.5	30	40.0	
1-3	15	26.8	43	57.3	
4-6	6	10.7	2	2.7	
Mean±SD	0.97±1.45		1.10±1.18		0.14

Mann-Whitney Test and significant at *p*-value $\leq$0.05

4.1.5. Physical performances

Physical performance outcomes are the ability of body to function involving muscle pain, muscle flexibility, grip strength and work ability. The current study measured 4 outcomes: 1) muscle pain within the past 7 days, 2) muscle flexibility, 3) grip strength and 4) work ability.

4.1.5.1. Muscle pain within past 7 days

At baseline, all participants had muscle pain or muscle discomfort within the past 7 days in at least 1 area. The body chart from the Nordic Musculoskeletal Questionnaire (NMQ) was used to locate the pain region. The body regions are separated as follows: 1) neck and upper back, 2) lower back, 3) right arm, 4) left arm, 5) right leg, and 6) left leg. Among 56 market vendors in the intervention group, (48.2%) had muscle pain or muscle discomfort at left arm followed by right arm (46.4%), left leg (33.9%), right leg (28.6%), neck and upper back (26.8%) and lower back (25%). In the control group, 75 market vendors, (48%) had muscle pain or muscle discomfort at right and left leg followed by left arm (46.4%), lower back (34.7%), right arm (33.3%) and neck and upper back (22.7%). There was no significant difference in pain areas between both groups. Mild to moderate pain in each area such as muscle pain or muscle discomfort within the past 7 days was reported in the intervention group. However, the degree of muscle pain or muscle discomfort within the past 7 days in the control group reported moderate pain levels in each area. The result showed only degree of pain in left leg area had significant difference between intervention group and control group. To prevent any confounding factors such as unbalanced degree of pain in left leg area, degree of pain in left leg area was adjusted

using covariate of repeated measures ANCOVA for the test effect on the Self-Static Stretching and Strengthening program.

Table 20 Muscle pain and degree of pain at baseline

Pain area	Intervention (n=56)		Control (n=75)		*p*-value
	n	%	n	%	
Neck and upper back	15	26.8	17	22.7	0.58 (a)
Mild pain (VAS=1-3)	6	40.0	1	5.9	
Moderate pain (VAS=4-6)	6	40.0	10	58.8	0.06(b)
Severe pain (VAS=7-10)	3	20.0	6	35.3	
Lower back	14	25	26	34.7	0.23 (a)
Mild pain (VAS=1-3)	6	42.9	1	3.8	
Moderate pain (VAS =4-6)	5	35.7	23	88.5	0.14(b)
Severe pain (VAS =7-10)	3	21.4	2	7.7	
Right arm	26	46.4	25	33.3	0.12 (a)
Mild pain (VAS =1-3)	6	23.1	3	12.0	
Moderate pain (VAS =4-6)	14	53.9	18	72.0	0.82 (b)
Severe pain (VAS =7-10)	6	23.0	4	16.0	
Left arm	27	48.2	27	36.0	0.16 (a)
Mild pain (VAS =1-3)	4	14.8	3	11.2	
Moderate pain (VAS =4-6)	14	51.9	17	62.9	0.78(b)
Severe pain (VAS =7-10)	9	33.3	7	25.9	
Right leg	16	28.6	36	48.0	0.07 (a)
Mild pain (VAS =1-3)	5	31.3	3	8.3	
Moderate pain (VAS =4-6)	8	50.0	22	61.1	0.08(b)
Severe pain (VAS =7-10)	3	18.7	11	30.6	

Pain area	Intervention (n=56)		Control (n=75)		*p*-value
	n	%	n	%	
Left leg	19	33.9	36	48.0	0.11 (a)
Mild pain (VAS =1-3)	6	31.6	2	5.6	
Moderate pain (VAS =4-6)	9	47.3	21	58.3	**0.04 (b)**
Severe pain (VAS =7-10)	4	21.1	13	36.1	

(a)Chi-square test (b) Mann-Whitney Test and significant at *p*-value $\leq$0.05, VAS= Visual Analog Scale

4.1.5.2. Muscle flexibility

At baseline, the intervention group showed higher levels of muscle flexibility in the right arm, and right and left legs compared to the control group. But the control group showed higher levels of muscle flexibility in the left arm than the intervention group. There was no significant difference in muscle flexibility between both groups. Table 21 shows 60% of participants in both groups had a negative result in the back scratch test and about 30% of participants in both groups had a distance between the tip of middle finger greater than 5cms. Approximately 50% of participants in both groups showed positive results in the chair sit and reach test. In both groups, arm muscle flexibility was less than leg muscle flexibility.

Table 21 Muscle flexibility at baseline

Muscle flexibility	Intervention (n=56)		Control (n=75)		*p*-value
	n	%	n	%	
Right arm muscle flexibility					
Positive result	20	35.7	11	14.7	
zero	1	1.8	6	8.0	
-0.1 to (-5.08) cm.	17	30.4	36	48.0	
>-5.08 cm.	18	32.1	22	29.3	
Mean±SD	-4.04±8.61		-5.12±5.71		0.08
Left arm muscle flexibility					
Positive result	11	19.6	7	9.3	
zero	1	1.8	4	5.3	
-0.1 to (-5.08) cm.	13	23.2	34	45.4	
>-5.08 cm.	31	55.4	30	40.0	
Mean±SD	-8.73±10.40		-6.03±6.01		0.22
Right leg muscle flexibility					
Positive result	30	53.6	12	16.0	
zero	1	1.8	34	45.3	
-0.1 to (-5.08) cm.	12	21.4	20	26.7	
>-5.08 cm.	13	23.2	9	12.0	
Mean±SD	0.63±10.21		-1.13±5.96		0.11
Left leg muscle flexibility					
Positive result	30	53.6	12	16.0	
zero	2	3.6	34	45.3	
-0.1 to (-5.08) cm.	11	19.6	16	21.3	
>-5.08 cm.	13	23.2	13	17.4	
Mean±SD	0.57±11.54		-1.25±6.00		0.07

Independent t-test and significant at *p*-value $\leq$0.05

4.1.5.3. Grip strength

Across the intervention and control groups, baseline strength levels in grip strength were approximately equal. There was no significant difference in grip strength between both groups. Table 22 shows that participants in the intervention group had moderate strength levels (48.2%) followed by very low strength levels (26.8%) in the right hand. Participants in the control group had very low strength levels (38.67%) followed by moderate strength levels (29.3%) in the right hand. Participants in the intervention group showed very low fitness levels (35.7%) followed by moderate strength levels (28.6%) in the left hand. Participants in the control group had very low strength levels (49.3%) followed by moderate strength levels (24%) in the left hand.

Table 22 Grip strength at baseline

Grip strength	Intervention (n=56)		Control (n=75)		*p*-value
	n	%	n	%	
Right hand grip (kg/weight in kilogram)					
Very good	2	3.6	6	8.0	
Good	4	7.1	3	4.0	
Moderate	27	48.2	22	29.3	
Low	8	14.3	15	20.0	
Very low	15	26.8	29	38.7	
Mean±SD	0.39±0.11		0.40±0.12		0.90
Left hand grip (kg/weight in kilogram)					
Very good	2	3.6	4	5.3	
Good	5	8.9	3	4.0	
Moderate	16	28.6	18	24.0	
Low	13	23.2	13	17.3	
Very low	20	35.7	37	49.4	
Mean±SD	0.38±0.14		0.38±0.13		0.92

Independent t-test and significant at *p*-value $\leq$0.05

4.1.5.4. Work ability

The current study utilized a self-assessment questionnaire to ask participants how do they think about their work ability, how many days have they stopped working in the past 1 month due to WRMDs and how they think muscle pain or muscle discomfort might limit their work performance. Both the intervention and control groups showed similar results. 94.6% participants in the intervention group and the 94.7% participants in the control group thought they had high work ability in the market; 71.4% of participants in intervention group and 82.3% of participants in the control group thought there was no limitation in working due to muscle pain or muscle discomfort. Both groups hardly ever stop work as a result of muscle pain There was no significant difference of work ability between both groups.

Table 23 Work ability at baseline

Work ability	Intervention (n=56)		Control (n=75)		*p*-value
	n	%	n	%	
How do they think about their work ability					
Low work ability	0	0.0	0	0.0	0.99
Moderate work ability	3	5.4	4	5.3	
High work ability	53	94.6	71	94.7	
How many days have participants stopped working in the past 1 month due to WRMDs					
0 days	52	80.0	64	85.3	
1-2 days	4	20.0	10	13.3	
≥ 3 days	0	0.0	1	1.4	
Mean±S.D.	0.10±0.41		0.26±0.92		0.18
They think that muscle pain or muscle discomfort limit their work					
Strongly agree	0	0.0	0	0.0	0.23
Agree	0	0.0	1	1.3	
Neutral	1	1.8	3	4.0	
Disagree	3	5.4	5	6.7	
Very disagree	12	21.4	4	5.3	
Totally disagree	40	71.4	62	82.7	

Mann-Whitney Test and significant at *p*-value ≤0.05

4.2. The effectiveness of the Self-Static Stretching and Strengthening program on physical performances and health risk behaviors

4.2.1. The effectiveness of Self-Static Stretching and Strengthening program on muscle pain within the past 7 days

All participants in both groups reported muscle pain in at least 1 area at the beginning of the intervention study. After market vendors in the intervention group received the Self-Static Stretching and Strengthening program, 53.6%, 48.2%, 53.6% and 53.6% participants reported muscle pain or muscle discomfort within the past 7 days in at least 1 region post-intervention, 1-month, 3-months and 6-months follow up, respectively. In the control group, 65.3%, 54.7%, 54.7% and 53.3% of participants reported of muscle pain or muscle discomfort within the past 7 days in at least 1 region post-intervention, 1-month, 3-months, and 6-months follow up, respectively. The intervention group showed a lower percent of participant who had muscle pain or muscle discomfort within the past 7 days than the control group. However, there was no significant difference of muscle pain within the past 7 days between both groups during data collection. Table 24 shows the number of participants who had muscle pain or muscle discomfort within the past 7 days at baseline, post-intervention, 1-month, 3-months, and 6-months follow up.

Table 24 Number of participants who had muscle pain within the past 7 days at baseline, post-intervention, 1-month, 3-months and 6-months follow up

Time of data collection	Had muscle pain within the past 7 day				*p*-value
	Intervention group (n=56)		Control group (n=75)		
	n	%	n	%	
Baseline	56	100.0	75	100.0	-
Post-intervention	30	53.6	49	65.3	0.17
1-month follow up	27	48.2	41	54.7	0.47
3-months follow up	30	53.6	41	54.7	0.90
6-months follow up	30	53.6	40	53.3	0.98

Chi-square Test and significant at *p*-value $\leq$0.05

The degree of muscle pain in the intervention group and control group at baseline, post-intervention, 1-month, 3-months and 6-months follow up are shown in Table 25-30 There was no significant difference on the degree of muscle pain at neck and upper back area, right and left arm area during each data collection point between the intervention group and control group. However, there were significant differences on the degree of muscle pain between both groups at the lower back area post-intervention and 1-month follow up (p=0.02), at right leg area post-intervention (p<0.01) and at left leg area at baseline (p=0.04) and post-intervention (p<0.01). These differences in the degree of pain in lower back area, right leg area and left leg area because the participants in the intervention group showed a higher percentage of the participants reported mild pain at the lower back, right leg, and left leg area at post-intervention and 1-month follow up when compared with the control group.

Table 25 Degree of muscle pain in neck and upper back area at baseline, post-intervention, 1-month follow up, 3-months follow up and 6-months follow up

Neck and upper back area						
Time	**Degree of pain**	**Intervention**		**Control**		***p*-value**
		n	**%**	**n**	**%**	
Baseline	Mild pain	6	40.0	1	5.9	0.06
	Moderate pain	6	40.0	10	58.8	
	Severe pain	3	20.0	6	35.4	
	Total	15	100.0	17	100.0	
Post-intervention	Mild pain	1	14.3	0	0.0	0.78
	Moderate pain	2	28.6	3	60.0	
	Severe pain	4	57.1	2	40.0	
	Total	7	100.0	5	100.0	
1-month F/U	Mild pain	0	0.0	0	0.0	0.61
	Moderate pain	4	80.0	6	66.7	
	Severe pain	1	20.0	3	33.3	
	Total	5	100.0	9	100.0	

Neck and upper back area						
Time	**Degree of pain**	**Intervention**		**Control**		***p*-value**
		n	**%**	**n**	**%**	
3-months F/U	Mild pain	0	0.0	0	0.0	0.26
	Moderate pain	3	100.0	6	66.7	
	Severe pain	0	0.0	3	33.3	
	Total	3	100	9	100	
6-months F/U	Mild pain	0	0.0	0	0.0	0.39
	Moderate pain	7	77.8	3	30.0	
	Severe pain	2	22.2	7	70.0	
	Total	9	100.0	10	100.0	

Mann-Whitney Test and significant at *p*-value $\leq$0.05

Table 26 Degree of muscle pain in lower back area at baseline, post-intervention, 1-month follow up, 3-months follow up and 6-months follow up

Lower back						
Time	**Degree of pain**	**Intervention**		**Control**		***p*-value**
		n	**%**	**n**	**%**	
Baseline	Mild pain	6	42.9	1	3.9	0.14
	Moderate pain	5	35.7	23	88.5	
	Severe pain	3	21.4	2	7.6	
	Total	14	100.0	26	100.0	
Post-intervention	Mild pain	6	75.0	0	0.0	**0.02**
	Moderate pain	1	12.5	15	71.4	
	Severe pain	1	12.5	6	28.6	
	Total	8	100.0	21	100.0	
1-month F/U	Mild pain	2	18.2	0	0.0	**0.02**
	Moderate pain	9	81.8	23	92.0	
	Severe pain	0	0.0	2	8.0	
	Total	11	100.0	25	100.0	

Lower back						
Time	**Degree of pain**	**Intervention**		**Control**		***p*-value**
		n	**%**	**n**	**%**	
3-months F/U	Mild pain	2	18.2	0	0.0	0.16
	Moderate pain	8	72.7	22	88.0	
	Severe pain	1	9.1	3	12.0	
	Total	11	100.0	25	100.0	
6-months F/U	Mild pain	1	8.3	0	0.0	0.09
	Moderate pain	10	83.4	18	72.0	
	Severe pain	1	8.3	7	28.0	
	Total	12	100.0	25	100.0	

Mann-Whitney Test and significant at *p*-value $\leq$0.05

Table 27 Degree of muscle pain in right arm area at baseline, post-intervention, 1-month follow up, 3-months follow up and 6-months follow up

Right arm						
Time	**Degree of pain**	**Intervention**		**Control**		***p*-value**
		n	%	n	%	
Baseline	Mild pain	6	23.1	3	12.0	0.82
	Moderate pain	14	53.9	18	72.0	
	Severe pain	6	23.0	4	16.0	
	Total	26	100.0	25	100.0	
Post-intervention	Mild pain	9	60.0	2	8.0	0.13
	Moderate pain	1	6.7	20	80.0	
	Severe pain	5	33.3	3	12.0	
	Total	15	100.0	25	100.0	
1-month F/U	Mild pain	4	36.4	3	15.8	0.82
	Moderate pain	4	36.4	14	73.7	
	Severe pain	3	27.2	2	10.5	
	Total	11	100.0	19	100.0	

Right arm						
Time	**Degree of pain**	**Intervention**		**Control**		***p*-value**
		n	%	n	%	
3-months F/U	Mild pain	4	40.0	3	13.7	0.66
	Moderate pain	3	30.0	16	72.7	
	Severe pain	3	30.0	3	13.6	
	Total	10	100.0	22	100.0	
6-months F/U	Mild pain	4	36.4	2	9.5	0.18
	Moderate pain	5	45.4	14	66.7	
	Severe pain	2	18.2	5	23.8	
	Total	11	100.0	21	100.0	

Mann-Whitney Test and significant at *p*-value $\leq$0.05

Table 28 Degree of muscle pain in left arm area at baseline, post-intervention, 1-month follow up, 3-months follow up and 6-months follow up

Left arm						
Time	**Degree of pain**	**Intervention**		**Control**		***p*-value**
		n	**%**	**n**	**%**	
Baseline	Mild pain	4	14.8	3	11.1	0.74
	Moderate pain	14	51.8	17	62.9	
	Severe pain	9	33.4	7	25.0	
	Total	27	100.0	27	100.0	
Post-intervention	Mild pain	8	61.5	2	8.7	0.12
	Moderate pain	1	7.7	19	82.6	
	Severe pain	4	30.8	2	8.7	
	Total	13	100.0	23	100.0	
1-month F/U	Mild pain	4	40.0	3	20.0	0.34
	Moderate pain	5	50.0	10	66.7	
	Severe pain	1	10.0	2	13.3	
	Total	10	100.0	15	100.0	

Left arm						
Time	**Degree of pain**	**Intervention**		**Control**		***p*-value**
		n	**%**	**n**	**%**	
3-months F/U	Mild pain	3	30.0	3	16.7	0.68
	Moderate pain	5	50.0	12	66.7	
	Severe pain	2	20.0	3	16.6	
	Total	10	100.0	18	100.0	
6-months F/U	Mild pain	3	33.3	2	12.5	0.09
	Moderate pain	6	66.7	9	56.2	
	Severe pain	0	0.0	5	31.3	
	Total	9	100.0	16	100.0	

Mann-Whitney Test and significant at *p*-value $\leq$0.05

Table 29 Degree of muscle pain in right leg area at baseline, post-intervention, 1-month follow up, 3-months follow up and 6-months follow up

Right leg						
Time	**Degree of pain**	**Intervention**		**Control**		***p*-value**
		n	**%**	**n**	**%**	
Baseline	Mild pain	5	31.2	3	8.3	0.08
	Moderate pain	8	50.0	22	61.1	
	Severe pain	3	18.8	11	30.6	
	Total	16	100.0	36	100.0	
Post-intervention	Mild pain	5	100	1	4.7	**<0.01**
	Moderate pain	0	0.0	13	62.0	
	Severe pain	0	0.0	7	33.3	
	Total	5	100.0	21	100.0	
1-month F/U	Mild pain	1	16.7	1	5.9	0.87
	Moderate pain	3	50.0	11	64.7	
	Severe pain	2	33.3	5	29.4	
	Total	6	100.0	17	100.0	

Right leg						
Time	**Degree of pain**	**Intervention**		**Control**		***p*-value**
		n	**%**	**n**	**%**	
3-months F/U	Mild pain	1	12.5	2	13.3	0.43
	Moderate pain	6	75.0	8	53.3	
	Severe pain	1	12.5	5	33.4	
	Total	8	100.0	15	100.0	
6-months F/U	Mild pain	1	20.0	1	6.3	0.26
	Moderate pain	3	60.0	8	50.0	
	Severe pain	1	20.0	7	43.7	
	Total	5	100.0	16	100.0	

Mann-Whitney Test and significant at *p*-value $\leq$0.05

Table 30 Degree of muscle pain in left leg area at baseline, post-intervention, 1-month follow up, 3-months follow up and 6-months follow up

Left leg						
Time	**Degree of pain**	**Intervention**		**Control**		***p*-value**
		n	**%**	**n**	**%**	
Baseline	Mild pain	6	31.5	2	5.5	**0.04**
	Moderate pain	9	47.4	21	58.3	
	Severe pain	4	21.1	13	36.2	
	Total	19	100.0	36	100.0	
Post-intervention	Mild pain	7	70.0	0	0.0	**<0.01**
	Moderate pain	2	20.0	13	65.0	
	Severe pain	1	10.0	7	35.0	
	Total	10	100.0	20	100.0	
1-month F/U	Mild pain	1	12.5	1	6.3	0.64
	Moderate pain	5	62.5	10	62.5	
	Severe pain	2	25.0	5	31.2	
	Total	8	100.0	16	100.0	

Left leg						
Time	**Degree of pain**	**Intervention**		**Control**		***p*-value**
		n	**%**	**n**	**%**	
3-month F/U	Mild pain	1	10.0	1	8.3	0.16
	Moderate pain	8	80.0	6	50.0	
	Severe pain	1	10.0	5	41.7	
	Total	10	100.0	12	100.0	
6-month F/U	Mild pain	1	14.0	1	6.7	0.22
	Moderate pain	5	71.4	8	53.3	
	Severe pain	1	14.3	6	40.0	
	Total	7	100	15	100	

Mann-Whitney Test and significant at *p*-value $\leq$0.05

4.2.2. The effectiveness of Self-Static Stretching Strengthening program (SSS program) on muscle flexibility

This study measured muscle flexibility involving right arm, left arm, right leg, and left leg. Arm and leg muscle flexibility were measured using the Back-scratch test and Chair sit and reach test, respectively. This section shows the results of Self-Static Stretching and Strengthening program on muscle flexibility in each limb. At baseline, working hours per day among both groups were different, hence working hours per day for the current study were adjusted. Repeated measurement ANCOVA were used to test the effectiveness of the Self-Static Stretching-Strengthening program on changes over time in mean muscle flexibility scores between and within groups.

SSS program on right arm muscle flexibility

The mean of right arm muscle flexibility in intervention group was -4.05±8.61, -2.24±7.31, -2.47±7.08, -3.23±7.72 and -3.65±7.64 cm. at baseline, post-intervention, 1-month follow up, 3-month follow up and 6-month follow up, respectively. The mean of right arm muscle flexibility in control group was -5.12±5.17, -4.73±5.19, -4.82±4.90, -4.84±5.72 and -5.40±5.66 cm. at baseline, post-intervention, 1-month follow up, 3-month follow up and 6-month follow up, respectively. The mean scores for right arm muscle flexibility showed negative results in both groups at baseline, post-intervention, 1-month follow up, 3-months and 6-months follow up.

Table 31 shows the mean and SD scores for right arm muscle flexibility at baseline, post-intervention, 1-month, 3-months, and 6-months follow up.

Table 31 Mean and SD in right arm muscle flexibility at baseline, post-intervention, 1-month, 3-months, and 6-months follow up

Right arm muscle flexibility (cm.)	group	Mean	SD
Baseline	Intervention	-4.05	8.61
	Control	-5.12	5.71
Post-intervention	Intervention	-2.24	7.31
	Control	-4.73	5.19
1-month follow up	Intervention	-2.47	7.08
	Control	-4.82	4.90
3-month follow up	Intervention	-3.23	7.72
	Control	-4.84	5.72
6-month follow up	Intervention	-3.65	7.64
	Control	-5.40	5.66

After controlling for the effect of working hours per day and degree of pain in left leg (Covariates appearing in the model are evaluated at the following values: working hour per day= 9.98, degree of pain at left leg = 2.16), the between groups test indicates there are significant differences between the intervention and control group (p=0.02), consequently the graph in Figure 18 shows there is a gap between the lines for both groups. The within subject test indicates there is no significant time effect, hence there was no change in right arm muscle flexibility within groups over time. An interaction effect between group and time shows no significant difference between group over time. Table 32 presents the repeated measures ANCOVA of right arm muscle flexibility between the intervention and control group.

Table 32 Repeated measures ANCOVA in right arm muscle flexibility between the intervention and control group

Source	SS	df	MS	F	*p*-value
Between group					
Group	1092.84	1	1092.84	6.04	**0.02**
Working hour per day	582.40	1	582.40	2.77	0.10
Degree of pain in left leg	9.02	1	9.02	0.04	0.84
Error	23146.17	128	180.83		
Within group					
Time	37.95	3.18	11.90	1.56	0.19
Time *group	35.07	3.18	10.99	1.44	0.22
Time*working hour per day	15.22	3.18	5.28	0.60	0.61
Time*degree of pain in left leg	15.40	3.18	5.35	0.61	0.60
Error (time)	3113.49	408.22	7.67		

SS= Sum of Squares, MS= Mean Square, df= degree of freedom

Significant at $p \leq 0.05$

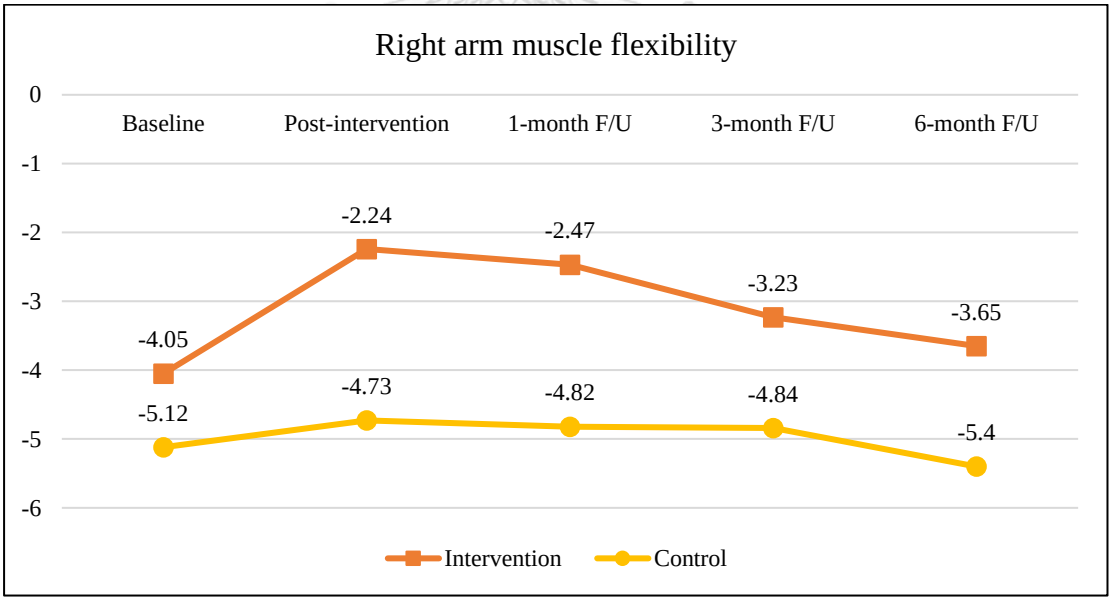


Figure 18 Right arm muscle flexibility over time

There were significant differences in right arm muscle flexibility between the intervention group and control group at post-intervention, 1-month, 3-months, and 6-months follow up (Table 33).

Table 33 Pairwise comparisons of the different measurements of right arm muscle flexibility between intervention group (n=56) and control group (n=75)

Time	Group		Mean-diff	SE	*p*-value	95% Confidence Interval for Difference	
	(i)	(j)	(i-j)			Lower Bound	Upper Bound
Baseline	I	C	2.17	1.32	0.10	-0.44	4.79
Post-intervention	I	C	3.64	1.14	**0.00**	1.38	5.9
1-month F/U	I	C	3.04	1.12	**0.00**	0.83	5.25
3-months F/U	I	C	2.63	1.24	**0.04**	0.18	5.08
6-months F/U	I	C	2.53	1.24	**0.04**	0.08	4.98

Mean-diff =mean difference, I =intervention group, C= control group

Based on estimated marginal means

*The mean difference is significant at *p*-value≤0.05

95%CI was adjusted for multiple comparisons: Bonferroni.

SSS program on left arm muscle flexibility

The mean of left arm muscle flexibility in intervention group was -8.74±10.40, -6.88±9.92, -3.54±7.17, -4.96±8.67 and -3.65±7.64 cm. at baseline, post-intervention, 1-month follow up, 3-month follow up and 6-month follow up, respectively. The mean of left arm muscle flexibility in control group was -6.88±6.01, -6.04±5.37, -5.89±5.19, -5.82±5.82 and -5.40±5.66 cm. at baseline, post-intervention, 1-month follow up, 3-month follow up and 6-month follow up, respectively. The mean scores in left arm muscle flexibility showed negative results in both groups at baseline, post-intervention, 1-month, 3-months, and 6-months follow up. Table 34 shows the mean and SD in left arm muscle flexibility at baseline, post-intervention, 1-month, 3-months, and 6-months follow up.

Table 34 Mean and SD in left arm muscle flexibility at baseline, post-intervention, 1-month, 3-months, and 6-months follow up

Left arm muscle flexibility (cm.)	Group	Mean	SD
Baseline	Intervention	-8.74	10.40
	Control	-6.03	6.01
Post-intervention	Intervention	-6.88	9.92
	Control	-6.04	5.37
1-month follow up	Intervention	-3.54	7.17
	Control	-5.89	5.19
3-month follow up	Intervention	-4.96	8.67
	Control	-5.82	5.82
6-month follow up	Intervention	-3.65	7.64
	Control	-5.40	5.66

After controlling for the effect of working hours per day and degree of pain in left leg (Covariates appearing in the model are evaluated at the following values: working hour per day= 9.98, degree of pain at left leg = 2.16), the between groups test indicates there was no difference between the intervention and control group, with the graph in Figure 19 displaying the lines for both two groups as close together. The within subject test indicates there was a significant time effect, hence there were some changes in left arm muscle flexibility within groups over time. Moreover, the interaction of time and groups is significant given that left arm muscle flexibility shows significant difference between group over time. Figure 19 shows that left arm muscle flexibility for the intervention group, increases then decreases and increases over time. Table 35 presents a repeated measures ANCOVA of left arm muscle flexibility between the intervention and control group.

Table 35 Repeated measurement ANCOVA of in left arm muscle flexibility between the intervention and control group

Source	SS	df	MS	F	*p*-value
Between group					
Group	337.99	1	337.99	2.03	0.15
Working hour per day	1803.33	1	1803.33	7.63	0.01
Degree of pain in left leg	317.13	1	317.13	1.34	0.25
Error	21225.37	128	165.82		
Within group					
Time	739.54	1.83	402.52	5.04	**0.00**
Time *group	607.84	1.83	321.29	4.14	**0.02**
Time*working hour per day	74.33	1.83	27.32	1.44	0.24
Time*degree of pain in left leg	62.44	1.83	22.95	1.44	0.31
Error (time)	18758.03	235.17	79.76		

SS= Sum of Squares, MS= Mean Square, df= degree of freedom

Significant at $p \leq 0.05$

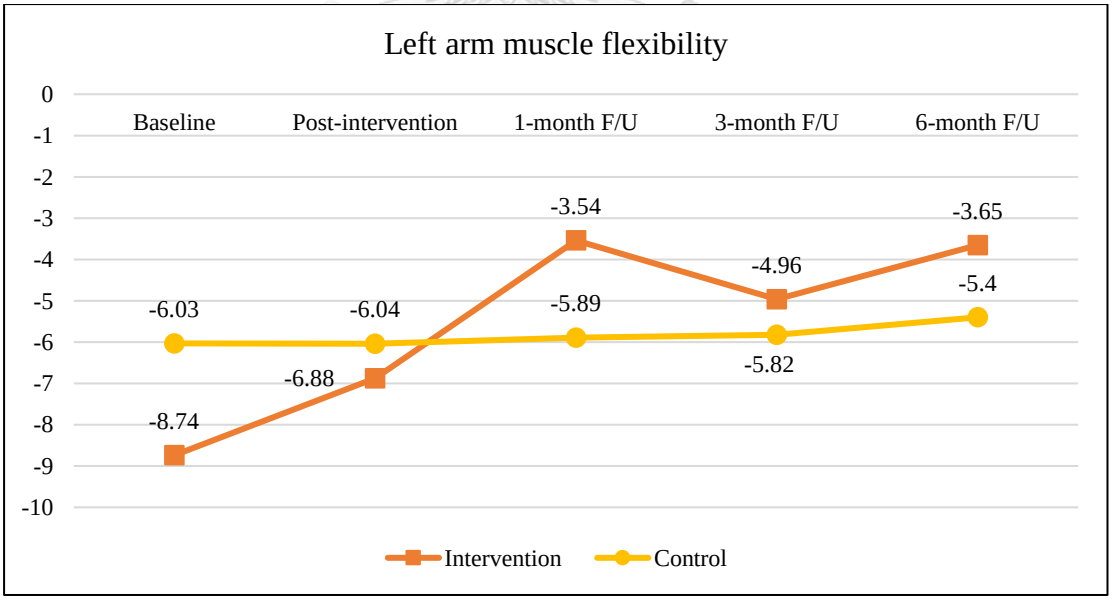


Figure 19 Left arm muscle flexibility over time

Testing the difference in left arm muscle flexibility for both the intervention and control group at baseline, post-intervention, 1-month, 3-months and 6-months follow up showed increases in left arm muscle flexibility for the intervention group between baseline and 1-month follow up (p<0.001), baseline and 3-months follow up (p<0.001), post-intervention and 1-month follow up (p=0.04). There was a statistically significant decrease between the 1-month and 6-month follow up (p<0.001). There was no difference in left arm muscle flexibility over time in the control group (Table 36).

Table 36 Pairwise comparisons of the different measurements of in left arm muscle flexibility within the intervention group (n=56) and control group (n=75)

Group	Time		Mean -diff	SE	*p*-value	95% Confidence Interval for Difference	
	i	j	i-j			Lower Bound	Upper Bound
Intervention	Baseline	Post-intervention	-1.85	0.93	0.50	-4.56	0.86
		1-month F/U	-5.19	1.14	**0.00**	-8.53	-1.85
		3-months F/U	-3.77	0.80	**0.00**	-6.12	-1.43
		6-months F/U	-2.15	0.83	0.12	-4.59	0.28
	Post-intervention	1-month F/U	-3.34	1.10	**0.04**	-6.56	-0.12
		3-months F/U	-1.92	1.06	0.77	-5.03	1.19
		6-months F/U	-0.30	1.19	1.00	-3.78	3.18
	1-month F/U	3-months F/U	1.42	0.81	0.87	-0.97	3.80
		6-months F/U	3.04	1.04	**0.05**	-0.01	6.08
	3-months F/U	6-months F/U	1.62	0.64	0.15	-0.26	3.50

Group	Time		Mean -diff	SE	*p*-value	95% Confidence Interval for Difference	
	i	j	i-j			Lower Bound	Upper Bound
Control	Baseline	Post-intervention	0.001	0.48	1.00	-1.39	1.39
		1-month F/U	-0.15	0.49	1.00	-1.57	1.27
		3-months F/U	-0.21	0.50	1.00	-1.65	1.23
		6-months F/U	0.14	0.48	1.00	-1.24	1.52
	Post-intervention	1-month F/U	-0.15	0.24	1.00	-.83	.53
		3-months F/U	-0.21	0.47	1.00	-1.57	1.15
		6-months F/U	0.14	0.47	1.00	-1.22	1.49
	1-month F/U	3-months F/U	-0.06	0.43	1.00	-1.30	1.18
		6-months F/U	0.29	0.43	1.00	-.96	1.54
	3-months F/U	6-months F/U	0.35	0.32	1.00	-.59	1.29

Mean-diff =mean difference

Based on estimated marginal means

*The mean difference is significant at *p*-value≤0.05

95%CI was adjusted for multiple comparisons: Bonferroni.

SSS program on right leg muscle flexibility

The mean of right leg muscle flexibility in intervention group was 0.63±10.22, 4.76±11.66, 3.19±11.63, 2.33±10.02 and 0.75±10.43 cm. at baseline, post-intervention, 1-month follow up, 3-month follow up and 6-month follow up, respectively. The mean of right leg muscle flexibility in control group was -1.14±5.97, -2.11±6.26, -2.00±5.89, -2.17±6.49 and -2.54±6.52 cm. at baseline, post-intervention, 1-month follow up, 3-month follow up and 6-month follow up, respectively. The mean scores in right leg muscle flexibility for the intervention showed positive results at baseline but the control group showed negative results. There was no statistically significant difference between groups at baseline. (Table 37).

Table 37 Mean and SD of in right leg muscle flexibility at baseline, post-intervention, 1-month follow up, 3-months follow up and 6-months follow up

Right leg muscle flexibility (cm.)	Group	Mean	SD
Baseline	Intervention	0.63	10.22
	Control	-1.14	5.97
Post-intervention	Intervention	4.76	11.66
	Control	-2.11	6.26
1-month follow up	Intervention	3.19	11.63
	Control	-2.00	5.89
3-months follow up	Intervention	2.33	10.02
	Control	-2.17	6.49
6-months follow up	Intervention	0.75	10.43
	Control	-2.54	6.52

After controlling for the effect of working hours per day and degree of pain in left leg (Covariates appearing in the model are evaluated at the following values: working hour per day= 9.98, degree of pain at left leg = 2.16), the between groups test indicates there was a statistically significant difference between the intervention and control group (p<0.001). The within subject test indicates there was a significant time effect with some changes in right leg muscle flexibility within groups over time. Moreover, the interaction between time and groups is significant. In Figure 20 intervention group for right leg muscle flexibility increases, then

decreases continuously over time. Table 38 presents repeated measures ANCOVA in right leg muscle flexibility between the intervention and control group.

Table 38 Repeated measures ANCOVA in right leg muscle flexibility between the intervention and control group

Source	SS	df	MS	F	*p*-value
Between group					
Group	3308.32	1	3308.32	9.93	**0.00**
Working hour per day	85.98	1	85.98	0.35	0.55
Degree of pain in left leg	0.04	1	0.04	0.00	0.99
Error	42620.43	128	332.97		
Within group					
Time	101.65	3.20	31.72	3.69	**0.00**
Time *group	326.53	3.20	101.91	11.87	**0.00**
Time*working hour per day	47.41	3.20	16.54	1.21	0.31
Time*degree of pain in left leg	15.737	3.20	5.49	0.40	0.74
Error (time)	3520.78	410.09	8.58		

SS= Sum of Squares, MS= Mean Square, df= degree of freedom

Significant at $p \leq 0.05$

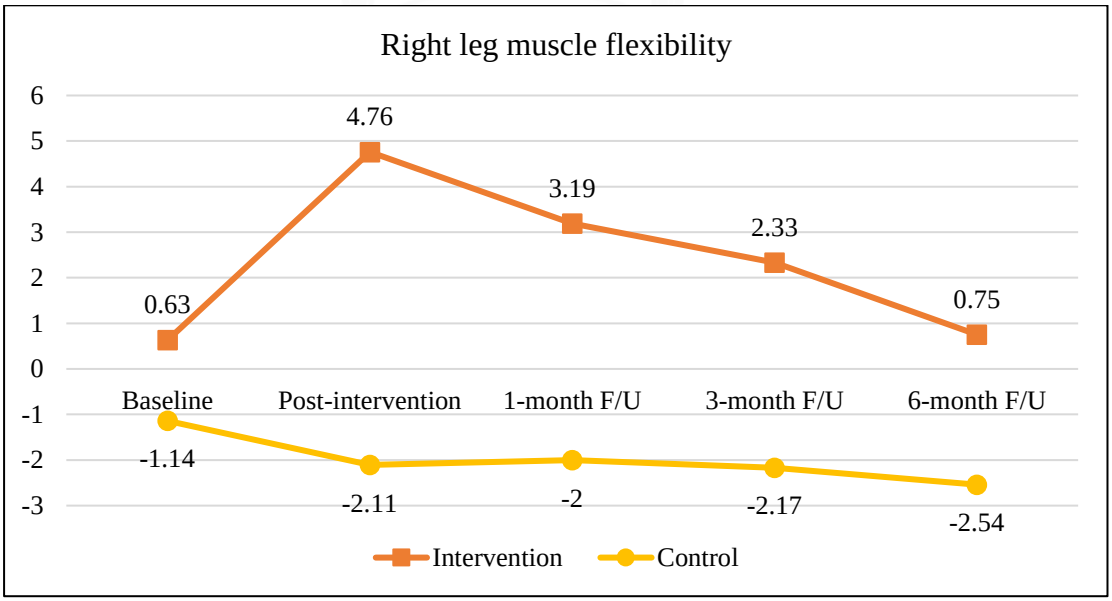


Figure 20 Right leg muscle flexibility over time

Differences in right leg muscle flexibility within the intervention and control group at baseline, post-intervention, 1-month f, 3-months and 6-months follow up showed a significant increase in right leg muscle flexibility between baseline and post-intervention, 1-month and 3-months follow up (p<0.001, p<=0.02 and p<0.001, respectively) for the intervention group and a significant decrease between post-intervention, 3-months and 6-months follow up (p<0.001), 6-months and 1-month follow up and 3-months follow up (p<0.001and p=0.01, respectively). In the control group, there was a significant decrease in right leg muscle flexibility between baseline, post-intervention and 6-months follow up (p=0.04 and p=0.01, respectively) (Table 39).

Table 39 Pairwise comparisons of the different measurements of in right leg muscle flexibility within the intervention group (n=56) and control group (n=75)

Group	Time		Mean-diff	SE	*p*-value	95% Confidence Interval for Difference	
	i	j	i-j			Lower Bound	Upper Bound
Intervention	Baseline	Post-intervention	-4.13	0.54	**0.00**	-5.72	-2.53
		1-month F/U	-2.56	0.77	**0.02**	-4.81	-0.32
		3-months F/U	-1.70	0.45	**0.00**	-3.01	-0.39
		6-months F/U	-0.12	0.55	1.00	-1.74	1.50
	Post-intervention	1-month F/U	1.57	0.61	0.13	-0.22	3.35
		3-months F/U	2.43	0.51	**0.00**	0.94	3.92
		6-months F/U	4.01	0.62	**0.00**	2.21	5.81
	1-month F/U	3-months F/U	0.86	0.71	1.00	-1.22	2.95
		6-months F/U	2.44	0.48	**0.00**	1.04	3.85
	3-months F/U	6-months F/U	1.58	0.45	**0.00**	0.26	2.89

Group	Time		Mean-diff	SE	*p*-value	95% Confidence Interval for Difference	
	i	j	i-j			Lower Bound	Upper Bound
Control	Baseline	Post-intervention	0.97	0.33	**0.04**	0.02	1.92
		1-month F/U	0.87	0.36	0.20	-0.18	1.92
		3-months F/U	1.03	0.41	0.14	-0.15	2.21
		6-months F/U	1.41	0.40	**0.00**	0.25	2.56
	Post-intervention	1-month F/U	-0.10	0.30	1.00	-0.97	0.76
		3-months F/U	0.06	0.43	1.00	-1.19	1.31
		6-months F/U	0.44	0.38	1.00	-0.67	1.55
	1-month F/U	3-months F/U	0.16	0.38	1.00	-0.93	1.26
		6-months F/U	0.54	0.35	1.00	-0.48	1.56
	3-months F/U	6-months F/U	0.38	0.24	1.00	-0.33	1.08

Mean-diff =mean difference

Based on estimated marginal means

*The mean difference is significant at *p*-value≤0.05

95%CI was adjusted for multiple comparisons: Bonferroni.

Testing the difference of in right leg muscle flexibility between the intervention and control group at baseline, post-intervention, 1-month follow up, 3-months follow up and 6-months follow up showed there were significant differences of in right leg muscle flexibility .between intervention group and control group at post-intervention, 1-month follow up, 3-month follow up and 6-month follow up (Table 40).

Table 40 Pairwise comparisons of the different measurements of right leg muscle flexibility between intervention group (n=56) and control group (n=75)

Time	Group		Mean-diff	SE	*p*-value	95% Confidence Interval for Difference	
	(i)	(j)	(i-j)			Lower Bound	Upper Bound
Baseline	I	C	2.71	1.52	0.08	-0.29	5.71
Post-intervention	I	C	7.18	1.71	**0.00**	3.80	10.55
1-month F/U	I	C	5.52	1.67	**0.00**	2.21	8.83
3-months F/U	I	C	5.20	1.55	**0.00**	2.14	8.27
6-months F/U	I	C	3.76	1.60	**0.02**	0.61	6.92

Mean-diff =mean difference, I =intervention group, C= control group

Based on estimated marginal means

*The mean difference is significant at *p*-value≤0.05

95%CI was adjusted for multiple comparisons: Bonferroni

SSS program on left leg muscle flexibility

The mean of left leg muscle flexibility in intervention group was 0.58±11.54, 4.38±12.90, 2.71±12.61, 2.08±10.97 and 1.08±11.11 cm. at baseline, post-intervention, 1-month follow up, 3-month follow up and 6-month follow up, respectively. The mean of left leg muscle flexibility in control group was -1.26±6.00, -2.29±6.60, -2.01±5.93, -2.23±6.74 and -2.53±6.90 cm. at baseline, post-intervention, 1-month follow up, 3-month follow up and 6-month follow up, respectively. The mean score for left leg muscle flexibility in the intervention group showed positive results at baseline however, the control group showed negative results. There was no statistically significant difference between groups at baseline. (Table 41).

Table 41 Mean scores and SD in left leg muscle flexibility at baseline, post-intervention, 1-month, 3-months and 6-months follow up

Left leg muscle flexibility (cm.)	Group	Mean	SD
Baseline	Intervention	0.58	11.54
	Control	-1.26	6.00
Post-intervention	Intervention	4.38	12.90
	Control	-2.29	6.60
1-month follow up	Intervention	2.71	12.61
	Control	-2.01	5.93
3-months follow up	Intervention	2.08	10.97
	Control	-2.23	6.74
6-months follow up	Intervention	1.08	11.11
	Control	-2.53	6.90

After controlling for the effect of working hours per day and degree of pain in left leg (Covariates appearing in the model are evaluated at the following values: working hour per day= 9.98, degree of pain at left leg = 2.16), the between groups test indicates there was statistically significant difference between the intervention and control groups (p<0.001). The within group test indicates there was no significant time effect and no changes to left leg muscle flexibility within the group over time. Moreover, the interaction of time and group was significant indicating that left leg muscle flexibility shows significant difference between group over time. According to Figure 21, the trending line for the intervention group increases and then decreases over time. Table 42 presents repeated measures ANCOVA in left leg muscle flexibility between the intervention and control group.

Table 42 Repeated measures ANCOVA in left leg muscle flexibility between the intervention and control group

Source	SS	df	MS	F	*p*-value
Between group					
Group	3232.92	1	3232.92	8.31	**0.00**
Working hour per day	143.69	1	143.69	0.58	0.45
Degree of pain in left leg	0.47	1	0.47	0.00	0.97
Error	49745.17	128	388.63		
Within group					
Time	72.55	3.08	23.48	2.41	0.06
Time *group	285.12	3.22	88.43	9.47	**0.00**
Time*working hour per day	39.90	3.22	14.78	0.93	0.42
Time*degree of pain in left leg	13.03	3.22	4.83	0.30	0.80
Error (time)	3851.15	395.44	9.73		

SS= Sum of Squares, MS= Mean Square, df= degree of freedom

Significant at $p \leq 0.05$

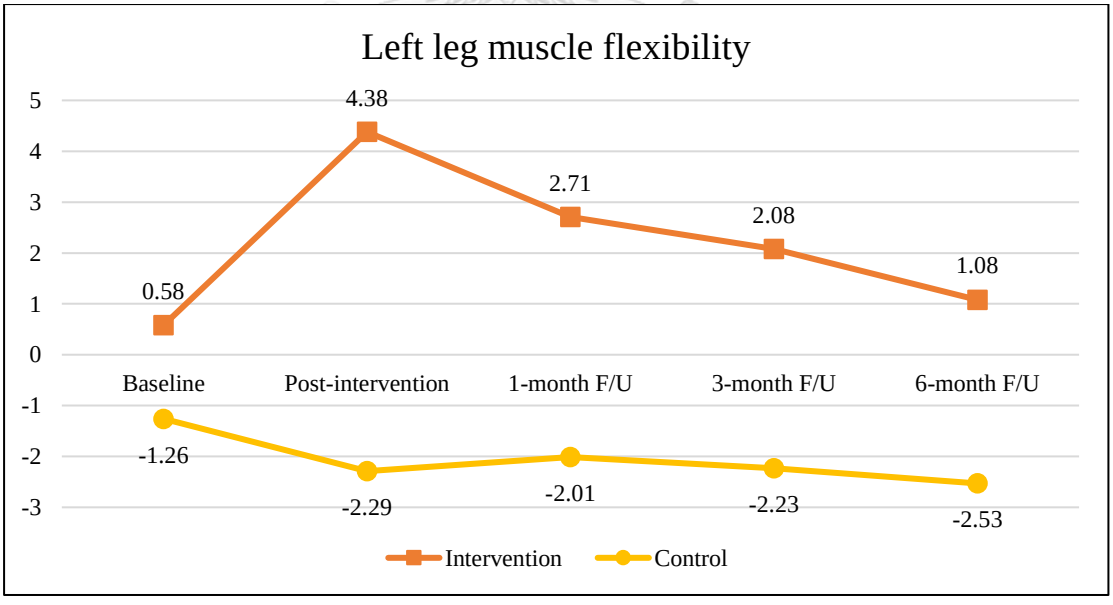


Figure 21 Left leg muscle flexibility over time

There was a significant difference in left leg muscle flexibility between the intervention and control group at baseline, post-intervention and 3-months follow up (p<0.001 and p<=0.04, respectively). However, there was a significant decrease in left leg muscle flexibility in the intervention group between post-intervention, 3-months and 6-months follow up (p<0.001). For the control group, there was a significant decrease in left leg muscle flexibility between baseline and 6-months follow up (p=0.04) (Table 43).

Table 43 Pairwise comparisons of the different measurements in left leg muscle flexibility within intervention group (n=56) and control group (n=75)

Group	Time		Mean-diff	SE	p-value	95% Confidence Interval for Difference	
	i	j	i-j			Lower Bound	Upper Bound
Intervention	Baseline	Post-intervention	-3.80	0.55	**0.00**	-5.40	-2.21
		1-month F/U	-2.13	0.75	0.06	-4.32	0.05
		3-months F/U	-1.50	0.50	**0.04**	-2.96	-0.04
		6-months F/U	-0.50	0.59	1.00	-2.22	1.21
	Post-intervention	1-month F/U	1.67	0.66	0.15	-0.27	3.60
		3-months F/U	2.30	0.57	**0.00**	0.63	3.98
		6-months F/U	3.30	0.67	**0.00**	1.34	5.26
	1-month F/U	3-months F/U	0.63	0.69	1.00	-1.38	2.65
		6-months F/U	1.63	0.45	**0.00**	0.31	2.95
	3-months F/U	6-months F/U	1.00	0.42	0.22	-0.24	2.23

Group	Time		Mean-diff	SE	p-value	95% Confidence Interval for Difference	
	i	j	i-j			Lower Bound	Upper Bound
Control	Baseline	Post-intervention	1.04	0.37	0.07	-0.04	2.11
		1-month F/U	0.75	0.37	0.48	-0.33	1.84
		3-months F/U	0.97	0.45	0.32	-0.32	2.26
		6-months F/U	1.27	0.42	**0.04**	0.05	2.50
	Post-intervention	1-month F/U	-0.28	0.32	1.00	-1.21	0.65
		3-months F/U	-0.06	0.48	1.00	-1.45	1.32
		6-months F/U	0.24	0.44	1.00	-1.04	1.52
	1-month F/U	3-months F/U	0.22	0.41	1.00	-0.98	1.42
		6-months F/U	0.52	0.38	1.00	-0.59	1.63
	3-months F/U	6-months F/U	0.30	0.20	1.00	-0.27	0.87

Mean-diff =mean difference

Based on estimated marginal means

*The mean difference is significant at p-value$\leq$0.05

95%CI was adjusted for multiple comparisons: Bonferroni.

Testing the difference in left leg muscle flexibility between the intervention and control group at baseline, post-intervention, 1-month, 3-months, and 6-months follow up showed significant differences between both groups (Table 44).

Table 44 Pairwise comparisons of the different measurements in left leg muscle flexibility between intervention group (n=56) and control group (n=75)

Time	Group		Mean-diff	SE	*p*-value	95% Confidence Interval for Difference	
	(i)	(j)	(i-j)			Lower Bound	Upper Bound
Baseline	I	C	2.76	1.66	0.10	-0.53	6.04
Post-intervention	I	C	7.12	1.86	**0.00**	3.44	10.80
1-month F/U	I	C	5.07	1.78	**0.00**	1.54	8.60
3-months F/U	I	C	5.07	1.66	**0.00**	1.78	8.36
6-months F/U	I	C	4.08	1.70	**0.02**	0.72	7.44

Mean-diff =mean difference, I =intervention group, C= control group

Based on estimated marginal means

*The mean difference is significant at *p*-value≤0.05

95%CI was adjusted for multiple comparisons: Bonferroni

4.2.3. The effectiveness of the Self-Static Stretching Strengthening program (SSS program) on grip strength

This study measured right-hand grip strength and left-hand grip strength. Grip strength was measured by a hand grip dynamometer (Takei 5401 Digital Dynamometer, Japan). This section shows the results of the effectiveness of Self-Static Stretching and Strengthening program for both the right and left hands. For both groups, working hours per day and degree of pain in left leg were different at baseline. Repeated measures ANCOVA was used to test the effectiveness of the Self-Static Stretching and Strengthening program on changes over time in mean grip strength between and within groups.

SSS program on right-hand grip strength

The mean of right-hand grip strength in intervention group was 0.39±0.11, 0.39±0.12, 0.38±0.10, 0.37±0.11 and 0.35±0.11 kilograms per weight at baseline, post-intervention, 1-month follow up, 3-month follow up and 6-month follow up, respectively. The mean of right hand grip strength in control group was 0.40±0.12, 0.42±0.12, 0.38±0.14, 0.41±0.13 and 0.45±0.12 kilograms per weight at baseline, post-intervention, 1-month follow up, 3-month follow up and 6-month follow up, respectively. The mean scores for right-hand grip strength on the intervention group and control group at baseline, post-intervention, 1-month, 3-months, and 6-months follow up in Table 45

Table 45 Mean score and SD of right-hand grip strength at baseline, post-intervention, 1-month, 3-months, and 6-months follow up

Right hand grip strength	Group	Mean	SD
Baseline	Intervention	0.39	0.11
	Control	0.40	0.12
Post-intervention	Intervention	0.39	0.12
	Control	0.42	0.12
1-month follow up	Intervention	0.38	0.10
	Control	0.38	0.14
3-month follow up	Intervention	0.37	0.11
	Control	0.41	0.13
6-month follow up	Intervention	0.35	0.11
	Control	0.45	0.12

After controlling for the effect of working hours per day and degree of pain in left leg (Covariates appearing in the model are evaluated at the following values: working hour per day= 9.98, degree of pain at left leg = 2.16), the between groups test indicates there was no significant difference between the intervention and control group. The graph in Figure 22 shows the lines for both groups as close. The within subject test indicates there was no significant time effect and there were no changes in right-hand grip strength over time. However, the interaction of time and group was significant (p=0.02) indicating that the right-hand grip strength shows significant difference between group over time. Table 46 presents repeats measures ANCOVA of right-hand grip strength between the intervention and control group.

Table 46 Repeated measures ANCOVA of right-hand grip strength between the intervention and control group

Source	SS	df	MS	F	*p*-value
Between group					
Group	0.16	1	0.16	3.52	0.55
Working hour per day	0.03	1	0.03	0.83	0.37
Degree of pain in left leg	0.03	1	0.03	0.87	0.36
Error	6.05	128	0.04		
Within group					
Time	0.04	3.45	0.01	1.91	0.11
Time *group	0.15	3.45	0.04	6.22	**0.02**
Time*working hour per day	0.02	3.45	0.00	0.51	0.69
Time*degree of pain in left leg	0.05	3.45	0.02	1.74	0.16
Error (time)	3.18	442.07	0.007		

SS= Sum of Squares, MS= Mean Square, df= degree of freedom

Significant at $p \leq 0.05$

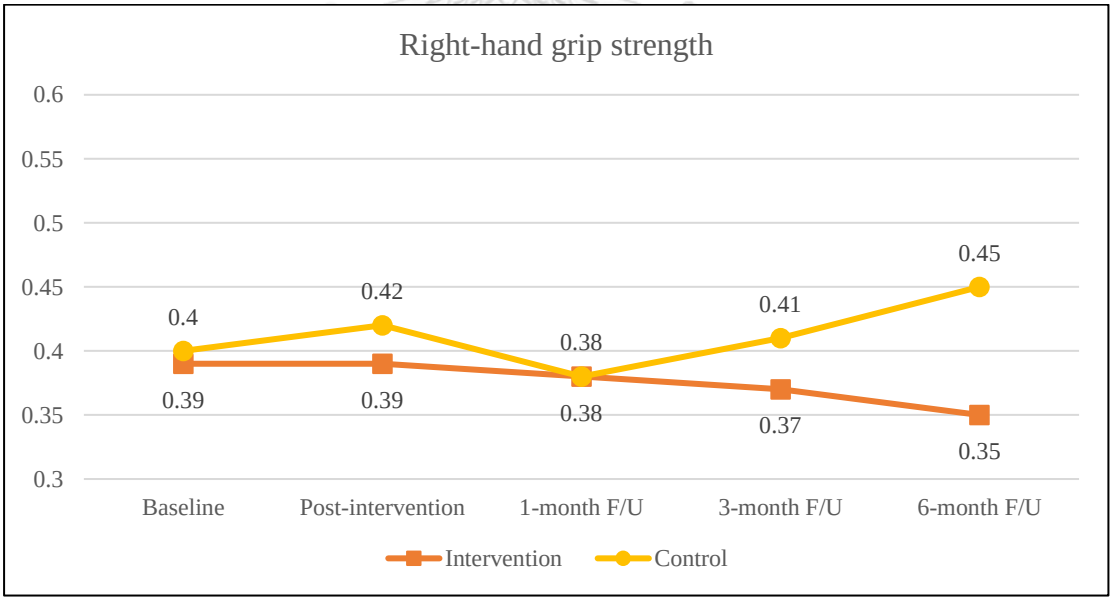


Figure 22 Right-hand grip strength over time

Testing the difference of right-hand grip strength within the intervention and control group at baseline, post-intervention, 1-month, 3-months, and 6-months follow up shows there was no significant difference of right-hand grip strength in the intervention group. There was a significant increase between baseline and 6-months follow up post-intervention and 3-months and 6-months follow up (p=0.03) and 1-month and 6-months follow up (p<0.01). There was a significant decrease between post-intervention and 1-month follow up (p<0.01) (Table 47).

Table 47 Pairwise comparisons of the different measurements of right-hand grip strength within intervention group (n=56) and control group (n=75)

Group	Time		Mean-diff	SE	*p*-value	95% Confidence Interval for Difference	
	i	j	i-j			Lower Bound	Upper Bound
Intervention	Baseline	Post-intervention	0.005	0.01	1.00	-0.01	0.02
		1-month F/U	0.02	0.01	1.00	-0.02	0.05
		3-month F/U	0.03	0.01	0.26	-0.01	0.07
		6-month F/U	0.04	0.02	0.14	-0.01	0.09
	Post-intervention	1-month F/U	0.01	0.01	1.00	-0.03	0.05
		3-month F/U	0.02	0.01	0.80	-0.02	0.06
		6-month F/U	0.04	0.02	0.46	-0.02	0.09
	1-month F/U	3-month F/U	0.01	0.01	1.00	-0.02	0.04
		6-month F/U	0.02	0.01	0.94	-0.02	0.06
	3-month F/U	6-month F/U	0.01	0.01	1.00	-0.03	0.05

Group	Time		Mean-diff	SE	*p*-value	95% Confidence Interval for Difference	
	i	j	i-j			Lower Bound	Upper Bound
Control	Baseline	Post-intervention	-0.02	0.01	1.00	-0.06	0.02
		1-month F/U	0.02	0.02	1.00	-0.03	0.07
		3-month F/U	-0.01	0.02	1.00	-0.06	0.04
		6-month F/U	-0.05	0.02	**0.03**	-0.09	0.003
	Post-intervention	1-month F/U	0.04	0.01	**0.00**	0.01	0.08
		3-month F/U	0.01	0.01	1.00	-0.03	0.05
		6-month F/U	-0.03	0.01	0.35	-0.06	0.01
	1-month F/U	3-month F/U	-0.03	0.01	0.09	-0.07	0.003
		6-month F/U	-0.07	0.01	**0.00**	-0.11	-0.03
	3-month F/U	6-month F/U	-0.03	0.01	0.09	-0.07	0.003

Mean-diff =mean difference

Based on estimated marginal means

*The mean difference is significant at *p*-value≤0.05

95%CI was adjusted for multiple comparisons: Bonferroni.

SSS program on left-hand grip strength

The mean of left-hand grip strength in intervention group was 0.38±0.14, 0.38±0.13, 0.35±0.11, 0.34±0.10 and 0.33±0.10 kilograms per weight at baseline, post-intervention, 1-month follow up, 3-month follow up and 6-month follow up, respectively. The mean of left hand grip strength in control group was 0.38±0.13, 0.38±0.12, 0.35±0.14, 0.39±0.13 and 0.41±0.12 kilograms per weight at baseline, post-intervention, 1-month follow up, 3-month follow up and 6-month follow up, respectively (Table 48).

Table 48 Mean score and SD of left-hand grip strength at baseline, post-intervention, 1-month, 3-months, and 6-months follow up

Left hand grip strength	Group	Mean	SD
Baseline	Intervention	0.38	0.14
	Control	0.38	0.13
Post-intervention	Intervention	0.38	0.13
	Control	0.38	0.12
1-month follow up	Intervention	0.35	0.11
	Control	0.35	0.14
3-month follow up	Intervention	0.34	0.10
	Control	0.39	0.13
6-month follow up	Intervention	0.33	0.10
	Control	0.41	0.12

After controlling for the effect of working hours per day and degree of pain in left leg (Covariates appearing in the model are evaluated at the following values: working hour per day= 9.98, degree of pain at left leg = 2.16), the between groups test indicates there was no significant difference between the intervention and control group, consequently the graph in Figure 23 shows the trend lines for both groups as close. The within subject test indicates there was no significant time effect and hence no changes of left-hand grip strength within groups over time. However, the interaction of time and group was significant (p=0.01) indicating that left-hand grip strength shows significant difference between group over time. Table 49 presents

repeated measures ANCOVA of left-hand grip strength between the intervention and control group.

Table 49 Repeated measure ANCOVA of left-hand grip strength between the intervention and control group

Source	SS	df	MS	F	*p*-value
Between group					
Group	0.07	1	0.07	1.47	0.22
Working hour per day	0.05	1	0.05	1.31	0.26
Degree of pain in left leg	0.00	1	0.00	0.09	0.76
Error	6.19	128	0.04		
Within group					
Time	0.02	3.22	0.009	1.07	0.36
Time *group	0.19	3.22	0.06	7.04	**0.01**
Time*working hour per day	0.01	3.22	0.00	0.37	0.79
Time*degree of pain in left leg	0.02	3.22	0.00	0.64	0.60
Error (time)	3.50	412.99	0.008		

SS= Sum of Squares, MS= Mean Square, df= degree of freedom

Significant at $p \leq 0.05$

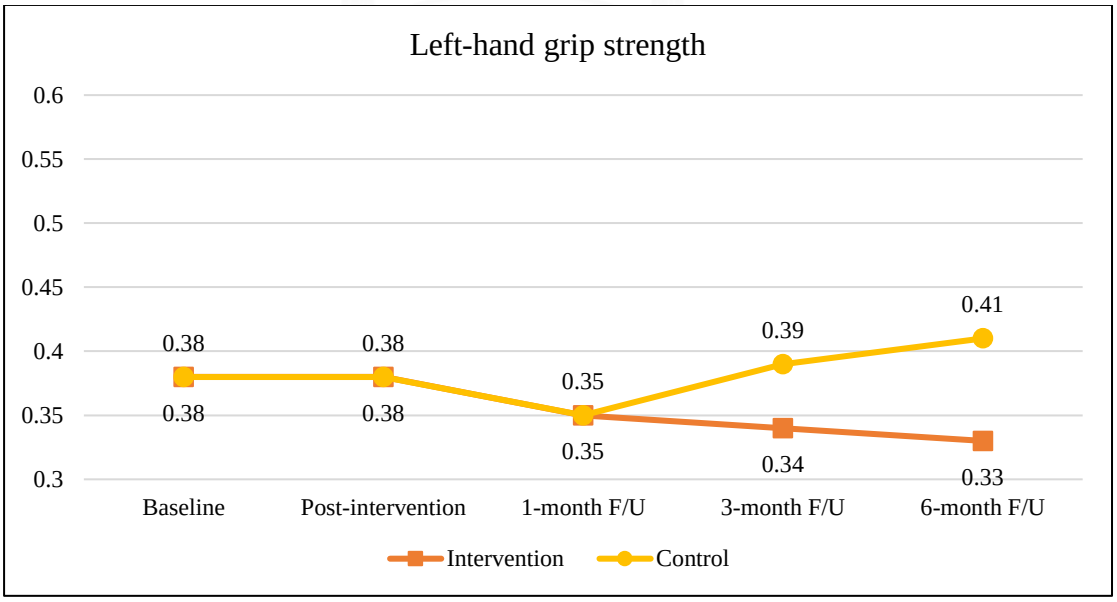


Figure 23 Left-hand grip strength over time

The difference in left-hand grip strength within the intervention and control groups at baseline, post-intervention, 1-month, 3-months and 6-months follow up showed a significant decrease in left-hand grip strength between post-intervention and 1-month follow up (p=0.02) in the intervention group. There was a significant increase between post-intervention, 3-months and 6-month follow (p=0.05) in the control group (Table 50).

Table 50 Pairwise comparisons of different measurements of left-hand grip strength within intervention group (n=56) and control group (n=75)

Group	Time		Mean-diff	SE	*p*-value	95% Confidence Interval for Difference	
	i	j	i-j			Lower Bound	Upper Bound
Intervention	Baseline	Post-intervention	0.00	0.01	1.00	-0.03	0.03
		1-month F/U	0.03	0.01	0.24	-0.01	0.06
		3-month F/U	0.01	0.01	1.00	-0.02	0.05
		6-month F/U	0.01	0.01	1.00	-0.02	0.05
	Post-intervention	1-month F/U	0.03	0.01	**0.02**	0.00	0.05
		3-month F/U	0.01	0.01	1.00	-0.01	0.04
		6-month F/U	0.01	0.01	1.00	-0.02	0.04
	1-month F/U	3-month F/U	-0.01	0.01	1.00	-0.04	0.01
		6-month F/U	-0.02	0.01	1.00	-0.04	0.01
	3-month F/U	6-month F/U	0.00	0.01	1.00	-0.03	0.02

Group	Time		Mean-diff	SE	*p*-value	95% Confidence Interval for Difference	
	i	j	i-j			Lower Bound	Upper Bound
Control	Baseline	Post-intervention	0.00	0.01	1.00	-0.04	0.05
		1-month F/U	0.03	0.02	0.87	-0.02	0.08
		3-month F/U	0.04	0.02	0.19	-0.01	0.09
		6-month F/U	0.06	0.02	0.08	0.00	0.12
	Post-intervention	1-month F/U	0.02	0.01	0.53	-0.01	0.06
		3-month F/U	0.04	0.01	**0.05**	0.00	0.07
		6-month F/U	0.05	0.02	**0.05**	0.00	0.11
	1-month F/U	3-month F/U	0.01	0.01	1.00	-0.02	0.04
		6-month F/U	0.03	0.01	0.42	-0.01	0.07
	3-month F/U	6-month F/U	0.02	0.01	1.00	-0.02	0.05

Mean-diff =mean difference

Based on estimated marginal means

*The mean difference is significant at *p*-value≤0.05

95%CI was adjusted for multiple comparisons: Bonferroni.

4.2.4. The effectiveness of Self Static Stretching Strengthening program on work ability

The 3 questions were used for work ability assessment in this study. The first question was "How they think about their work ability?". The result showed the majority of participants in the intervention group (94.64%) thought they had a high ability to work in the market at baseline and post-intervention. All reported a high ability to work in the market at 1-month, 3-months and 6-months follow up. Similar with the control group, more than 95% of participants in the control group reported they had a high ability to work in the market at baseline, post-intervention, 1-month, 3-months, and 6-months follow up. There was no significant difference between both groups over time during data collection (Table 51). And, there were no differences in work ability within each group during data collection (intervention group; p=0.13 and control group p=0.06).

Table 51 How they think about their work ability at baseline, post-intervention, 1-month, 3-months, and 6-months follow up

Time of data collection	Work ability												*p*-value
	Intervention group (n=56)						Control group (n=75)						
	Low		Moderate		High		Low		Moderate		High		
	n	%	n	%	n	%	n	%	n	%	n	%	
Baseline	0	0.0	3	5.3	53	94.6	0	0.0	4	5.3	71	94.6	0.99
Post-intervention	0	0.0	3	5.3	53	94.6	0	0.0	1	1.3	74	98.6	0.18
1-month F/U	0	0.0	0	0.0	56	100.0	0	0.0	0	0.0	75	100.0	-
3-months F/U	0	0.0	1	1.7	56	100.0	0	0.0	0	0.0	75	100.0	0.24
6-month F/U	0	0.0	0	0.0	56	100.0	0	0.0	1	1.3	74	98.6	0.38

Mann-Whitney Test and significant at p-value $\leq$0.05

The second question was “Do they think that muscle pain or muscle discomfort limit their work”. The result showed there were 71.4%, 62.5%, 67.9%, 53.6% and 69.6% of participants in the intervention group at baseline, post-intervention, 1-month, 3-months and 6-months follow up, respectively thought that WRMDs did not limit their work in the market (Table 52). Similar with the control group, 82.7%, 64.0%, 77.3%, 50.7% and 64.0% of participants in the control group at baseline, post-intervention, 1-month, 3-months and 6-months follow up, respectively, thought that WRMDs did not limit their work in the market (Table 53). And, it showed no significant difference of work limitation between both groups at baseline, post-intervention, 1-month, 3-months, and 6-months follow up (p=0.23, p=1.00, p=0.17, p=0.78 and p=0.49, respectively). There was no difference in work ability within the intervention group during time of data collection (p=0.22). However, the within subject testing of the control group shows significant differences of work limitation between post-intervention and 1-month follow up (p=0.006) and 1-month follow up and 3-months follow up (p=0.001).

Table 52 “Do they think that muscle pain or muscle discomfort limit their work” in intervention group at baseline, post-intervention, 1-month, 3-months and 6-months follow up

Time of data collection	Intervention group (n=56)											
	Strongly agree		Agree		Neutral		Disagree		Strongly disagree		Totally disagree	
	n	%	n	%	n	%	n	%	n	%	n	%
Baseline	0	0	0	0	1	1.8	3	5.4	12	21.4	40	71.4
Post-intervention	0	0	0	0	2	3.6	2	3.6	17	30.4	35	62.5
1-month follow up	0	0	0	0	0	0	3	5.4	15	26.8	38	67.9
3-months follow up	0	0	0	0	0	0	4	7.1	22	39.3	30	53.6
6-months follow up	0	0	0	0	0	0	3	5.4	14	25	39	69.6

Table 53 "Do they think that muscle pain or muscle discomfort limit their work" in control group at baseline, post-intervention, 1-month, 3-months and 6-months follow up

Time of data collection	Control group (n=75)											
	Strongly agree		Agree		Neutral		disagree		Strongly disagree		Totally disagree	
	n	%	n	%	n	%	n	%	n	%	n	%
Baseline	0	0	1	1.3	3	4	5	6.7	4	5.3	62	82.7
Post-intervention	0	0	0	0	0	0	9	12	18	24	48	64
1-month follow up	0	0	0	0	0	0	0	0	17	22.7	58	77.3
3-months follow up	0	0	0	0	0	0	5	6.7	32	42.7	38	50.7
6-months follow up	0	0	0	0	0	0	5	6.7	22	29.3	48	64

The last question was "How many days that you stop working within the past 1 month due to WRMDs?". Both groups, reported they were hardly ever absent from their work. Table 54 shows mean scores and SD of absences in working day in previous month at baseline, post-intervention, 1-month, 3-months, and 6-months follow up. The between groups test indicates there was no significant difference between the intervention group and control group. The within subject test indicates there was no significant difference in the intervention group (p= 0.13) and control group (p=0.16). There was no difference within groups of a day absence in 1 month over time.

Table 54 Mean and SD of the stop working day in 1 month at baseline, post-intervention1-month, 3-months and 6-months follow up

Time of data collection	Intervention (n=56)		Control (n=75)		*p*-value
	Mean	SD	Mean	SD	
Baseline	0.11	0.41	0.27	0.92	0.18
Post-intervention	0.13	0.57	0.36	1.02	0.08
1-month follow up	0.29	1.06	0.24	0.57	0.13
3-month follow up	0.26	0.58	0.35	0.60	0.32
6-month follow up	0.20	0.72	0.36	0.95	0.48

Mann-Whitney Test and significant at *p*-value $\leq$0.05

4.2.5. The effectiveness of Self Static Stretching Strengthening program on health risk behaviors

Alcohol consumption

There were 7 participants in the intervention group and 26 participants in the control group reporting they drank alcohol within the past 30 days. Results indicate there was no significant difference of the average amount of alcohol per time between the intervention group and control group (p=0.24). Moreover, the Wilcoxon Signed Range test indicates there were no significant differences within the intervention group and control group.

Table 55 Alcohol consumption at post-intervention

Alcohol consumption	Intervention(n=7)		Control (n=26)	
	n	%	n	%
Last drink within 30 days				
Within a week	5	71.4	18	69.2
Within two weeks	1	14.3	1	3.9
More than two weeks	1	14.3	7	26.9
Amount of alcohol per time (gram)				
<14 grams	2	28.6	2	7.7
14-42 grams	5	71.4	21	80.8
43-69 grams	0	0.0	1	3.8
≥ 70grams	0	0.0	2	7.7
Mean±SD	17.30±7.48		35.71±55.22	

Mann-Whitney Test and significant at p-value ≤0.05

Smoking

There were 3 participants in the intervention group and 10 participants in the control group reporting they smoked within the past 30 days. Results indicate there was no significant difference of the average of the number of cigarettes per day between the intervention group and control group (p=0.47). Moreover, the Wilcoxon Signed Range test indicates there were no significant differences within the intervention group and control group.

Table 56 Smoking at post-intervention

Smoking	Intervention(n=3)		Control (n=10)	
	n	%	n	%
Last smoking within 30 days				
Within a week	3	100.0	10	100.0
The number of cigarettes per day (cigarettes)				
1-5 cigarettes	2	66.7	6	60.0
6-10 cigarettes	1	33.3	4	40.0
>10 cigarettes	0	0.0	0	0.0
Mean±SD	5.00±3.00		6.20±2.35	

Mann-Whitney Test and significant at p-value $\leq$0.05

Analgesic drug abuse

There were 4 participants in the intervention group and 8 participants in the control group reporting they took an analgesic drug within the past 30 days. Results indicate there was no significant difference of the average amount drug use on the last day and the number of pills per day between the intervention group and control group (p=0.07, p=0.47, respectively). Moreover, the Wilcoxon Signed Range test indicates there were no significant differences within the intervention group and control group.

Table 57 Analgesic drug abuse at post-intervention

Analgesic drug abuse	Intervention(n=4)		Control (n=8)	
	n	%	n	%
Taking an analgesic drug within the past 30 days				
Within a week	2	50.0	7	87.5
Within two weeks	0	0.0	1	12.5
More than two weeks	2	50.0	0	0.0
The number of pills per day (pill)				
1 pill	3	75.0	6	75.0
2 pills	1	25.0	2	25.0
Mean±SD	1.37±0.47		1.25±0.46	

Mann-Whitney Test and significant at p-value $\leq$0.05

Regular intervention program performing

The current study used checklist book in this intervention program including follow-up for the intervention group is shown in Appendix G. Table 58 shows the percent of participants in the intervention group who performed the intervention program regularly at the 1-month, 3-months and 6-months follow up. Results indicate there was significant difference in the percent of participants in the intervention group who performed the intervention program between the 1-month and 6-months follow up. And there were significant differences on SSS program practicing day per week between 1-month and 3-months follow up and 1-month and 6-months follow up.

Table 58 The percent of participant in the intervention group who performed the intervention program regularly (n=56)

Time of data collection	n	%	Days per week of program performance	
			Mean	Standard deviation
1-month follow up	53	96.6	5.11	1.78
3-month follow up	47	83.9	2.60*	1.14
6-month follow up	44	78.6*	2.68*	1.36

*Significant at p-value ≤ 0.05

Summary

This chapter has described the outcomes of the current study. The sample size was 56 and 75 market-vendors in the intervention and control groups, respectively. There was no statistical difference in baseline characteristics between groups, except working hours per day. The objectives of the current study and results are summarized below:

- To examine pain related problems of WRMDs and health risk behaviors in market vendors in Bangkok, Thailand. Results indicate the highest prevalence of muscle pain among participants was the left leg followed by both arms. Common muscle pain areas for both the intervention and control groups were both arms and both legs.

- To determine effectiveness of the Self-Static Stretching and Strengthening program compared with a control group on muscle pain within the past 7 days, muscle flexibility, grip strength, work ability and health risk behaviors in market vendors.

Table 59 Summary of results: Comparison between intervention group and control group

Outcome variables	Time of data collection			
	Post-intervention	**1-month F/U**	**3-months F/U**	**6-months F/U**
Muscle pain within the past 7 day	×	×	×	×
Degree of muscle pain	↑at lower back ↑at right leg ↑at left leg	↑at lower back	×	×
Right arm muscle flexibility	↑	↑	↑	↑
Left arm muscle flexibility	×	×	×	×
Right leg muscle flexibility	↑	↑	↑	↑
Left leg muscle flexibility	↑	↑	↑	↑
Right hand grip strength	×	×	×	×
Left hand grip strength	×	×	×	×
Work ability	×	×	×	×
Health risk behaviors	×	N/A	N/A	N/A

× = No difference between group, ↑= Significant improving, N/A= no assessment

Table 59 shows no significant difference in muscle pain within the past 7 days between groups during time of data collection. However, there were significant differences on degree of pain between groups at the lower back area post-intervention and 1-month follow up and there were significant differences on degree of pain between groups for right and left leg areas post-intervention. Right arm muscle flexibility and leg muscle flexibility are greater in the intervention group than the control group. However, there was no significant difference of left arm muscle flexibility, grip strength and work ability between both groups during data collection. Finally, results there was no difference in health behaviors between the intervention group and control group.

- To determine effectiveness of the Self-Static Stretching and Strengthening program before and after intervention in market vendors.

Table 60 Summary of results: Comparison of baseline and after intervention program in intervention

Outcome variables	Time of data collection			
	Post-intervention	1-month F/U	3-month F/U	6-month F/U
Muscle pain within the past 7 day	Trend to decrease	Trend to decrease	Trend to decrease	Trend to decrease
Degree of muscle pain	Trend to decrease	Trend to decrease	Trend to decrease	Trend to decrease
Right arm muscle flexibility	×	×	×	×
Left arm muscle flexibility	×	↑	↑	×
Right leg muscle flexibility	↑	↑	↑	×
Left leg muscle flexibility	↑	↑	↑	×
Right hand grip strength	×	×	×	×

Outcome variables	Time of data collection			
	Post-intervention	1-month F/U	3-month F/U	6-month F/U
Left hand grip strength	×	×	×	×
Work ability	×	×	×	×
Health risk behaviors	×	N/A	N/A	N/A

× = No difference between group, ↑= Significant improving, N/A= no assessment

Results from table 60, indicate a decreasing trend in the number of participants reporting muscle pain within the past 7 days including a decrease in the degree of pain at the lower back and both legs. There was no significant difference within the intervention group in right arm muscle flexibility, grip strength, work ability and health risk behaviors. However, there was a significant increase in left arm muscle flexibility at the 1-month and 3-months follow up. As well, there was a significant increase muscle flexibility in both legs at post-intervention, 1-month and 3-months follow up.

Chapter 5

Discussion and Conclusion

This chapter describes the effectiveness of the Self-Static Stretching and Strengthening program on physical performance outcomes of market vendors in Bangkok, Thailand. The current findings are supported by comparing and contrasting results from previous studies. This chapter is discussed in term of:

1. Research methodology
2. Baseline characteristics
3. The prevalence of WRMDs and health risk behaviors among the market vendors
4. Effectiveness of Self-Static Stretching and Strengthening program
5. Strengths and limitations of the current study
6. Clinical implementation

5.1. Research methodology

5.1.1. Research design

The research design of the current study is quasi-experimental with a control group. The quasi-experiment is one study that aims to determine the effects of an intervention but does not use randomization (92). Another study selected this quasi-experiment design because of its suitability for testing the effects of an intervention program (the main objective), however, this study was difficult to randomize by locations (93).

5.1.2. Participants

The participants of the current study are market vendors. My main interest in this group are the many health problems associated with work related musculoskeletal disorders. The signs and symptoms of muscle pain, muscle discomfort, muscle tightness or muscle weakness are often ignored by market vendors because of requirement to work every day due to financial reasons. In Thailand, market vendors work in open areas, not situated in buildings. Working spaces for market vendors might not appropriate resulting in WRMDs. Generally, market vendors may sit or stand often in awkward postures within their shop and make contact directly with buyers when selling their products. The final reason for choosing market vendors as participants are that very few previous studies conducted to determine health problems among this group

despite a National Statistic survey that reported there are approximately 25% employed persons in Bangkok working in the wholesale and retail trade industries (39).

5.1.3. Sampling technique

Previous studies have used volunteer sampling techniques. This technique is a form of sample selection which usually recruits a sample cohort who agree to participate (94). The current study utilized this technique due to a long period of data collection, and the requirement to choose willing market vendors. This technique may cause selection bias and is a limitation because of the difficulty to randomize participants by location. However, this study used specific and comprehensive inclusion and exclusion criteria to prevent selection bias.

5.1.4 Sample calculation

The current study calculated the sample size by using the G-power program version 3.1. This program was designed for statistical tests generally used in social and behavioral research (90). The author specified a power of 0.8 and calculated the effect size by the previous study mentioned earlier. The advantage of the G-power program version 3.1 it is that it was developed for social and behavioral research (90). Furthermore, the current study calculated a 30% of dropout rate of participants due to the markets was open setting, hence the sample size obtained was appropriate. The sample size was 51 in each group (intervention group and control group, respectively), with the total at 102 participants. The intervention market had less shops than the control market (126 shops to 608 shops respectively), and therefore, market vendors who volunteered to participate from the intervention market were less than the control market at the beginning (65 market vendors in the intervention market and 153 market vendors in the control market). Participants who did not meet the inclusion criteria from the current study at time of data collection were excluded (9.2% of participants in the intervention group and 47.7% of participants in the control group). Therefore, a total of 59 market vendors in the intervention market and 80 market vendors in the control market who met the inclusion criteria were selected. At the end of the current study's 6-months follow up, a total of 56 market vendors in the intervention market and 75 market vendors in the control market completed measurements and questionnaires. Amongst participants, 5.1% in intervention group (n=3) and 6.3% in the control group (n=5) were drop out from this study. Although the participants in both groups were not equal, the current study's outcomes were not affected.

Both markets in Bangkok, Thailand are located 9 kilometers from each other, and participants were not aware of the current study's parameters and hence there was no contamination of information between these two markets.

5.1.5. Study instruments

The current study used 4 instruments for data collection: 1) questionnaires, 2) Back scratch test, 3) Chair sit and reach test and 4) Hand grip dynamometer.

5.1.5.1. Questionnaire

The current study modified a questionnaire from related previous studies. Reliability and validity tests from previous studies have shown moderate to high levels for the Visual Analog Scale (VAS), Nordic Musculoskeletal Questionnaire (NMQ), and work ability questionnaire. There was moderate to good reliability for the VAS in chronic musculoskeletal pain, 0.60 to 0.77, respectively (49). The NMQ was designed as a screening tool for musculoskeletal problems. Validity tests have shown that the number of non-identical answers varied between 0 and 20% concluding that the NMQ is acceptable as a screening tool (51). Work ability questions were adapted from Work ability index that showed IOC is at acceptable levels (0.81-0.91) (59). High levels of reliability and validity of questionnaires have been shown in previous studies (95) and hence the current study's questionnaire is suitable for answering the research question.

5.1.5.2. Back scratch test and Chair sit and reach test

These tests are used to assess muscle flexibility in field studies (53). Guidelines for the current study are taken from the Sports Authority of Thailand which is a unit of the Ministry of Tourism and Sports and its main responsibilities are to promote sports and sports events including physical assessments for athletes.

5.1.5.3. Hand grip dynamometer

The hand grip dynamometer is used for testing grip strength. The current study used guidelines from The Sports Authority of Thailand to measure grip strength.

5.1.6. Study intervention

The current study designed an intervention program known as the Self-Static Stretching and Strengthening program. It was created for market vendors from related, previous studies. Stretching exercise is a common intervention technique for reducing muscle pain from WRMDs, however, workers often ignore stretching or may perform stretching incorrectly. Workers often ignore exercise due to lack of time for exercise, followed by being tired from work and no interest to exercise (96). Reasons outlined above are similar to the observations obtained in the current study. Market vendors are very busy during the day, starting work early morning for shop arrangement and food preparation as well as conducting product sales. When work is finished for the day, market vendors will go home to relax. Amongst participants in this study, 73.3% did not exercise regularly.

The protocol for this program is based on guidelines from the American College of Sports Medicine (22) which is considered a standard protocol. The exercise postures chosen are easy to perform and market vendors able to easily remember when performing by themselves. The intervention program involved 6 stretching exercises and a 600ml water bottle as a weight training device to strengthen the arms. The current study designed a stretching exercise program that focused on large muscle groups of the arms, legs and trunk as these muscles are used for standing, sitting and working in market vendors. The use of a water bottle to strengthen the arms in market vendors is ideal due to repetitive arm movements when working. Therefore, this program was designed to mimic the working patterns of market vendors.

The Self-Static Stretching and Strengthening program began with 4 physical therapists that introduced and conducted this program at the intervention market 3 days a week for 1 month. After the 1-month program, the market vendors were asked to do this program by themselves and the author put out a reminder every week for 12 weeks. The active learning process theory and Edgar Dale's Cone of Experience were used as the basis for explaining to market vendors including remembering the exercise intervention in this program. A physical therapist demonstrated the intervention exercises in-situ and then asked participants to practice. According to Edgar Dale's Cone of Experience this method could help participants remember 70% of information received (43).

The majority of previous studies on program design were for stretching exercises or strengthening exercises according to specific objectives for example, reducing pain, improving muscle flexibility, or increasing quality of life. In addition, previous studies have focused on specific muscles such as the hamstrings, shoulders, or neck muscles. However, the Self-Static Stretching and Strengthening program combines stretching exercises with arm strengthening exercises that also focused on large muscle groups of the body.

5.1.7. Data collection

The current study utilized repetitive data collection techniques to assess muscle pain within the past 7 days including muscle flexibility, grip strength and work ability. Previous studies have shown that self-reported questionnaires are suitable as they are convenient and save time when collecting from many participants (97) and hence appropriate for market vendors. To ensure answers in the questionnaire were valid, the current study utilized laboratory measurements for supporting results.

After ethics approval, the intervention program began in July 2019 and ended August 2019. Baseline data was collected at the beginning and post-intervention data was collected immediately after finishing the intervention program. Follow up data was collected at 3 time points: first month after post-intervention, the third month after post-intervention and at the sixth month after post-intervention. Although the data collection at each time point was short to limited availability from market vendors as they were busy, there was not limitation on data collection.

5.1.8. Data analysis

The current study used descriptive statistics to show the prevalence of WRMDs and health risk behaviors among market vendors. Chi-square and independent t-tests were used for comparing variables the between intervention group and control group. A repeated measures ANCOVA was used to determine the effectiveness of the intervention program. The main strengths of the repeated measures ANCOVA is that it can test the effects between group factors, the effects of within group factors and interaction of effects between factors, covariate effects and effects of interactions between covariates and between-group factors. An assumption of normal distribution was accepted before testing.

Statistical analysis applied in the current study was suitable in response to research objectives and hypothesis of this study

5.2. Baseline characteristics

The baseline characteristics in both the intervention and control group are displayed in mean scores, SD or number and percentage. The current study did not randomize samples for both groups given that socio-demographic data showed no differences between groups according to specific participant inclusion and exclusion criteria. More than 70% of participants in both groups were female, about 35% (n=20) in the intervention group and about 22% (n=17) in the control group had an underlying disease. Hypertension was the most common underlying disease among both groups. Market vendors rarely visit a doctor for an annual checkup due to life problems and may partly explain the low percent of underlying disease reported in the current study. The mean scores for body mass index (BMI) among market vendors may be interpreted as being overweight in both groups due to low physical activity. Results indicate that 36 participants (64.3%) in the intervention group and 60 participants (80%) in the control group did not exercise regularly. The most common reason cited was no time for group exercise due to work conditions and life problems. A recent survey from the National Statistical Office of Thailand revealed the following reasons Thai people did not exercise: 39.7% had no time for exercise, 31.1% were not interested in exercise, 25.1% felt tired from work and 1.4% had no exercise equipment (96). Being overweight was not a direct risk factor for WRMDs but was associated with chronic muscle pain. Previous study findings have suggested there is a relationship between an increase in weight and musculoskeletal disorders, especially for lower back pain (73). In the United States, the prevalence of lower back pain increases when BMI increases. A report has shown that 20% of overweight adults experience chronic pain (74). Chronic muscle pain could encourage symptoms of WRMDs and may get worse with an increase in muscle tension, muscle weakness, and muscle fatigue. Figure 24 shows the cycle of chronic pain. Chronic pain leads to an increase in muscle tension resulting in a decrease of blood circulation and associated muscle weakness and muscle fatigue. Movement is restricted and further limited as symptoms and pain increase. If the cycle of chronic pain continues over time, the symptoms of WRMDs may increase along with poor recovery.

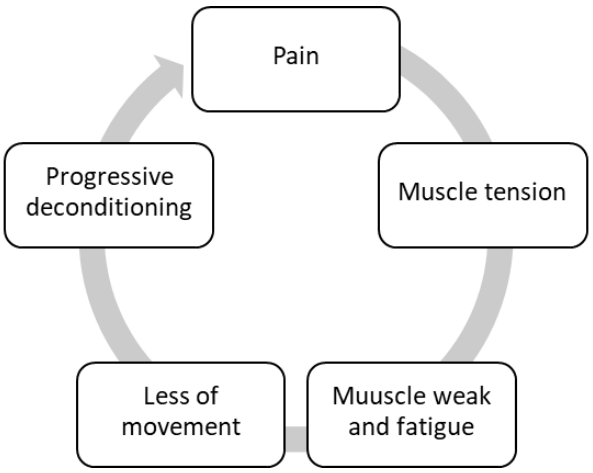


Figure 24 Chronic pain cycle

Reference: http://www.back-in-rehab.com/pain/the-problem/

Approximately 90% of participants in both groups work every day for financial gain. Results indicate there were no differences between both groups in working variables except working hours per day. The intervention group had shorter working hours per day than the control group (mean difference = 1.46 hours) due to opening hours of the control market (7am-7pm) to that of the intervention market (7am-4pm). To consider any confounding effects due to unbalanced working hours per day, workings hour per day were adjusted using a covariate of repeated measures ANCOVA when testing the effects of the Self-Static Stretching and Strengthening program. However, symptoms of WRMDs between groups were not different as a result of participants in both groups working more than 54 hours/week. Similar results were obtained from a previous study in Korea that examined the association between long working hours and work-related musculoskeletal symptoms. The odds ratios for upper limb pain in male and female workers who worked more than 52 hours per week were 1.40 times and 1.66 times more likely to be exposed to upper limb pain compared to male and female workers who worked less than 40 hours per week. The odds ratios for lower limb pain in male and female workers who worked more than 52 hours/week were both 1.47 times more likely to be exposed to lower limb pain compared to male and female workers who worked less than 40 hours per week (31). The results from the current study, show that market vendors in both groups had a high chance for exposure to WRMDs due long working hours and a decrease in recovery time for muscle fatigue or muscle soreness.

5.3. The problems of work-related musculoskeletal disorder and health risk behaviors among the market vendors

5.3.1. The prevalence of work-related musculoskeletal disorders in market vendors

The current study recorded muscle pain that occurred within the past 7 days because the duration between baseline assessment and post-intervention assessment was 1 month which is the same duration between post-intervention and 1-month follow up. Another reason was to reduce the recall bias.

Results from the current study show the highest problems of WRMDs in market vendors was the left leg, followed by the left and right arms. The degree of reported pain was moderate to severe pain at arm and leg regions. The main reason was job characteristics. Leg pain was caused by prolonged standing and arm pain was caused by repetitive arm movement. Prolonged standing during working hours in the intervention group was 4.94±1.86 mean hours and control group was 5.77±2.55 mean hours. From the literature review, prolonged standing more than 2 hours may cause muscle discomfort, muscle fatigue and muscle pain relating to back, leg and foot regions (28). Repetitive arm movements where the arms work in the same range result in pain due to muscle fatigue and possible injury (2, 3). Results from the current study may differ from previous studies due to differences in job characteristics.

Previous studies have determined the prevalence of work-related musculoskeletal disorders in various job sectors. Results from Sevim Celik, study of office workers who presented with neck and lower back pain was due to prolonged sitting and an increase in computer usage (10). Jiraporn Tangkittipaporn, study show that handicraft workers had a high percentage of pain at the upper back region because of static and awkward postures such as bending the head downwards and holding the arms upwards or seated on the floor without back support (13). Wenzhou Yu, collected data from factory workers in China, showing that lower back pain was the highest symptom among this group due to prolonged standing (34). Sandul Yasobant, studied health care providers, with the highest prevalence of pain in the lower back area due to the occasional lift in heavy loads.(36). Teerasak Phajan, determined the top three pain areas and resultant work-related musculoskeletal disorders among workers who worked in sugar cane fields were lower back pain, shoulder pain and wrist pain due greater arm movement when working (11).

In addition, other risk factors relating to work-related musculoskeletal disorders in different job sectors are the workplace, work environment, and psychological factors. Hence, a consideration of these risk factors when designing and creating appropriate intervention programs is required when considering specific groups within different job sectors.

5.3.2. The prevalence of health risk behaviors in the market vendors

The current study collected 3 health risk behaviors: alcohol consumption, smoking and drug abuse due to previous studies on common health risk behaviors in worker groups such as alcohol consumption and smoking (40, 41). Drug abuse in the current study may be referred to as taking medicines without a doctor's prescription including the absence of signs and symptoms of disease.

Results indicate that, 23.7 %, 10.7% and 10.7% of participants consumed alcohol, smoked, and abused drugs respectively within the last month. The current study also found that 36.7% males (n=14) and 19.8% females (n=20) reported they consumed alcohol within the past month and 26.7% males (n=8) and 5.94% females (n=6) reported they smoked within the past month. Findings conclude that male market vendors had a higher percentage of consuming alcohol than female market vendors. A previous study in Germany showed that gender was a risk factor for alcohol consumption. Males had a higher relative risk than females for alcohol consumption (Relative Risk, RR=1.5. 95% CI 1.19-1.90) (40). Another study examined the indicators for alcohol use in the workplace were long working hours, shift work, high risk of injury at work, and high work loads (80). The job characteristics for working in markets are high work loads and long working hours. The mean scores for working hours was 9.85±1.98 hours/day and higher than the Thailand Labor Law (98). Thus, the current study has shown that 23.66% participants consumed alcohol regularly because they believed that alcohol could help decrease tiredness from work, and often drink after finishing their working shifts or before sleep with friends or family. In addition, market vendors consumed alcohol for relaxation.

Addtionally, a recent report supports the current study findings that male market vendors showed higher percentage of smoking cigarettes than female market vendors. 16.7% males and 13.6% female smoked cigarettes with risk factors being a combination of physiology, culture and behavior (99). Heavy cigarette smokers are defined as: those who smoke equal to greater than 25 cigarettes/day (100). The mean scores for market vendors who smoke cigarettes

every day was 6.92±2.97 cigarettes and hence further studies should address questions of nicotine dependence. The main reasons reported for smoking among market vendors were to reduce stress and increase energy. The current study findings are consistent with Jahnel T that there was a small significant and indirect effect of daily stress reduction on the experience of smoking (101).

The current study findings report that 13.3% male market vendors and 10.9% of female market vendors abuse drugs. The most common medicine was an analgesic drug used for relieving pain and fever and about 10% of in both groups took an analgesic drug without any signs or symptoms of disease as they did not want to be absent from work from visiting doctors. Although findings of the current study show that the prevalence and associated problems among the market vendors for drug abuse was not a big factor, additional studies should add a greater awareness for creating prevention programs given that drugs for general sale are at risk for overuse (102). A study in United Kingdom reported that drug overuse may lead to drug abuse and addiction (21).

5.4. Effectiveness of Self Static Stretching Strengthening program

5.4.1. Effectiveness of the Self-Static Stretching Strengthening program on muscle pain within the past 7 days

At the baseline, all participants reported they had muscle pain in at least one area within the past 7 days. After the intervention program, approximately 50% of participants in the intervention group and about 40% of participants in the control group reported they had muscle pain in at least one area in the past 7 days. Findings show there was no significant difference of the percentage of participants who had muscle pain or muscle discomfort within the past 7 days between the intervention group and control group at baseline, post-intervention, 1-month, 3-months and 6-months follow up. The percent of participants who had muscle pain and muscle discomfort in the past 7 days for the intervention group was less than the control group at post-intervention and 1-month follow up. The small reduction of pain in the intervention group may be due to WRMDs being chronic condition as a result of market vendors continuing to work and therefore, the number of participants reporting muscle pain or muscle discomfort did not differ during data collection time. Furthermore, other reasons may be due to the self-report nature for muscle pain assessment as it was easy for data collection purposes. The participants were asked “Do you have any muscle pain or muscle discomfort at least 1 region within past 7 days?”, thus

the self-report was subjective on feeling pain and “Yes” to questions for any pain areas since the current study did not specify body parts.

Most participants in both groups reported moderate pain at baseline for all body pain areas. Result indicate there were no significant differences in the degree of muscle pain at neck and upper back areas, right and left arm areas during the time of data collection between the intervention group and control group. This may be explained due to WRMDs and associated symptoms being chronic as it develops gradually over time. The body gets used to the pain and market vendors often ignore this pain due to the requirement to work every day. Hence, the degree of pain levels at neck and upper back areas, right and left arm areas did not change which increases the risk of WRMDs making it impossible for complete recovery. In contrast, there were significant differences in the degree of muscle pain between groups at the lower back area post-intervention and 1-month follow up, and there were significant differences at right and left leg areas post-intervention. A higher percentage of participants in the intervention group reported mild pain at the lower back, right leg, and left leg area as a result of the intervention program. For example, the hamstring and lower back stretch was used to strengthen the lower back, hamstrings, and gastrocnemius muscles as part of the static stretching exercise protocol. The intervention group moved forward as far as possible and held at the end point of tension for 10-15 seconds and repeated 3 times. Theories of static, passive stretching exercises have shown that they may reduce muscle pain and muscle tension (66, 103). As muscle is held and stretched for 10-60 seconds, muscle spindles habituated to changes length and consequently there was a reduction of signals to the spine and brain, resulting in a stretched muscle with an increase in flexibility and reduced tension. Furthermore, as the Golgi tendon organ is stimulated, it sends signals that inhibit muscle contraction. Therefore, holding a stretch for a prolonged period of time allows for a lengthening reaction caused by the Golgi tendon organ and helping stretched muscles to relax (64).

In a previous intervention study, a 4-week stretching program on 81 bus drivers has shown a 25% reduction in pain at the neck and a 28% reduction of pain at the shoulders. The intervention protocol was administered as a self-stretch routine that focused on the evator scapulae, upper trapezius, and sternocleidomastoid muscles. Each stretching movement was held for 25 seconds at the end point of maximum tension and performed 3 times/set, 3 times/week for 4 weeks. It is assumed that performing stretching to treat WRMDs may have a positive effect on

reducing muscle pain (83). Consistent with the above results is a review of 7 studies to clarify the physiological effects, benefits, and any misconceptions about stretches used to reduce musculoskeletal problems. Results indicate that stretching exercises may reduce discomfort and pain in computer workers, manufacturing workers, firefighters and military workers (15).

For the current study, participants in the intervention group performed the intervention program with physical therapists at their shop 3 days per week for 4 weeks and were directed to perform the intervention program by themselves every day for 6 months and recorded the number of times the intervention program was conducted in a logbook. Records indicate the average days per week at 1-month, 3-months and 6-months follow up were 5.11±1.78, 2.60±1.14 and 2.68±1.36 days per week, respectively. There were significant differences in the number of days per week for the intervention program conducted between the 1-month, and 3-months follow up, 1-month and 6-months follow up. Inconstancies in intervention program performance resulted in no difference in the degree of pain between the group at 3-months and 6-months follow up.

5.4.2. Effectiveness of the Self-Static Stretching and Strengthening program on muscle flexibility

At baseline**,** the average scores for arm muscle flexibility with back scratch test were negative in both groups and the average scores for leg muscle flexibility with the Chair sit and reach test were less than 1 cm in both groups. Market vendors had less arm and leg muscle flexibility than normal (53). Interestingly, arm muscle flexibility is poorer than leg muscle flexibility in market vendors. Possible reasons maybe due to job characteristics from the requirement to move arms when conducting shop arrangement, cooking food and food preparation and thus relating to the prevalence of muscle pain area. Very poor muscle flexibility in market vendors may be caused by prolonged static standing, repetitive arm movements, lifting heavy loads and awkward posture. The left arm and left leg showed poorer muscle flexibility than the right side and could be due to more than 80% of market vendors being right-handed. The non-dominant hand may cause muscle pain or muscle discomfort and loss of muscle flexibility as a result of muscle weakness and therefore a greater chance for injury compared to the dominant hand.

The current study findings on the effectiveness of the intervention program on muscle flexibility were compared between the intervention group and the control group at each data collection point. There were significant differences of muscle flexibility between intervention group and control group for the right arm and both legs but there was no significant difference of muscle flexibility between the intervention group and the control group for left arm. Although left arm muscle flexibility was not different between groups, there was a trend towards an improvement in muscle flexibility.

The improvement in muscle flexibility in the intervention group after the intervention program may be explained by: **Firstly** the intervention program focused on large groups of muscles in the arms, legs and trunk such as the deltoids, triceps, biceps, lattisimus dosi, external obliques, hamstrings, lower back, and gastrocnemius muscles. The intervention protocol was static passive stretching exercises where participants moved and held the stretch at end point of tension for 10 seconds, 3 times in each stretching posture and performed at least 2 times a day, every day. Results from the current study are similar to previous studies due to the same stretching exercise technique. To determine the effect of a stretching program performed in the workplace on hamstring muscle extensibility and sagittal spinal posture of adult women, a study used passive stretching exercises for the hamstring muscle held for 20 seconds, 3 sessions/week for 12 weeks. Results showed significant increases in hamstring muscle flexibility (82). **Secondly** improvements in muscle flexibility may be obtained by a decrease in muscle tension and muscle pain (66, 103). A study reported a decrease in pain intensity after participants received the intervention program. A 1-month continuous stretching program showed positive effects in reducing pain among workers. Similarly, another study demonstrated that a 4-week stretching program among bus drivers resulted in a 25% decrease in pain (83). **Lastly,** the intervention program for the current study used a static stretching method according to guidelines from the American College of Sports Medicine (22). This method stimulates the Golgi tendon organ to inhibit alpha motoneuron in order to release muscle tension and therefore increasing the range of motion due to a decrease of tension, but not an increase in muscle length (65).

In considering changes in right arm muscle flexibility within the intervention group, there was no differences but there were significant differences in left arm muscle flexibility baseline and at 1-month follow up and baseline and 3-months follow up. Current studies have shown improvements only in left arm muscle flexibility due to poor flexibility when compared to the right arm at the beginning. However, right arm muscle flexibility improved at post-intervention and 1-month follow up. When considering changes in leg muscle flexibility within the intervention group, results for both legs showed there was a significant difference in leg muscle flexibility within the intervention group when compared to leg muscle flexibility at baseline and post-intervention, baseline and at 1-month follow up and baseline and 3-months follow up. Improvements may be related to decreasing degrees of muscle pain in the right and left leg areas at post-intervention within the intervention group. Previous studies have reported that muscle flexibility improvements are due to decreasing muscle tension and muscle pain (66, 103).

5.4.3. Effectiveness of Self Static Stretching Strengthening program on grip strength

At baseline, the average scores for right hand grip strength were 0.39±0.11 kg/m^2 for the intervention group and 0.40±0.12 kg/m^2 for the control group and left hand grip strength was 0.38±0.14 kg/m^2 for the intervention group and 0.38±0.13 kg/m^2 for the control group. When compared to previous studies, the current study results for hand grip strength in market vendors were very low to low levels of fitness (53). Arm and hand muscle weakness in market vendors may be due to muscle pain and lack of exercise. The Visual Analog Scale (VAS) results show that more than 50% of participants in both groups reported moderate pain levels. Approximately 65% of participants in the intervention group and 80% of participants in the control group reported they did not exercise regularly. For participants who regularly engaged in exercise, the aerobic style training would be walking, jogging, and dancing. They did not pay attention to strengthening exercise.

Comparing the effectiveness of hand grip strength between the intervention group and the control group during the data collection points reveals that there were no significant differences in right and left-hand grip strength between the intervention group and control group. This may be due to a lack of intensity when exercising. Guidelines from the American College of Sports Medicine recommend the intensity of strengthening exercises may be set to 10 repetition maximum for muscle strength (75% 1RM) (22). From a current study, an intervention program

did not train grip muscles involving the flexor digitorum superficialis, flexor digitorum profondus and the flexor pollicis longus muscle (104). In contrast, a previous study examined the effects of 12 weeks of wrist and forearm training on male high school baseball players. The exercise protocol was a 5RM external load repeated for 5 times in a session, 3 days per week for 12 weeks. Findings show significant increases in grip strength after 12 weeks of resisted exercise (105). But the current study utilized a 600-cc water bottle for external loads due to its availability and ease of use when exercising in the market. Arm exercises in the current study focused on the deltoids, triceps and biceps muscles as these muscles are large groups and help market vendors engage in work.

Results of the hand grip strength within the intervention group, for the right-hand and left-hand grip at post-intervention, 1-month, 3-months and 6-months follow up showed decreases in strength when compared to baseline. Data analysis show there was significant decrease in left-hand grip strength between post-intervention and 1-month follow up. Additionally, the results of the hand grip strength within the control group has shown there were significant increases in right-hand grip strength between baseline and 6-months follow up, 1-month and 6-months follow up and significant decreases in right-hand grip strength between post-intervention and 1-month follow up. Results of testing within the control group show there were significant increases of left-hand grip strength between post-intervention, 3-months and 6-months follow up.

Many factors relate to the result of a grip strength test. A review of the measurement of grip strength for clinical and epidemiological researches (106) showed that the variability of result of grip strength test depended on individual factors and protocol factors. The current study showed similar of participants characteristics between both groups. Thus, the trend of improvement of left-hand grip strength might cause by protocol factors especially, effort and encouragement and familiar effect. Before starting the data collection, all research assistances were trained clearly about how to instruct and encourage the grip strength protocol. However, the research assistances might not encourage the participants adequately in control group at the baseline assessment. Or the participants in control group had more familiar to the grip strength test than the participants in intervention group. The familiar effect could develop the result of

muscle testing because the participants were familiar with the test and learned how to gain maximum effort.

The improvement in control group were statistically significant within group but not clinically significant. The mean difference between data collection time points was 0.3-3 kg in both groups, which is less than the MCID (Table 61-62). A study conducted a literature review of minimal clinically important difference (MCID) in grip strength suggesting that 5-6 kilograms might be reasonable estimates for meaningful changes in grip strength (55). In conclusion, the Self-Static Stretching Strengthening program (SSS program) had no effect on right-hand grip and left-hand grip strength in market vendors. But the benefit of arm exercise in SSS program was the participants moved their arms that increase circulation which resulted in reducing muscle pain.

Table 61 Mean difference in right-hand grip strength (kg)

Data collection time (i)	Data collection time (j)	Intervention group		Control group	
		Mean-diff (i-j)	SD	Mean-diff (i-j)	SD
Baseline	Post-intervention	0.35	2.93	-1.05	7.76
	1-month F/U	1.40	6.23	1.67	9.58
	3-months F/U	2.05	5.99	-0.69	9.68
	6-months F/U	2.57	7.65	-2.88	8.77
Post-intervention	1-month F/U	1.05	6.92	2.72	5.76
	3-months F/U	1.70	6.51	0.36	7.07
	6-months F/U	2.22	8.41	-1.83	6.73
1-month F/U	3-months F/U	0.65	4.24	-2.36	7.25
	6-months F/U	1.17	6.10	-4.55	7.74
3-months F/U	6-months F/U	0.52	6.11	-2.19	7.46

Mean-diff = Mean difference, S.D. = Standard deviation

Table 62 Mean difference in left-hand grip strength (kg)

Data collection time (i)	Data collection time (j)	Intervention group		Control group	
		Mean-diff (i-j)	SD	Mean-diff (i-j)	SD
Baseline	Post-intervention	0.37	6.70	0.18	8.26
	1-month F/U	2.01	8.19	1.97	9.65
	3-months F/U	2.70	8.13	-0.57	9.61
	6-months F/U	3.53	9.84	-2.01	9.16
Post-intervention	1-month F/U	1.64	6.18	1.79	5.49
	3-months F/U	2.34	5.84	-0.75	6.87
	6-months F/U	3.16	8.27	-2.20	6.93
1-month F/U	3-months F/U	0.69	4.24	-2.54	7.13
	6-months F/U	1.52	6.27	-3.98	7.36
3-months F/U	6-months F/U	0.83	6.21	-1.44	7.22

Mean-diff = Mean difference, S.D. = Standard deviation

5.4.4. Effectiveness of the Self-Static Stretching Strengthening program on work ability

The majority of participants in both groups reported ta high ability to work in their respective markets and muscle pain did not limit their work. This may be to moderate degrees of pain level that participants could tolerate and also work every day.

Results from the current study reveal there was no significant difference of work ability between the intervention group and control group and no difference within groups when compared at each data collection point. A previous study (60). determined the effects of a hamstring stretch with pelvic control on pain and work ability in standing workers. All participants were divided into 3 groups: pelvic control hamstring stretch (PCHS), general hamstring stretch (GHS) and home program (control). Results indicate that both the PCHS and GHS groups showed significantly greater Work Ability Index (WAI). Factors relating to low work ability were less recovery time, muscle weakness, elderly, being overweight and high workload. Results of the current study were different from previous study because in this study

almost participants reported high work ability and high performance but participants in a previous study reported work ability was of moderate performance.

In conclusion, results showed there was neither positive nor negative effects of the Self-Static Stretching and Strengthening program on work ability performance in market vendors, however, the intervention program administered could maintain work ability performance among market vendors.

5.4.5. Effectiveness of the Self-Static Stretching Strengthening program on health risk behaviors

The current study collected health risk behaviors data only at baseline and post-intervention because the number of samples was small after the recruitment. So, it was difficult to follow up. The result of this part is a pilot study and shows the short-term effect of the Self-Static Stretching and Strengthening program on health risk behaviors.

Results of the current study reveal there were no differences in health risk behaviors between the intervention and control group and could be due to a small sample size in each group. Stretching combined with strengthening exercises may not affect a change in health risk behaviors directly, however, the mean scores for alcohol consumption in the intervention group decreased at post-intervention.

Reasons for alcohol consumption among market vendors believe that alcohol helps reduce tiredness. Some market-vendors said, “I drink alcohol every day because it helps me to sleep well and I will feel refreshed in the morning”, and “I drink alcohol with my friends after finishing my work, it helps me to relax and forget the problems from my work”. The current study findings showed mean scores for working hours was 9.02±1.95 hours per day in the intervention group and 10.48±1.78 hours per day in the control group. This was longer than the standard number of working hours in Thailand. Previous study findings reveal that the indicators for alcohol consumption in the workplace were long working hours, shift work, high risk of injury at work, and high work loads (80). The National Institute on Alcohol Abuse and Alcoholism reported people often use alcohol to relieve body pain (86).

Findings from the current study revealed that degrees of pain were decreasing and muscle flexibility improving at the conclusion of the intervention program among market vendors in the intervention group. This may be due to stretching exercises helping to release

muscle tightness and muscle pain from WRMDs and could also be an enabling factor for reducing alcohol consumption among market vendors.

Summary

The Self-Static Stretching and Strengthening program (SSS program) has been used in a short period as the inconsistency practices of the participants. The market vendors volunteered to participate for this study, and they performed SSS program with physical therapists at market for 12 times. It can imply that they were in the action stage which is the fourth stage of the Transtheoretical Model (TTM). However, they could rarely move to the next stage of the Transtheoretical Model, which is maintenance stage. This is due to 3 reasons as follows: firstly, the SSS program was conducted to the market vendors in a short period, so they might be unfamiliar to this program. Secondly, the burdens and job conditions made the market vendors spent less time to exercise. Lastly, most market vendors perceived that they are healthy. To maintain SSS program in the market vendors, the SSS program should be conducted longer period than one month and the process for increasing exercise motivation and health awareness should be promoted for the market vendors.

5.5. Strengths and limitations of the current study

Strengths of the current study

1. The current study focused on a new group for a particular job sector (market vendors working in markets). Market vendors present with WRMDs due to job characteristics such as prolonged sitting and standing, repetitive arm movements and lifting heavy loads. A high workload during the day throughout the week results in less time for leisure activities and may be a factor related to WRMDs.

2. The current study considered health risk behaviors among market vendors such as alcohol consumption, smoking and drug abuse and could be related to various health problems.

3. The intervention program is called the Self-Static Stretching and Strengthening program designed by physical therapists that focused on market vendors. The benefits of this intervention program are 1) simple to practice at home or the shop, 2) takes around 10 minutes per session to complete and 3) requires only 2 x 600 cc bottles as exercise equipment.

4. To our knowledge, this is the first time that an intervention program combined stretching and strengthening exercises related to WRMDs in market vendors.

5. There was collecting data at 5 time points: baseline, post-intervention, 1 months, 3 months, and 6 months.

Limitations of the current study

1. The current study surveyed WRMDs and health risk behaviors among market vendors only in Bangkok, at an urban area. Results may not generalize to other job sectors or other areas.

2. A quasi-experimental design might cause a selection bias because of lack of randomization despite the use of specific inclusion and exclusion criteria to limit selection bias.

3. Market vendors were time-poor and preferred to not be bothered over a long time. So, performing SSS program in market might not be continuous.

4. During the follow up period, this study used a checklist book to count the number of exercises recorded by the market vendors although some participants forgot to record in the logbook and hence a recall bias may occur.

5. This current study did not ask the dominant hand of the participants. It is important to interpret the result of the effectiveness of the Self-Static Stretching and Strengthening program on grip strength.

5.6. Clinical implementation

The current study focused on the effects of the Self-Static Stretching and Strengthening program on physical performance outcomes in market vendors in Bangkok, Thailand.

Individual level

Market vendors who received the intervention program showed a decreasing degree of pain and an improvement in muscle flexibility. For the short-term, symptoms of WRMDs improved. For the long-term, they had acquired some knowledge for stretching and strengthening exercise correctly and preventing WRMDs.

Social level

Market vendors who received the intervention program could teach or demonstrate correct stretching exercise techniques to families or friends.

Physical therapists and health providers can use or modify the Self-Static Stretching and Strengthening program or its concept to other job sectors or the patients who have work-related musculoskeletal disorders.

Policy level

Results of the current study may be used to develop an information campaign for the prevention of WRMDs among market vendors.

5.7. Conclusion

Market vendors often present with WRMDs. The common symptoms of WRMDs include pain, muscle discomfort, muscle fatigue and loss of function. In addition, common health risk behaviors in market vendors are alcohol consumption, smoking and analgesic drug abuse that often have specific consequences on market vendor's health. Although there are many techniques for the prevention and treatment of WRMDs, to date, there have been no specific techniques for market vendors.

The current study describes the physical performance outcomes on market vendors administered via a Self-Static Stretching and Strengthening program. The protocol for this program is based on guidelines from the American College of Sports Medicine. As an intervention protocol, the program was easy to deliver whether at a market vendor's shop or home due to the majority of market vendors having no time for group exercise because of work conditions or financial reasons. The program consisted of self-static stretching and strengthening exercises that focused on the arms, trunk, and legs. The program also utilized a 600 ml water bottle as a weight training device to strengthen the upper extremities.

The objectives of the current study were to determine the effectiveness of the Self-Static Stretching and Strengthening program on physical performance outcomes among market vendors in Bangkok, Thailand. This study is quasi-experimental utilizing a control group. Two markets within a center area of Bangkok were selected as an intervention and control for this study. Participants recruited in both markets were employees known as market vendors between18 to 64 years of age. A questionnaire which consisted of questions on demographic data, health information, working factors and health risk behaviors was used. A Visual Analog Scale (VAS) and body chart of the Nordic Musculoskeletal Questionnaire (NMQ) was used to evaluate muscle pain and degree of pain in each area. Grip strength and muscle flexibility were tested according to the guidelines from the Sports Authority of Thailand. The total number of participants was 131 (intervention group =56 and control group =75). Data collection began June

2019 and concluded February 2020. Five assessment timelines were conducted: baseline, post-intervention, 1-month, 3-months, and 6-months follow up. The intervention program consisted of 6 self-stretching exercises and a 600-cc water bottle utilized as resisted arm exercise. This program was applied only to the intervention market, 3 times/week for 4 weeks and then, participants were asked to practice this program by themselves every day for 12 weeks with a reminder from the author every week. Both the intervention and control groups received a brochure on ergonomic knowledge during the first week of assessment.

The objectives and result of the current study are shown below.

1. To examine areas of pain associated as a result of WRMDs and health risk behaviors in market vendors, Bangkok, Thailand. The highest prevalence of muscle pain among participants was the left leg followed by both arms. Common muscle pain areas for the intervention group and control group, were both arms and both legs. Leg and arm pain in market vendors was associated from awkward working postures, for example being in the same position or the same job for the whole day (standing and chopping food products, sitting with packing products).

The current study collected 3 health risk behaviors: alcohol consumption, smoking and drug abuse. The percent of market vendors who consumed alcohol was higher than the percent of market vendors who smoked or took an analgesic drug. The main reason was that alcohol consumption was for relaxation and the belief it could help decrease tiredness from work. Often, alcohol was consumed after work or before sleep with family or friends.

2. To determine the effectiveness of the Self-Static Stretching and Strengthening program compared with a control group on muscle pain in the past 7 days, muscle flexibility, grip strength, work ability and health risk behaviors in market vendors. Results indicate there were no significant differences in muscle pain within the past 7 days between groups during the time of data collection. However, there were significant differences on degree of pain between groups at the lower back areas and at left leg areas. There were significant differences in right arm muscle flexibility and both leg muscle flexibility between groups. There was no significant difference in left arm muscle flexibility, grip strength, working performance and health risk behaviors between the intervention group and control group.

3. To determine the effectiveness of the Self-Static Stretching and Strengthening program before and after intervention in the intervention group. Results indicate there were significant differences in left arm muscle flexibility between baseline, 1-month, and 3-months follow up. There were significant differences of muscle flexibility in both legs between baseline and post-intervention, 1-month and 3-months follow up. There were no significant differences within the intervention group in right arm muscle flexibility, grip strength, work ability and health risk behaviors.

The decreasing degree of muscle pain and improvement of muscle flexibility in the current study may be the result of the intervention program focusing on large groups of muscle and static-stretching exercises that stimulate the Golgi tendon organ in order to decrease muscle tension and muscle pain. However, there was no change to grip strength after the intervention program and this may be due to inappropriate choice of exercises in the protocol, for example, intensity of exercise. Results further indicate there was neither a positive effect nor a negative effect of the intervention program on work ability, thus maintaining work ability and performance in market vendors. The mean scores for amount of alcohol consumption in the intervention group showed a decreasing trend at the conclusion of the intervention program. A reduction in muscle pain, and an improvement in muscle flexibility may be an enabling factor for reducing alcohol consumption in market-vendors.

Highlighting the strengths of the current study design was the use of a control group and the first time an intervention program was administered that combined stretching and strengthening exercises relating to WRMDs in market vendors including long term follow up for determining the effectiveness of the intervention program, which is the main objective of this study. The limitation of the current is that results may not be generalized to other job sectors or other areas.

Further studies should examine related issues:

1. Applying the self-static stretching and strengthening program on physical performance outcomes in other markets to get more consolidated evidence.

2. Using new technology methods such as social media application for reminding the self-static stretching and strengthening program to prevent WRMDs and promote health behaviors among market vendors.

3. Testing the cost-effectiveness of the self-static stretching and strengthening program on muscle pain, muscle flexibility and grip strength.

4. To provide an understanding on the prevalence of health risk behaviors among market vendors, via a larger sample size where there is a prevalence of alcohol consumption, smoking or taking analgesic drugs.

In conclusion, the Self-Static Stretching and Strengthening program may be effective on the degree of muscle pain and muscle flexibility when compared between the intervention group and control group. For short-term effects, the symptoms of WRMDs were improved. For long-term effects, market vendors were educated towards a prevention of WRMDs and exercise instruction. The results of this study may be used to develop a campaign for the education and prevention of WRMDs among market vendors. Additionally, the results of this study may be generalized to market vendors in other markets with a similar context.

Appendix

Appendix A: Ethical approval

AF 02-12

The Research Ethics Review Committee for Research Involving Human Research Participants, Health Sciences Group, Chulalongkorn University
Jamjuree 1 Building, 2nd Floor, Phyathai Rd., Patumwan district, Bangkok 10330, Thailand,
Tel/Fax: 0-2218-3202, 0-2218-3409 E-mail: eccu@chula.ac.th

COA No. 151/2019

Certificate of Approval

Study Title No. 091.1/62 : EFFECTIVENESS OF THE SELF STATIC STRETCHING PROGRAM ON PHYSICAL PERFORMANCES IN MARKET VENDORS: A QUASI-EXPERIMENTAL STUDY

Principal Investigator : MISS SALILA CETTHAKRIKUL

Place of Proposed Study/Institution : College of Public Health Sciences, Chulalongkorn University

The Research Ethics Review Committee for Research Involving Human Research Participants, Health Sciences Group, Chulalongkorn University, Thailand, has approved constituted in accordance with Belmont Report 1979, Declaration of Helsinki 2013, Council for International Organizations of Medical Sciences (CIOM) 2016, Standards of Research Ethics Committee (SREC) 2013, and National Policy and guidelines for Human Research 2015.

Signature: Prida Tasanapradit Signature: Nuntaree Chaichanawongsaroj

(Associate Prof. Prida Tasanapradit, M.D.) Chairman

(Assistant Prof. Nuntaree Chaichanawongsaroj, Ph.D.) Secretary

Date of Approval : 31 May 2019 Approval Expire date : 30 May 2020

The approval documents including;

1) Research proposal
2) Participant Information Sheet and Consent Form
3) Researcher
4) Questionnaire

Protocol No. 091.1/62
Date of Approval 31 MAY 2019
Approval Expire Date 30 MAY 2020

The approved investigator must comply with the following conditions:

1. *The research/project activities must end on the approval expired date of the Research Ethics Review Committee for Research Involving Human Research Participants, Health Sciences Group, Chulalongkorn University (RECCU). In case the research/project is unable to complete within that date, the project extension can be applied one month prior to the RECCU approval expired date.*
2. *Strictly conduct the research/project activities as written in the proposal.*
3. *Using only the documents that bearing the RECCU's seal of approval with the subjects/volunteers (including subject information sheet, consent form, invitation letter for project/research participation (if available).*
4. *Report to the RECCU for any serious adverse events within 5 working days.*
5. *Report to the RECCU for any change of the research/project activities prior to conduct the activities.*
6. *Final report (AF 02-14) and abstract is required for a one year (or less) research/project and report within 30 days after the completion of the research/project. For thesis, abstract is required and report within 30 days after the completion of the research/project.*
7. *Annual progress report is needed for a two- year (or more) research/project and submit the progress report before the expire date of certificate. After the completion of the research/project processes as No. 6.*

Appendix B/1: Participant information sheet for the intervention group

ข้อมูลสำหรับกลุ่มประชากรหรือผู้มีส่วนร่วมในการวิจัย

สำหรับกลุ่มออกกำลังกาย

ชื่อโครงการวิจัย…ผลของโปรแกรม ยืด-เหยียด-ขยับ-หยุด ต่อสมรรถภาพทางกายในคนค้าขาย; การศึกษากึ่งทดลอง.

ชื่อผู้วิจัย…นางสาวสลิลา เศรษฐไกรกุล….ตำแหน่ง…นิสิตปริญญาเอก …

สถานที่ติดต่อผู้วิจัย (ที่ทำงาน) …วิทยาลัยวิทยาศาสตร์สาธารณสุข จุฬาลงกรณ์มหาวิทยาลัย.....

(ที่บ้าน) .....555/16 หมู่ 4 ต.บางสีทอง อ.บางกรวย จ.นนทบุรี 11130.....

โทรศัพท์ (ที่ทำงาน) …….....……ต่อ …...…….. โทรศัพท์ที่บ้าน

โทรศัพท์มือถือ ……0815707702…… E-mail : ……scetthakrikul@gmail.com…….

1. ขอเรียนเชิญท่านเข้าร่วมในการวิจัยก่อนที่ท่านจะตัดสินใจเข้าร่วมในการวิจัย มีความจำเป็นที่ท่านควรทำความเข้าใจว่างานวิจัยนี้ทำเพราะเหตุใด และเกี่ยวข้องกับอะไร กรุณาใช้เวลาในการอ่านข้อมูลต่อไปนี้อย่างละเอียดรอบคอบ และสอบถามข้อมูลเพิ่มเติมหรือข้อมูลที่ไม่ชัดเจนได้ตลอดเวลา

2. เนื่องจากอาการเจ็บปวดกล้ามเนื้อที่เกิดจากการทำงาน เป็นสาเหตุที่ทำให้เกิดการบาดเจ็บต่อกล้ามเนื้อได้ง่าย ส่งผลให้จำเป็นต้องขาดงานซึ่งส่งผลต่อการสูญเสียรายได้ ซึ่งในการศึกษาก่อนหน้านี้ที่ประเทศเกาหลีพบว่า พ่อค้า แม่ค้าในตลาดมากกว่าร้อยละ 30 มีภาวะเจ็บปวดกล้ามเนื้อที่เกิดจากการทำงาน ซึ่งมีสาเหตุมาจาก การยืน หรือนั่งในท่าใดท่าหนึ่งเป็นเวลานาน การใช้แขนทำกิจกรรมซ้ำ ๆ รวมไปถึงท่าทางการทำงานที่ไม่ถูกต้อง

ในประเทศไทยยังมีการศึกษาที่น้อยเกี่ยวกับภาวะเจ็บปวดกล้ามเนื้อที่เกิดจากการทำงานในกลุ่มพ่อค้า แม่ค้าในตลาด และการศึกษาก่อนหน้านี้ในกลุ่มงานอื่นๆพบว่า การยืดเหยียดกล้ามเนื้อช่วยลดและบรรเทาภาวะเจ็บปวดกล้ามเนื้อที่เกิดจากการทำงานได้ แต่อย่างไรก็ตามยังไม่มีการศึกษารูปแบบกิจกรรมการออกกำลังกายที่ทำร่วมกันระหว่างการยืดเหยียดกล้ามเนื้อ และการออกกำลังกายแบบมีแรงต้านสำหรับภาวะเจ็บปวดกล้ามเนื้อที่เกิดจากการทำงาน ในกลุ่มพ่อค้าแม่ค้าในตลาด โครงการนี้จึงได้ออกแบบโปรแกรมที่มีชื่อว่า โปรแกรมยืด-เหยียด-ขยับ-หยุด ซึ่งเป็นโปรแกรมการออกกำลังกายที่ ร่วมกันระหว่างการยืดเหยียดกล้ามเนื้อ และการออกกำลังกายแบบมีแรงต้าน เป็นท่าทางการออกกำลังกายที่ง่าย ใช้เวลาไม่นาน และสามารถฝึกปฏิบัติได้ด้วยตนเอง

โครงการนี้มีวัตถุประสงค์เพื่อศึกษาผลของโปรแกรมยืด-เหยียด-ขยับ-หยุด ต่อการลดอาการปวดกล้ามเนื้อ, เพิ่มความยืดหยุ่นของกล้ามเนื้อ, เพิ่มความสามารถในการทำงาน และ เพิ่มความแข็งแรงของการบีบมือ ในพ่อค้า แม่ค้าในตลาด

3. รายละเอียดของกลุ่มประชากรหรือผู้มีส่วนร่วมในการวิจัย

ท่านได้รับเชิญให้เข้าร่วมโครงการนี้เนื่องจากท่านมีลักษณะตรงตามกลุ่มประชากรหรือผู้มีส่วนร่วมในการวิจัย ซึ่งมีเกณฑ์ดังนี้

- เกณฑ์คัดเข้า
    - เพศชายและหญิง
    - มีอายุอยู่ระหว่าง 18-64 ปี
    - มีอาการปวด เมื่อยกล้ามเนื้อ (ประเมินจากคะแนนความปวดอยู่ในระดับมากกว่าหรือเท่ากับ 3) หรือ ท่านมีความยืดหยุ่นของกล้ามเนื้ออยู่ในเกณฑ์ติดลบ
    - เป็นพ่อค้า แม่ค้าในตลาดเป็นเวลาอย่างน้อย 1 ปี
    - เต็มใจที่เข้าร่วมในการวิจัย และสามารอ่านและเขียนภาษาไทยได้
- เกณฑ์การคัดออก
    - มีโรคประจำตัวที่ทำให้ไม่สามารถออกกำลังกายได้ เช่น โรคหัวใจชนิดรุนแรง โรคทางระบบทางเดินหายใจชนิดรุนแรง หรือเฉียบพลัน หรือโรคทางระบบประสาท
    - มีภาวะกล้ามเนื้ออักเสบชนิดเฉียบพลัน หรือเรื้อรัง หรือได้รับบาดเจ็บที่รุนแรง
    - มีภาวะความดันโลหิตสูง หรือเบาหวานชนิดที่ควบคุมไม่ได้
    - ตั้งครรภ์ หรือสงสัยว่าตั้งครรภ์ หรือไม่แน่ใจว่าตั้งครรภ์
- ในการศึกษานี้มีผู้เข้าร่วมโครงการนี้จำนวน 102 คน และจะแบ่งกลุ่มออกเป็น 2 กลุ่ม จำนวนกลุ่มละ 51 คน ทั้งนี้ได้กำหนดให้ผู้เข้าร่วมวิจัยในตลาดสามย่านเป็นกลุ่มได้รับโปรแกรมโปรแกรม ยืด-เหยียด-ขยับ-หยุด และ แผ่นพับความรู้ท่าทางที่ถูกต้องในการทำงาน และผู้เข้าร่วมวิจัยในตลาดองค์การตลาดเพื่อเกษตรกรได้รับแผ่นพับความรู้ท่าทางที่ถูกต้องในการทำงาน

4. กระบวนการการวิจัยมีขั้นตอนดังนี้

4.1. ท่านจะได้รับการเชิญชวนโดยวาจาจากทีมนักวิจัย และจะได้รับข้อมูล รายละเอียดของโครงการ ประโยชน์ที่ได้รับและผลกระทบที่อาจจะเกิดขึ้นจากโครงการวิจัย เมื่อท่านรับทราบ

และยินยอมเข้าร่วมงานวิจัยจะขอให้ท่านลงชื่อในใบยินยอมของกลุ่มประชากรหรือผู้มีส่วนร่วมในการวิจัย

4.2. ในการการคัดกรองเบื้องต้น ท่านจะได้ถูกสอบถามเกี่ยวกับข้อมูลทั่วไป ลักษณะงานและความสามารถการทำงาน และตรวจประเมินน้ำหนัก ส่วนสูง ระดับความเจ็บปวดกล้ามเนื้อ ความยืดหยุ่นของกล้ามเนื้อ และแรงบีบมือจากทีมผู้วิจัย และนักกายภาพบำบัด ซึ่งจะทำที่แผง/ร้านค้าของท่านโดยนักกายภาพบำบัด ที่แผง/ร้านค้าของท่าน ในช่วงเวลาที่ท่านสะดวกโดยใช้เวลา 15-20 นาที

4.3. สำหรับกลุ่มศึกษาวิจัย

4.3.1. ท่านจะได้รับโปรแกรมยืด-เหยียด-ขยับ-หยุด ร่วมกับแผ่นพับความรู้ท่าทางที่ถูกต้องในการทำงาน โดยในครั้งแรกท่านจะได้รับโปรแกรมมออกกำลังกายจากนักกายภาพบำบัด ซึ่งจะทำที่แผง/ร้านค้าของท่านโดยใช้เวลา 5-10 นาที

4.3.2. ในเดือนที่ 1 ของโครงการวิจัยนี้ ท่านจะได้รับการทบทวนโปรแกรมยืด-เหยียด-ขยับ-หยุดจากนักกายภาพบำบัดซึ่งจะทำที่แผง/ร้านค้าของท่านทุกวัน โดยใช้เวลาวันละ 10 นาที

4.3.3. ในเดือนที่ 2 ของโครงการวิจัยนี้ ท่านจะได้รับการทบทวนโปรแกรมยืด-เหยียด-ขยับ-หยุดจากนักกายภาพบำบัดซึ่งจะทำที่แผง/ร้านค้าของท่าน 3 วันต่อสัปดาห์ โดยใช้เวลาวันละ 10 นาที และท่านจะได้รับคลิปวีดีโอ และแผ่นพับที่แสดงท่าทางการออกกำลังกายในโปรแกรมยืด-เหยียด-ขยับ-หยุด เพื่อนำไปใช้ในการฝึกโปรแกรมด้วยตัวท่านเอง และท่านจะต้องบันทึกจำนวนครั้งการออกกำลังกายและเหตุการณ์ที่ไม่พึงประสงค์ที่เกิดจากการออกกำลังกาย เช่น อาการเจ็บกล้ามเนื้อที่มากขึ้น อาการล้าของกล้ามเนื้อ ที่โดยบันทึกลงในแบบบันทึกการออกกำลังกายประจำวัน

4.3.4. ในเดือนที่ 3-4 ของโครงการวิจัยนี้ ท่านจะต้องปฏิบัติโปรแกรมยืด-เหยียด-ขยับ-หยุด ท ด้วยตัวของท่านเอง ซึ่งสามารถทำได้ที่บ้านหรือที่ร้านค้าของท่าน ท่านสามารถใช้คลิปวีดีโอและแผ่นพับที่แสดงท่าทางการออกกำลังกายในโปรแกรมยืด-เหยียด-ขยับ-หยุด ในการฝึกโปรแกรมด้วยตัวท่านเอง และท่านจะต้องบันทึกจำนวนครั้งการออกกำลังกายและเหตุการณ์ที่ไม่พึงประสงค์ที่เกิดขึ้นลงในแบบบันทึกการออกกำลังกายประจำวัน และทีมผู้วิจัยจะแจ้งเตือนท่านให้ปฏิบัติโดยทางโทรศัพท์ อาทิตย์ละ 1 ครั้ง

4.3.5. ในเดือนที่ 5-6 ของโครงการวิจัยนี้ ท่านจะต้องปฏิบัติโปรแกรมยืด-เหยียด-ขยับ-หยุด ด้วยตัวของท่านเอง ซึ่งสามารถทำได้ที่บ้านหรือที่ร้านค้าของท่าน ท่านสามารถใช้คลิปวีดีโอและแผ่นพับที่แสดงท่าทางการออกกำลังกายในโปรแกรมยืด-เหยียด-ขยับ-หยุด ในการฝึก

โปรแกรมด้วยตัวท่านเอง และท่านจะต้องบันทึกจำนวนครั้งการออกกำลังกายและเหตุการณ์ที่ไม่พึงประสงค์ที่เกิดขึ้นลงในแบบบันทึกการออกกำลังกายประจำวัน

4.4. ท่านจะถูกสอบถามเกี่ยวกับความพึงพอใจ หรือปัญหาที่เกิดขึ้นจากโปรแกรมนี้ และได้รับการตรวจประเมินระดับความเจ็บปวดกล้ามเนื้อ ความยืดหยุ่นของกล้ามเนื้อ และแรงบีบมือจากทีมผู้วิจัย และนักกายภาพบำบัด ซึ่งจะทำที่แผง/ร้านค้าของท่านโดยใช้เวลา 15-20 นาที โดยการประเมินดังกล่าวจะทำในวันศุกร์สุดท้ายของเดือนที่ 2, 4 และ 6

4.5. เมื่อเสร็จสิ้นการวิจัยแล้วข้อมูลที่เกี่ยวข้องกับผู้มีส่วนร่วมในการวิจัย ได้แก่ ข้อมูลส่วนตัว จะถูกทำลาย

5. กระบวนการให้ข้อมูลแก่กลุ่มประชากรหรือผู้มีส่วนร่วมในการวิจัยจะดำเนินการโดยทีมนักวิจัยที่ได้รับการฝึกฝน เพื่อให้เป็นรูปแบบ หรือแนวทางเดียวกัน และท่านสามารถสอบถามข้อมูลที่เกี่ยวข้องกับโครงการวิจัยจนเข้าใจ เพื่อใช้ประกอบการตัดสินใจในการยินยอมเข้าร่วมงานวิจัย

6. ในกรณี หากพบว่าท่านไม่อยู่ในเกณฑ์คัดเข้า และอยู่ในสภาวะที่สมควรได้รับความช่วยเหลือ/แนะนำ ผู้วิจัยจะแนะนำการดูแลตัวเองเบื้องต้น หรือส่งท่านต่อไปยัง แพทย์หรือผู้เชี่ยวชาญที่เกี่ยวข้องกับสภาวะของท่าน

7. **อันตราย**หรือ**ความเสี่ยง**ที่อาจเกิดขึ้นในโครงการวิจัยนี้มีน้อย เนื่องจากโปรแกรมการออกกำลังกายเป็นท่าทางที่เบาและผ่านความเห็นชอบจากผู้เชี่ยวชาญ ร่วมถึงท่านจะได้รับโปรแกรมนี้จากนักกายภาพบำบัด ซึ่งจะสอนแสดง และอธิบายท่าทางการออกกำลังกายในโปรแกรมนี้จนกว่าท่านจะเข้าใจ ร่วมถึงชี้แจงถึงข้อห้าม ข้อควรระวังในการออกกำลังกาย ข้อสังเกตอาการผิดปกติต่างๆ เช่นอาการล้า อาการเจ็บปวดกล้ามเนื้อและการปฐมพยาบาลเบื้องต้นหากมีอาการผิดปกติ แต่อย่างไรก็ตามการออกกำลังกายเองที่บ้านอาจทำให้เกิดความรู้สึกล้า หรือเมื่อยกล้ามเนื้อหลังการออกกำลังกายได้ ท่านสามารถพักจนกว่าอาการจะดีขึ้น และถ้าหากท่านไม่ดีขึ้นท่านสามารถแจ้งผู้วิจัยรับทราบทางโทรศัพท์หมายเลข 0815707702 เพื่อจะได้รับการส่งต่อไปยังแพทย์หรือผู้เชี่ยวชาญที่เกี่ยวข้องกับสภาวะของท่าน

ท่านอาจจะรู้สึกไม่สะดวก หรือไม่สบายใจในการสอบถามข้อมูลหรือตรวจประเมินร่างกายของท่านที่แผง/ร้านค้าของท่านเนื่องจากท่านจะต้องค้าขาย ทั้งนี้ผู้วิจัยจะดำเนินการสอบถามข้อมูลหรือตรวจประเมินร่างกายของท่านในช่วงเวลาที่ท่านสะดวกเท่านั้น โดยจะหลีกเลี่ยงช่วงเวลาที่ท่านไม่สะดวก หรือในระหว่างท่านมีลูกค้า

8. ประโยชน์ในการเข้าร่วมวิจัยครั้งนี้ ท่านจะได้รับโปรแกรมที่สามารถ ลดอาการปวดกล้ามเนื้อ, เพิ่มความยืดหยุ่นของกล้ามเนื้อ, เพิ่มความสามารถในการทำงาน และ เพิ่มความแข็งแรง

ของการบีบมือ และผลการศึกษาสามารถนำไปเพื่อพัฒนารูปแบบการออกกำลังกายที่เหมาะสมในกลุ่มคนที่มีรูปแบบลักษณะงานที่คล้ายคลึงกัน อีกทั้งท่านจะได้รับผลการตรวจวัดสมรรถภาพทางร่างกายพร้อมทั้งให้คำแนะนำในการปฏิบัติตัวที่เหมาะสมตามสภาวะสุขภาพของท่านต่อไป

9. การเข้าร่วมในการวิจัยของท่านเป็นโดย**สมัครใจ** และสามารถ**ปฏิเสธ**ที่จะเข้าร่วมหรือ**ถอนตัว**จากการวิจัยได้ทุกขณะ โดยไม่ต้องให้เหตุผลและไม่สูญเสียประโยชน์ที่พึงได้รับ

10. หากท่านมีข้อสงสัยให้สอบถามเพิ่มเติมได้โดยสามารถติดต่อผู้วิจัยได้ตลอดเวลา และหากผู้วิจัยมีข้อมูลเพิ่มเติมที่เป็นประโยชน์หรือโทษเกี่ยวกับการวิจัย ผู้วิจัยจะแจ้งให้ท่านทราบอย่างรวดเร็ว**เพื่อให้ผู้มีส่วนร่วมในการวิจัยทบทวนว่ายังสมัครใจจะอยู่ในงานวิจัยต่อไปหรือไม่**

11. ข้อมูลที่เกี่ยวข้องกับท่านจะเก็บเป็น**ความลับ** หากมีการเสนอผลการวิจัยจะเสนอเป็นภาพรวม ข้อมูลใดที่สามารถระบุถึงตัวท่านได้จะไม่ปรากฏในรายงาน

12. หลังเสร็จสิ้นงานวิจัยนี้ท่านจะได้รับของที่ระลึกเป็นผ้ากันเปื้อนที่ปักชื่อกิจกรรม และในการวิจัยนี้ท่านไม่ต้องเสียค่าใช้จ่ายใดๆทั้งสิ้น

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

Appendix B/2: Participant information sheet for the control group

ข้อมูลสำหรับกลุ่มประชากรหรือผู้มีส่วนร่วมในการวิจัย

สำหรับกลุ่มควบคุม

ชื่อโครงการวิจัย…ผลของโปรแกรม ยืด-เหยียด-ขยับ-หยุด ต่อสมรรถภาพทางกายในคนค้าขาย; การศึกษากึ่งทดลอง.

ชื่อผู้วิจัย…นางสาวสลิลา เศรษฐไกรกุล….ตำแหน่ง…นิสิตปริญญาเอก

สถานที่ติดต่อผู้วิจัย (ที่ทำงาน) …วิทยาลัยวิทยาศาสตร์สาธารณสุข จุฬาลงกรณ์มหาวิทยาลัย.....

(ที่บ้าน) .....555/16 หมู่ 4 ต.บางสีทอง อ.บางกรวย จ.นนทบุรี 11130.....

โทรศัพท์ (ที่ทำงาน) …….....……ต่อ …...…….. โทรศัพท์ที่บ้าน

โทรศัพท์มือถือ ……0815707702…… E-mail : ……scetthakrikul@gmail.com…….

1. ขอเรียนเชิญท่านเข้าร่วมในการวิจัยก่อนที่ท่านจะตัดสินใจเข้าร่วมในการวิจัย มีความจำเป็นที่ท่านควรทำความเข้าใจว่างานวิจัยนี้ทำเพราะเหตุใด และเกี่ยวข้องกับอะไร กรุณาใช้เวลาในการอ่านข้อมูลต่อไปนี้อย่างละเอียดรอบคอบ และสอบถามข้อมูลเพิ่มเติมหรือข้อมูลที่ไม่ชัดเจนได้ตลอดเวลา

2. เนื่องจากอาการเจ็บปวดกล้ามเนื้อที่เกิดจากการทำงาน เป็นสาเหตุที่ทำให้เกิดการบาดเจ็บต่อกล้ามเนื้อได้ง่าย ส่งผลให้จำเป็นต้องขาดงานซึ่งส่งผลต่อการสูญเสียรายได้ ซึ่งในการศึกษาก่อนหน้านี้ที่ประเทศเกาหลีพบว่า พ่อค้า แม่ค้าในตลาดมากกว่าร้อยละ 30 มีภาวะเจ็บปวดกล้ามเนื้อที่เกิดจากการทำงาน ซึ่งมีสาเหตุมาจาก การยืน หรือนั่งในท่าใดท่าหนึ่งเป็นเวลานาน การใช้แขนทำกิจกรรมซ้ำๆ รวมไปถึงท่าทางการทำงานที่ไม่ถูกต้อง

ในประเทศไทยยังมีการศึกษาที่น้อยเกี่ยวกับภาวะเจ็บปวดกล้ามเนื้อที่เกิดจากการทำงานในกลุ่มพ่อค้า แม่ค้าในตลาด และการศึกษาก่อนหน้านี้ในกลุ่มงานอื่นๆพบว่า การยืดเหยียดกล้ามเนื้อช่วยลดและบรรเทาภาวะเจ็บปวดกล้ามเนื้อที่เกิดจากการทำงานได้ แต่อย่างไรก็ตามยังไม่มีการศึกษารูปแบบกิจกรรมการออกกำลังกายที่ทำร่วมกันระหว่างการยืดเหยียดกล้ามเนื้อ และการออกกำลังกายแบบมีแรงต้านสำหรับภาวะเจ็บปวดกล้ามเนื้อที่เกิดจากการทำงาน ในกลุ่มพ่อค้าแม่ค้าในตลาด โครงการนี้จึงได้ออกแบบโปรแกรมที่มีชื่อว่า โปรแกรมยืด-เหยียด-ขยับ-หยุด ซึ่งเป็นโปรแกรมการออกกำลังกายที่ ร่วมกันระหว่างการยืดเหยียดกล้ามเนื้อ และการออกกำลังกายแบบมีแรงต้าน เป็นท่าทางการออกกำลังกายที่ง่าย ใช้เวลาไม่นาน และสามารถฝึกปฏิบัติได้ด้วยตนเอง

โครงการนี้มีวัตถุประสงค์เพื่อศึกษาผลของโปรแกรมยืด-เหยียด-ขยับ-หยุด ต่อการลดอาการปวดกล้ามเนื้อ, เพิ่มความยืดหยุ่นของกล้ามเนื้อ, เพิ่มความสามารถในการทำงาน และ เพิ่มความแข็งแรงของการบีบมือ ในพ่อค้า แม่ค้าในตลาด

3. รายละเอียดของกลุ่มประชากรหรือผู้มีส่วนร่วมในการวิจัย

ท่านได้รับเชิญให้เข้าร่วมโครงการนี้เนื่องจากท่านมีลักษณะตรงตามกลุ่มประชากรหรือผู้มีส่วนร่วมในการวิจัย ซึ่งมีเกณฑ์ดังนี้

- เกณฑ์คัดเข้า
    - เพศชายและหญิง
    - มีอายุอยู่ระหว่าง 18-64 ปี
    - มีอาการปวด เมื่อยกล้ามเนื้อ (ประเมินจากคะแนนความปวดอยู่ในระดับมากกว่าหรือเท่ากับ 3) หรือ ท่านมีความยืดหยุ่นของกล้ามเนื้ออยู่ในเกณฑ์ติดลบ
    - เป็นพ่อค้า แม่ค้าในตลาดเป็นเวลาอย่างน้อย 1 ปี
    - เต็มใจที่เข้าร่วมในการวิจัย และสามารอ่านและเขียนภาษาไทยได้
- เกณฑ์การคัดออก
    - มีโรคประจำตัวที่ทำให้ไม่สามารถออกกำลังกายได้ เช่น โรคหัวใจชนิดรุนแรง โรคทางระบบทางเดินหายใจชนิดรุนแรง หรือเฉียบพลัน หรือโรคทางระบบประสาท
    - มีภาวะกล้ามเนื้ออักเสบชนิดเฉียบพลัน หรือเรื้อรัง หรือได้รับบาดเจ็บที่รุนแรง
    - มีภาวะความดันโลหิตสูง หรือเบาหวานชนิดที่ควบคุมไม่ได้
    - ตั้งครรภ์ หรือสงสัยว่าตั้งครรภ์ หรือไม่แน่ใจว่าตั้งครรภ์
- ในการศึกษานี้มีผู้เข้าร่วมโครงการนี้จำนวน 102 คน และจะแบ่งกลุ่มออกเป็น 2 กลุ่ม จำนวนกลุ่มละ 51 คน ทั้งนี้ได้กำหนดให้ผู้เข้าร่วมวิจัยในตลาดสามย่านเป็นกลุ่มได้รับโปรแกรมโปรแกรม ยืด-เหยียด-ขยับ-หยุด และ แผ่นพับความรู้ท่าทางที่ถูกต้องในการทำงาน และผู้เข้าร่วมวิจัยในตลาดองค์การตลาดเพื่อเกษตรกรได้รับแผ่นพับความรู้ท่าทางที่ถูกต้องในการทำงาน

4. กระบวนการการวิจัยมีขั้นตอนดังนี้

4.1. ท่านจะได้รับการเชิญชวนโดยวาจาจากทีมนักวิจัย และจะได้รับข้อมูล รายละเอียดของโครงการ ประโยชน์ที่ได้รับและผลกระทบที่อาจจะเกิดขึ้นจากโครงการวิจัย เมื่อท่านรับทราบ

และยินยอมเข้าร่วมงานวิจัยจะขอให้ท่านลงชื่อในใบยินยอมของกลุ่มประชากรหรือผู้มีส่วนร่วมในการวิจัย

4.2. ในการการคัดกรองเบื้องต้น ท่านจะได้ถูกสอบถามเกี่ยวกับข้อมูลทั่วไป ลักษณะงานและความสามารถการทำงาน และตรวจประเมินน้ำหนัก ส่วนสูง ระดับความเจ็บปวดกล้ามเนื้อ ความยืดหยุ่นของกล้ามเนื้อ และแรงบีบมือจากทีมผู้วิจัย และนักกายภาพบำบัด ซึ่งจะทำที่แผง/ร้านค้าของท่านโดยนักกายภาพบำบัด ที่แผง/ร้านค้าของท่าน ในช่วงเวลาที่ท่านสะดวกโดยใช้เวลา 15-20 นาที

4.3. สำหรับกลุ่มควบคุม

สำหรับกลุ่มควบคุม ท่านจะได้รับแผ่นพับความรู้ท่าทางที่ถูกต้องในการทำงานจากนักกายภาพบำบัด และจะได้รับคำแนะนำในการดูแลสุขภาพทั่วไปจากนักกายภาพบำบัดในวันแรกของการตรวจประเมินโดยใช้เวลา 5-10 นาที

4.4. ท่านจะได้รับการตรวจประเมินระดับความเจ็บปวดกล้ามเนื้อ ความยืดหยุ่นของกล้ามเนื้อ และแรงบีบมือจากทีมผู้วิจัย และนักกายภาพบำบัด ซึ่งจะทำที่แผง/ร้านค้าของท่านโดยใช้เวลา 15-20 นาที โดยการประเมินดังกล่าวจะทำในวันศุกร์สุดท้ายของเดือนที่ 2, 4 และ 6

4.5. เมื่อเสร็จสิ้นการวิจัยแล้วข้อมูลที่เกี่ยวข้องกับผู้มีส่วนร่วมในการวิจัย ได้แก่ ข้อมูลส่วนตัว จะถูกทำลาย

5. กระบวนการให้ข้อมูลแก่กลุ่มประชากรหรือผู้มีส่วนร่วมในการวิจัยจะดำเนินการโดยทีมนักวิจัยที่ได้รับการฝึกฝน เพื่อให้เป็นรูปแบบ หรือแนวทางเดียวกัน และท่านสามารถสอบถามข้อมูลที่เกี่ยวข้องกับโครงการวิจัยจนเข้าใจ เพื่อใช้ประกอบการตัดสินใจในการยินยอมเข้าร่วมงานวิจัย

6. ในกรณี หากพบว่าท่านไม่อยู่ในเกณฑ์คัดเข้า และอยู่ในสภาวะที่สมควรได้รับความช่วยเหลือ/แนะนำ ผู้วิจัยจะแนะนำการดูแลตัวเองเบื้องต้น หรือส่งท่านต่อไปยัง แพทย์หรือผู้เชี่ยวชาญที่เกี่ยวข้องกับสภาวะของท่าน

7. **อันตราย**หรือ**ความเสี่ยง**ที่อาจเกิดขึ้นในโครงการวิจัยนี้มีน้อย เนื่องจากโปรแกรมการออกกำลังกายเป็นท่าทางที่เบาและผ่านความเห็นชอบจากผู้เชี่ยวชาญ ร่วมถึงท่านจะได้รับโปรแกรมนี้จากนักกายภาพบำบัด ซึ่งจะสอนแสดง และอธิบายท่าทางการออกกำลังกายในโปรแกรมนี้จนกว่าท่านจะเข้าใจ ร่วมถึงชี้แจงถึงข้อห้าม ข้อควรระวังในการออกกำลังกาย ข้อสังเกตอาการผิดปกติต่างๆ เช่นอาการล้า อาการเจ็บปวดกล้ามเนื้อและการปฐมพยาบาลเบื้องต้นหากมีอาการผิดปกติ แต่อย่างไรก็ตามการออกกำลังกายเองที่บ้านอาจทำให้เกิดความรู้สึกล้า หรือเมื่อยกล้ามเนื้อหลังการ

ออกกำลังกายได้ ท่านสามารถพักจนกว่าอาการจะดีขึ้น และถ้าหากท่านไม่ดีขึ้นท่านสามารถแจ้งผู้วิจัยรับทราบ เพื่อจะได้รับการส่งต่อไปยังแพทย์หรือผู้เชี่ยวชาญที่เกี่ยวข้องกับสภาวะของท่าน

ท่านอาจจะรู้สึกไม่สะดวก หรือไม่สบายใจในการสอบถามข้อมูลหรือตรวจประเมินร่างกายของท่านที่แผง/ร้านค้าของท่านเนื่องจากท่านจะต้องค้าขาย ทั้งนี้ผู้วิจัยจะดำเนินการสอบถามข้อมูลหรือตรวจประเมินร่างกายของท่านในช่วงเวลาที่ท่านสะดวกเท่านั้น โดยจะหลีกเลี่ยงช่วงเวลาที่ท่านไม่สะดวก หรือในระหว่างท่านมีลูกค้า

8. ประโยชน์ในการเข้าร่วมวิจัยครั้งนี้ ท่านจะได้รับโปรแกรมที่สามารถ ลดอาการปวดกล้ามเนื้อ, เพิ่มความยืดหยุ่นของกล้ามเนื้อ, เพิ่มความสามารถในการทำงาน และ เพิ่มความแข็งแรงของการบีบมือ และผลการศึกษาสามารถนำไปเพื่อพัฒนารูปแบบการ ออกกำลังกายที่เหมาะสมในกลุ่มคนที่มีรูปแบบลักษณะงานที่คล้ายคลึงกัน อีกทั้งท่านจะได้รับผลการตรวจวัดสมรรถภาพทางร่างกายพร้อมทั้งให้คำแนะนำในการปฏิบัติตัวที่เหมาะสมตามสภาวะสุขภาพของท่านต่อไป

9. การเข้าร่วมในการวิจัยของท่านเป็นโดย**สมัครใจ** และสามารถ**ปฏิเสธ**ที่จะเข้าร่วมหรือ**ถอนตัว**จากการวิจัยได้ทุกขณะ โดยไม่ต้องให้เหตุผลและไม่สูญเสียประโยชน์ที่พึงได้รับ

10. หากท่านมีข้อสงสัยให้สอบถามเพิ่มเติมได้โดยสามารถติดต่อผู้วิจัยได้ตลอดเวลา และหากผู้วิจัยมีข้อมูลเพิ่มเติมที่เป็นประโยชน์หรือโทษเกี่ยวกับการวิจัย ผู้วิจัยจะแจ้งให้ท่านทราบอย่างรวดเร็ว**เพื่อให้ผู้มีส่วนร่วมในการวิจัยทบทวนว่ายังสมัครใจจะอยู่ในงานวิจัยต่อไปหรือไม่**

11. ข้อมูลที่เกี่ยวข้องกับท่านจะเก็บเป็น**ความลับ** หากมีการเสนอผลการวิจัยจะเสนอเป็นภาพรวม ข้อมูลใดที่สามารถระบุถึงตัวท่านได้จะไม่ปรากฏในรายงาน

12. หลังเสร็จสิ้นงานวิจัยนี้ท่านจะได้รับของที่ระลึกเป็นผ้ากันเปื้อนที่ปักชื่อกิจกรรม และในการวิจัยนี้ท่านไม่ต้องเสียค่าใช้จ่ายใดๆทั้งสิ้น

13. หากท่านไม่ได้รับการปฏิบัติตามข้อมูลดังกล่าวสามารถร้องเรียนได้ที่ 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”

Appendix C/1: Consent form for the intervention group

หนังสือแสดงความยินยอมเข้าร่วมการวิจัย

สำหรับกลุ่มออกกำลังกาย

ทำที่.....

วันที่.....เดือน.....พ.ศ. .....

เลขที่ ประชากรตัวอย่างหรือผู้มีส่วนร่วมในการวิจัย….....……

ข้าพเจ้า ซึ่งได้ลงนามท้ายหนังสือนี้ ขอแสดงความยินยอมเข้าร่วมโครงการวิจัย

ชื่อโครงการวิจัย .....ผลของโปรแกรม ยืด-เหยียด-ขยับ-หยุด ต่อสมรรถภาพทางกายในคนค้าขาย; การศึกษากึ่งทดลอง.....

ชื่อผู้วิจัย …นางสาวสลิลา เศรษฐไกรกุล……..

ที่อยู่ที่ติดต่อ ..... 555/16 หมู่ 4 ต.บางสีทอง อ.บางกรวย จ.นนทบุรี 11130.....

โทรศัพท์ .....081-5707702.....

ข้าพเจ้า ได้รับทราบรายละเอียดเกี่ยวกับที่มาและวัตถุประสงค์ในการทำวิจัย รายละเอียดขั้นตอนต่างๆ ที่จะต้องปฏิบัติหรือได้รับการปฏิบัติ ความเสี่ยง/อันตราย และประโยชน์ซึ่งจะเกิดขึ้นจากการวิจัยเรื่องนี้ โดยได้อ่านรายละเอียดในเอกสารชี้แจงผู้เข้าร่วมการวิจัยโดยตลอด และได้รับคำอธิบายจากผู้วิจัย จนเข้าใจเป็นอย่างดีแล้ว

ข้าพเจ้าจึงสมัครใจเข้าร่วมในโครงการวิจัยนี้ ตามที่ระบุไว้ในเอกสารชี้แจงผู้เข้าร่วมการวิจัย ซึ่งโครงการนี้ใช้เวลาทั้งสิ้น 6 เดือน โดยข้าพเจ้ายินยอมตอบแบบสอบถามเกี่ยวกับข้อมูลทั่วไป ลักษณะงานและความสามารถการทำงาน และตรวจประเมินน้ำหนัก ส่วนสูง ระดับความเจ็บปวดกล้ามเนื้อ ความยืดหยุ่นของกล้ามเนื้อ และแรงบีบมือจากทีมผู้วิจัย และนักกายภาพบำบัด ซึ่งจะทำที่แผง/ร้านค้าโดยใช้เวลา 15-20 นาที การประเมินดังกล่าวจะทำครั้งแรกก่อนการศึกษา และในวันศุกร์สุดท้ายของเดือนที่ 2, 4 และ 6 ของโครงการวิจัย และข้าพเจ้าจะเข้าร่วมกิจกรรมตามโปรแกรมยืด เหยียด ขยับ หยุด ซึ่งเป็นโปรแกรมออกกำลังกายในโครงการตามที่ทีมผู้วิจัยกำหนดครั้งละ 5-10 นาที 42 ครั้ง ซึ่งจะทำที่แผง/ร้านค้า และจะต้องปฏิบัติตามโปรแกรมนี้ต่อเนื่องไปอีก 4 เดือน เมื่อเสร็จสิ้นการวิจัยแล้วข้อมูลที่เกี่ยวข้องกับผู้มีส่วนร่วมในการวิจัยจะถูกทำลาย

ข้าพเจ้ามีสิทธิถอนตัวออกจากการวิจัยเมื่อใดก็ได้ตามความประสงค์ โดยไม่ต้องแจ้งเหตุผล ซึ่งการถอนตัวออกจากการวิจัยนั้น จะไม่มีผลกระทบในทางใดๆ ต่อข้าพเจ้าทั้งสิ้น

ข้าพเจ้าได้รับคำรับรองว่า ผู้วิจัยจะปฏิบัติต่อข้าพเจ้าตามข้อมูลที่ระบุไว้ในเอกสารชี้แจงผู้เข้าร่วมการวิจัย และข้อมูลใดๆ ที่เกี่ยวข้องกับข้าพเจ้า ผู้วิจัยจะเก็บรักษาเป็นความลับ โดยจะ

นำเสนอข้อมูลการวิจัยเป็นภาพรวมเท่านั้น ไม่มีข้อมูลใดในการรายงานที่จะนำไปสู่การระบุตัวข้าพเจ้า

หากข้าพเจ้าไม่ได้รับการปฏิบัติตรงตามที่ได้ระบุไว้ในเอกสารชี้แจงผู้เข้าร่วมการวิจัย ข้าพเจ้าสามารถร้องเรียนได้ที่คณะกรรมการพิจารณาจริยธรรมการวิจัยในคน กลุ่มสหสถาบัน ชุดที่ 1 จุฬาลงกรณ์มหาวิทยาลัย 254 อาคารจามจุรี 1 ชั้น 2 ถนนพญาไท เขตปทุมวัน กรุงเทพฯ 10330 โทรศัพท์/โทรสาร 0-2218-3202

E-mail: eccu@chula.ac.th

ข้าพเจ้าได้ลงลายมือชื่อไว้เป็นสำคัญต่อหน้าพยาน ทั้งนี้ข้าพเจ้าได้รับสำเนาเอกสารชี้แจงผู้เข้าร่วมการวิจัย และสำเนาหนังสือแสดงความยินยอมไว้แล้ว

ลงชื่อ..... ลงชื่อ.....

(นางสาวสลิลา เศรษฐไกรกุล) (.....)

ผู้วิจัยหลัก ผู้มีส่วนร่วมในการวิจัย

ลงชื่อ.....

(.....)

พยาน

Appendix C/2: Consent form for the control group

หนังสือแสดงความยินยอมเข้าร่วมการวิจัย

สำหรับกลุ่มควบคุม

ทำที่.....

วันที่.....เดือน.....พ.ศ. .....

เลขที่ ประชากรตัวอย่างหรือผู้มีส่วนร่วมในการวิจัย….....……

ข้าพเจ้า ซึ่งได้ลงนามท้ายหนังสือนี้ ขอแสดงความยินยอมเข้าร่วมโครงการวิจัย

ชื่อโครงการวิจัย .....ผลของโปรแกรม ยืด-เหยียด-ขยับ-หยุด ต่อสมรรถภาพทางกายในคนค้าขาย; การศึกษากึ่งทดลอง.....

ชื่อผู้วิจัย …นางสาวสลิลา เศรษฐไกรกุล……..

ที่อยู่ที่ติดต่อ ..... 555/16 หมู่ 4 ต.บางสีทอง อ.บางกรวย จ.นนทบุรี 11130.....โทรศัพท์ .....081-5707702.....

ข้าพเจ้า ได้รับทราบรายละเอียดเกี่ยวกับที่มาและวัตถุประสงค์ในการทำวิจัย รายละเอียดขั้นตอนต่างๆ ที่จะต้องปฏิบัติหรือได้รับการปฏิบัติ ความเสี่ยง/อันตราย และประโยชน์ซึ่งจะเกิดขึ้นจากการวิจัยเรื่องนี้ โดยได้อ่านรายละเอียดในเอกสารชี้แจงผู้เข้าร่วมการวิจัยโดยตลอด และได้รับคำอธิบายจากผู้วิจัย จนเข้าใจเป็นอย่างดีแล้ว

ข้าพเจ้าจึงสมัครใจเข้าร่วมในโครงการวิจัยนี้ ตามที่ระบุไว้ในเอกสารชี้แจงผู้เข้าร่วมการวิจัย ซึ่งโครงการนี้ใช้เวลาทั้งสิ้น 6 เดือน โดยข้าพเจ้ายินยอมตอบแบบสอบถามเกี่ยวกับข้อมูลทั่วไป ลักษณะงานและความสามารถการทำงาน และตรวจประเมินน้ำหนัก ส่วนสูง ระดับความเจ็บปวดกล้ามเนื้อ ความยืดหยุ่นของกล้ามเนื้อ และแรงบีบมือจากทีมผู้วิจัย และนักกายภาพบำบัด ซึ่งจะทำที่แผง/ร้านค้าโดยใช้เวลา 15-20 นาที การประเมินดังกล่าวจะทำครั้งแรกก่อนการศึกษา และในวันศุกร์สุดท้ายของเดือนที่ 2, 4 และ 6 ของโครงการวิจัย และข้าพเจ้าจะได้รับแผ่นพับความรู้ท่าทางที่ถูกต้องในการทำงานจากนักกายภาพบำบัด และจะได้รับคำแนะนำในการดูแลสุขภาพทั่วไปจากนักกายภาพบำบัด ซึ่งข้าพเจ้าจะอ่านและทำความเข้าใจ หากมีข้อสงสัยจะสอบถามกับนักกายภาพบำบัดจนเข้าใจ และเมื่อเสร็จสิ้นการวิจัยแล้วข้อมูลที่เกี่ยวข้องกับผู้มีส่วนร่วมในการวิจัยจะถูกทำลาย

ข้าพเจ้ามีสิทธิถอนตัวออกจากการวิจัยเมื่อใดก็ได้ตามความประสงค์ โดยไม่ต้องแจ้งเหตุผล ซึ่งการถอนตัวออกจากการวิจัยนั้น จะไม่มีผลกระทบในทางใดๆ ต่อข้าพเจ้าทั้งสิ้น

ข้าพเจ้าได้รับคำรับรองว่า ผู้วิจัยจะปฏิบัติต่อข้าพเจ้าตามข้อมูลที่ระบุไว้ในเอกสารชี้แจงผู้เข้าร่วมการวิจัย และข้อมูลใดๆ ที่เกี่ยวข้องกับข้าพเจ้า ผู้วิจัยจะเก็บรักษาเป็นความลับ โดยจะ

นำเสนอข้อมูลการวิจัยเป็นภาพรวมเท่านั้น ไม่มีข้อมูลใดในการรายงานที่จะนำไปสู่การระบุตัวข้าพเจ้า

หากข้าพเจ้าไม่ได้รับการปฏิบัติตรงตามที่ได้ระบุไว้ในเอกสารชี้แจงผู้เข้าร่วมการวิจัย ข้าพเจ้าสามารถร้องเรียนได้ที่คณะกรรมการพิจารณาจริยธรรมการวิจัยในคน กลุ่มสหสถาบัน ชุดที่ 1 จุฬาลงกรณ์มหาวิทยาลัย 254 อาคารจามจุรี 1 ชั้น 2 ถนนพญาไท เขตปทุมวัน กรุงเทพฯ 10330 โทรศัพท์/โทรสาร 0-2218-3202

E-mail: eccu@chula.ac.th

ข้าพเจ้าได้ลงลายมือชื่อไว้เป็นสำคัญต่อหน้าพยาน ทั้งนี้ข้าพเจ้าได้รับสำเนาเอกสารชี้แจงผู้เข้าร่วมการวิจัย และสำเนาหนังสือแสดงความยินยอมไว้แล้ว

ลงชื่อ..... ลงชื่อ.....

(นางสาวสลิลา เศรษฐไกรกุล) (.....)

ผู้วิจัยหลัก ผู้มีส่วนร่วมในการวิจัย

ลงชื่อ.....

(.....)

พยาน

Appendix D/1: Questionnaire at baseline

แบบสอบถาม (Baseline data)

วันที่…… ID: ……

ชื่อร้านค้า …….…… เบอร์แผง ……

☐ 1) เนื้อหมู/เนื้อวัว/เนื้อไก่ ☐ 2) อาหารทะเล ☐ 3) ผัก/ผลไม้

☐ 4) อาหารปรุงสุก ☐ 5) สินค้าอุปโภค ☐ 6)

อื่นๆ…….

ข้อมูลทั่วไป

1. อายุ: ……
2. เพศ

☐ 1) ชาย ☐ 2) หญิง

3. ท่านมีโรคประจำตัวอะไรหรือไม่ โปรดระบุ……...

ข้อมูลการทำงาน

4. ลักษณะงาน

☐ 1) ขายของหน้าร้าน ☐ 2) จัดสิ่งของ ☐ 3) ยกของหนัก

☐ 4) เสริฟอาหาร ☐ 5) ทำอาหาร

☐ 6) ทำมากว่า 1 ข้อ ระบุ.....

☐ 7) อื่นๆ ระบุ.....

5. คุณทำงานค้า ขายมานานเท่าไร ……ปี ……เดือน
6. คุณทำงานกี่วันต่อสัปดาห์ …… วัน
7. ใน 1 วันคุณทำงานกี่ชั่วโมง …… ชั่วโมง …… นาที

   โดยส่วนใหญ่ท่านอยู่ในท่าทางใด

☐ 1) นั่ง ☐ 2) ยืน ☐ 3) เดิน ☐ 4) อื่น ระบุ.....

   นั่ง …… ชั่วโมง …… นาที

   ยืน …… ชั่วโมง …… นาที

   เดิน …… ชั่วโมง …… นาที

   อื่นๆ …… ชั่วโมง …… นาที

ข้อมูลสุขภาพ

8. ส่วนสูง ……. cm.
9. น้ำหนัก ……..kg.
10. ความดันโลหิตตัวบน.....มม.ปรอท
    ความดันโลหิตตัวล่าง.....มม.ปรอท
    ชีพจร..... ครั้ง/นาที
11. ใน 1 สัปดาห์คุณได้ออกกำลังกายอย่างน้อย 20-30 นาทีกี่วัน

☐ 0) ไม่มี ☐ 1) มี ……. วัน

การออกกำลังกายแบบไหนที่คุณทำเป็นประจำ?

☐ 1) เดินเร็ว ☐ 2) วิ่งเหยาะ/วิ่ง ☐ 3) ปั่นจักรยาน
☐ 4) เต้น ☐ 5) กายบริหาร ☐ 6) โยคะ
☐ 7) อื่นๆ…….

12. ใน 1 วันคุณใช้เวลากี่ชั่วโมงเพื่อดูโทรทัศน์ หรือ youtube หรือเล่นอินเตอร์เนตเพื่อทำงานหรือความบันเทิง ……. ชั่วโมง ……นาที

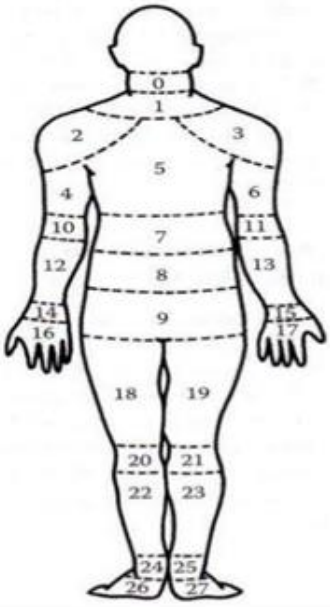
ข้อมูลอาการปวดเมื่อยกล้ามเนื้อ

13. ใน 7 วันที่ผ่านมาคุณมีอาการปวด เมื่อย ตึง กล้ามเนื้อในตำแหน่งใดบ้าง

☐ 0) ไม่มี ☐ 1) มี, กรุณาระบุตำแหน่ง และระดับความปวด เมื่อย ตึงในรูปด้านล่าง

ด้านซ้าย

ด้านขวา



หมายเหตุ : ระดับความปวด เมื่อย ตึง กล้ามเนื้อประเมินโดย VAS. กรุณาเลือกตัวเลขที่ระบุระดับความปวด เมื่อย ตึงของคุณ

14. เมื่อมีอาการปวด เมื่อย ตึงกล้ามเนื้อ ดังกล่าว คุณบรรเทาอาการหรือรักษาอย่างไร

☐ 1) พัก/นอนพัก ☐ 2) กินยาลดปวด ☐ 3) ทายา

☐ 4) นวด ☐ 5) ยืดเหยียดกล้ามเนื้อ ☐ 6) ไปหาหมอ

☐ 7) อื่นๆ…….

15. การประเมินความสามารถในการทำงาน****

ความสามารถในการทำงานปัจจุบัน

15.1. คุณคิดว่าระดับความสามารถในการทำงานปัจจุบันของคุณเป็นอย่างไร หากกำหนดคะแนน 0-10 โดย 10 คือมีความสามารถสูงสุดในการทำงาน และ 0 คือไม่สามารถทำงานได้เลย

0	1	2	3	4	5	6	7	8	9	10

ผลกระทบต่อการทำงานในปัจจุบันจากการเจ็บป่วยหรือการบาดเจ็บต่างๆ

15.2. ความเจ็บป่วยหรือการบาดเจ็บของคุณเป็นอุปสรรคต่องานปัจจุบันของคุณหรือไม่? เลือกได้มากกว่าหนึ่งข้อถ้าจำเป็น?

ทำงานได้ตามปกติ	6
ฉันสามารถทำงานของฉันได้ แต่มีอาการผิดปกติของร่างกาย หรือเจ็บป่วยเป็นครั้งคราว	5
อาการที่เกิดทำให้ในบางครั้งฉันต้องลดการทำงานลง หรือเปลี่ยนวิธีทำงาน	4
อาการที่เกิดทำให้ในฉันต้องทำงานช้าลง หรือเปลี่ยนวิธีทำงานบ่อยๆ	3
อาการที่เกิดขึ้น ทำให้สามารถทำงานนอกเวลาได้เท่านั้น	2
ฉันไม่สามารถทำงานใดๆ ได้เลย	1

15.3. จำนวนวันในการหยุดงานทั้งวันเนื่องจาก ปัญหาสุขภาพหรือการเจ็บป่วย หรือการหยุดงานเพื่อไปรักษาในรอบ 1 เดือน

จำนวนวัน.....วัน

16. แรงบีบมือ

ตำแหน่ง	วัดครั้งที่ 1	วัดครั้งที่ 2	วัดครั้งที่ 3	ค่ามากที่สุด
แขนขวา				
แขนซ้าย				

17. ความยืดหยุ่นของกล้ามเนื้อ

ตำแหน่ง	วัดครั้งที่ 1	วัดครั้งที่ 2	วัดครั้งที่ 3	เฉลี่ย
แขนขวา				
แขนซ้าย				
ขาขวา				
ขาซ้าย				

18. คุณเคยใช้สารต่อไปนี้หรือไม่

ลำดับ	ชนิด	เคยใช้.... อย่างน้อย 1 ครั้งในชีวิต		สาเหตุการใช้	ใน 1 ปีที่ผ่านมายังใช้อยู่หรือไม่		สาเหตุการใช้	ครั้งสุดท้ายที่ใช้คือ	ปริมาณที่ใช้
		ไม่เคยใช้เลย (0)	เคยใช้ (1)		ไม่ (0)	ใช้ (1)			
1	เครื่องดื่มแอลกอฮอล์ ระบุ.....								
2	ยาอื่นที่ไม่ใช่ยารักษาโรคประจำตัว ระบุ.....								

Appendix D/2: Questionnaire at post-intervention and follow up

แบบบันทึกข้อมูล (ติดตามผล)

วันที่…… ID: ……

ชื่อร้านค้า …… เบอร์แผง ……

ข้อมูลสุขภาพ/ข้อมูลทั่วไป

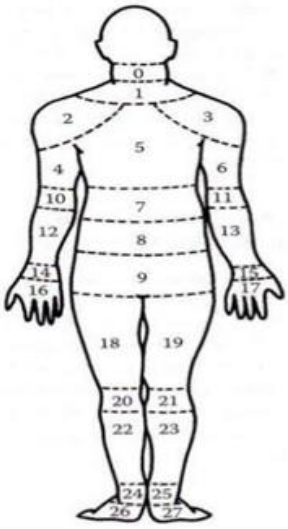
1. ส่วนสูง …… cm.
2. น้ำหนัก ……..kg.
3. ความดันโลหิตตัวบน.....มม.ปรอท
   ความดันโลหิตตัวล่าง.....มม.ปรอท
   ชีพจร..... ครั้ง/นาที
4. ในช่วง 2 เดือนที่ผ่านมาคุณได้ทำกิจกรรมดังต่อไปนี้หรือไม่
   4.1. ยก/ ดัน/ ดึง ของหนักมากๆ ☐ 0) ไม่มี ☐ 1) มี,
   ระบุจำนวนครั้ง.....
   4.2. บิดตัว หรือเอี้ยวตัวอย่างกระทันหัน ☐ 0) ไม่มี ☐ 1) มี,
   ระบุจำนวนครั้ง.....
   4.3. หกล้ม ☐ 0) ไม่มี ☐ 1) มี,
   ระบุจำนวนครั้ง.....
   4.4. อุบัติเหตุที่รุนแรง ☐ 0) ไม่มี ☐ 1) มี,
   ระบุจำนวนครั้ง.....

ข้อมูลอาการปวดเมื่อยกล้ามเนื้อ

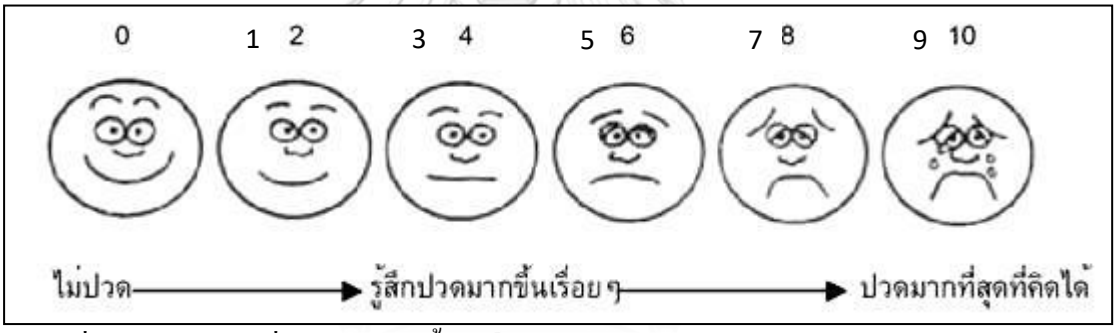
5. ใน 7 วันที่ผ่านมาคุณมีอาการปวด เมื่อย ตึง กล้ามเนื้อในตำแหน่งใดบ้าง
   ☐ 0) ไม่มี ☐ 1) มี, กรุณาระบุตำแหน่ง และระดับความปวด เมื่อย ตึงในรูปด้านล่าง

ด้านซ้าย

ด้านขวา



หมายเหตุ : ระดับความปวด เมื่อย ตึง กล้ามเนื้อประเมินโดย VAS. กรุณาเลือกตัวเลขที่ระบุระดับความปวด เมื่อย ตึงของคุณ



6. เมื่อมีอาการปวด เมื่อย ตึงกล้ามเนื้อ ดังกล่าว คุณบรรเทาอาการหรือรักษาอย่างไร

☐ 1) พัก/นอนพัก ☐ 2) กินยาลดปวด ☐ 3) ทายา

☐ 4) นวด ☐ 5) ยืดเหยียดกล้ามเนื้อ ☐ 6) ไปหาหมอ

☐ 7) อื่นๆ…….

7. การประเมินความสามารถในการทำงาน

ความสามารถในการทำงานปัจจุบัน

7.1. คุณคิดว่าระดับความสามารถในการทำงานปัจจุบันของคุณเป็นอย่างไร หากกำหนดคะแนน 0-10 โดย 10 คือมีความสามารถสูงสุดในการทำงาน และ 0 คือไม่สามารถทำงานได้เลย

0	1	2	3	4	5	6	7	8	9	10

ผลกระทบต่อการทำงานในปัจจุบันจากการเจ็บป่วยหรือการบาดเจ็บต่างๆ

7.2. ความเจ็บป่วยหรือการบาดเจ็บของคุณเป็นอุปสรรคต่องานปัจจุบันของคุณหรือไม่? เลือกได้มากกว่าหนึ่งข้อถ้าจำเป็น?

ทำงานได้ตามปกติ	6
ฉันสามารถทำงานของฉันได้ แต่มีอาการผิดปกติของร่างกาย หรือเจ็บป่วยเป็นครั้งคราว	5
อาการที่เกิดทำให้ในบางครั้งฉันต้องลดการทำงานลง หรือเปลี่ยนวิธีทำงาน	4
อาการที่เกิดทำให้ในฉันต้องทำงานช้าลง หรือเปลี่ยนวิธีทำงานบ่อยๆ	3
อาการที่เกิดขึ้น ทำให้สามารถทำงานนอกเวลาได้เท่านั้น	2
ฉันไม่สามารถทำงานใดๆ ได้เลย	1

7.3. จำนวนวันในการหยุดงานทั้งวันเนื่องจาก ปัญหาสุขภาพหรือการเจ็บป่วย หรือการหยุดงานเพื่อไปรักษาในรอบ 1 เดือน

จำนวนวัน.....วัน

8. แรงบีบมือ

ตำแหน่ง	วัดครั้งที่ 1	วัดครั้งที่ 2	วัดครั้งที่ 3	ค่ามากที่สุด
แขนขวา				
แขนซ้าย				

9. ความยืดหยุ่นของกล้ามเนื้อ

ตำแหน่ง	วัดครั้งที่ 1	วัดครั้งที่ 2	วัดครั้งที่ 3	เฉลี่ย
แขนขวา				
แขนซ้าย				
ขาขวา				
ขาซ้าย				

10. คุณเคยใช้สารต่อไปนี้หรือไม่

ลำดับ	ชนิด	เคยใช้.... อย่างน้อย 1 ครั้งในชีวิต		สาเหตุการใช้	ใน 1 ปีที่ผ่านมายังใช้อยู่หรือไม่		สาเหตุการใช้	ครั้งสุดท้ายที่ใช้คือ	ปริมาณที่ใช้
		ไม่เคยใช้เลย (0)	เคยใช้ (1)		ไม่ (0)	ใช้ (1)			
1	เครื่องดื่มแอลกอฮอล์ ระบุ.....								
2	ยาอื่นที่ไม่ใช่ยารักษาโรคประจำตัว ระบุ.....								

ความพึงพอใจในโปรแกรม (ถามเฉพาะกลุ่มทดลอง)

11. จำนวนครั้งต่อวันในการฝึกปฏิบัติโปรแกรม

☐ 0) ไม่ได้ฝึกเลย ☐ 1) 1-2 ครั้ง/วัน ☐ 2) มากกว่า 2 ครั้ง/วัน

12. จำนวนวันต่อสัปดาห์ในการฝึกปฏิบัติโปรแกรม .....วัน

13. คุณพึงพอใจในโปรแกรมนี้มากน้อยแค่ไหน หากกำหนดคะแนน 0-10 โดย 10 คือมีความพึงพอใจมากที่สุด และ 0 คือไม่พึงพอใจเลย

0	1	2	3	4	5	6	7	8	9	10

โปรดอธิบายเพิ่มเติมว่าพอใจ หรือไม่พอใจอย่างไร

.....

14. คุณคิดว่าในโปรแกรมนี้สามารถแก้ไขปัญหาที่เกิดจากความเจ็บปวดกล้ามเนื้อของคุณได้มากน้อยแค่ไหน หากกำหนดคะแนน 0-10 โดย 10 คือมีแก้ไขปัญหามากที่สุด และ 0 คือไม่สามารถแก้ไขปัญหาได้เลย

0	1	2	3	4	5	6	7	8	9	10

โปรดอธิบายเพิ่มเติมว่าแก้ไขปัญหาได้ หรือไม่ได้อย่างไร

.....

15. ในระหว่างทำกิจกรรมนี้ คุณมีปัญหา หรือเหตุการณ์ที่ไม่พึงประสงค์ เช่น เจ็บปวดกล้ามเนื้อมากขึ้น อ่อนแรงหรืออ่อนล้า เป็นต้น หรือไม่

☐ 0) ไม่มี ☐ 1) มี ระบุ .....

Appendix E: Self-Static Stretching Strengthening program booklet

คำนำ

โปรแกรม ยืด-เหยียด-ขยับ-หยุด คือ โปรแกรมการออกกำลังกายที่ถูกออกแบบมาเพื่อลดภาวะเจ็บปวดของกล้ามเนื้อเนื่องจากการทำงานในพ่อค้า แม่ค้าที่ขายของในตลาด ประกอบด้วย 2 ส่วนหลักๆ คือ

1. การออกกำลังกายเพื่อเพิ่มความยืดหยุ่น (Stretching exercise)
2. การออกกำลังกายแบบมีแรงต้าน (Strengthening exercise)

โดยท่าทางการออกกำลังกายถูกออกแบบโดยนักกายภาพบำบัด ซึ่งการออกแบบอาศัยแนวคิดว่า

1. ท่าทางการออกกำลังกายจะต้องง่าย และสะดวกสามารถทำได้ทั้งที่บ้านและที่ตลาด
2. ท่าทางการออกกำลังกายเพื่อเพิ่มความยืดหยุ่นจะต้องเป็นการเน้นยืดกล้ามเนื้อมัดใหญ่ทั่วร่างกาย
3. ท่าทางการออกกำลังกายเพื่อเพิ่มความแข็งแรง จะต้องเน้นกล้ามเนื้อมัดใหญ่ของแขน แรงต้านที่ใช้เป็นแรงต้านที่น้อย และใช้ขวดน้ำขนาดเล็กที่เป็นวัสดุที่หาได้ง่าย

ทั้งนี้คณะผู้จัดทำหวังว่าโปรแกรมการออกกำลังกายนี้จะเป็นประโยชน์ และส่งเสริมสุขภาพของท่านไม่มากก็น้อย

ผู้จัดทำ

ท่าที่ 1 ท่ายืดกล้ามเนื้อรอบหัวไหล่และสะบัก

ท่าเริ่มต้น: อยู่ในท่ายืน หรือนั่ง

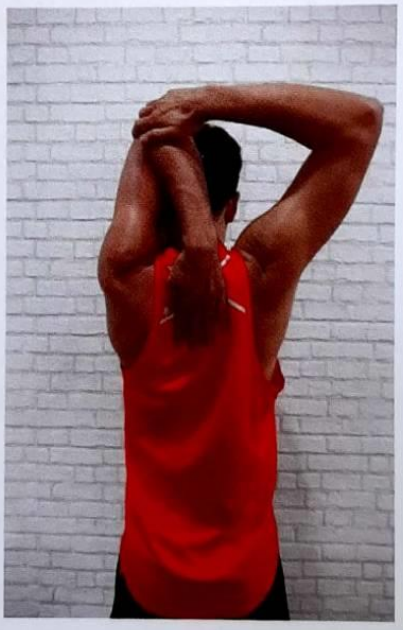
วิธีการ: ยกแขนข้างหนึ่งข้ามผ่านลำตัว ใช้แขนอีกข้างออกแรงกดที่ข้อศอกโดยกดเข้าหาลำตัว

ค้างไว้ในตำแหน่งที่รู้สึกตึง 10-15 วินาที ก่อนกลับมาสู่ท่าเริ่มต้น ทำซ้ำ 2-3 ครั้งในแขนแต่ละข้าง และยืดกล้ามเนื้อท่านี้อย่างน้อย 2 ครั้งต่อวัน และควรทำทุกวัน

ท่าที่ 2 ท่ายืดกล้ามเนื้อแขนด้านหลัง

ท่าเริ่มต้น: อยู่ในท่ายืน หรือนั่ง

วิธีการ: ยกแขนข้างหนึ่งขึ้นเหนือศีรษะ และวางลงกลางหลัง ใช้แขนอีกข้างออกแรงกดที่ข้อศอกโดยออกแรงดึงแขนเข้าหาลำตัว ค้างไว้ในตำแหน่งที่รู้สึกตึง 10-15 วินาที ก่อนกลับมาสู่ท่าเริ่มต้น ทำซ้ำ 2-3 ครั้งในแขนแต่ละข้าง และยืดกล้ามเนื้อท่านี้อย่างน้อย 2 ครั้งต่อวัน และควรทำทุกวัน



ท่าที่ 3 ท่ายืดกล้ามเนื้อแขนด้านหน้า และกล้ามเนื้อหน้าอก

ท่าเริ่มต้น: อยู่ในท่ายืน หรือนั่ง

วิธีการ: ประสานมือทั้ง 2 ข้าง คว่ำมือไว้ด้านหลัง ยืดแขนไปด้านหลังให้ข้อศอกเหยียดตรง

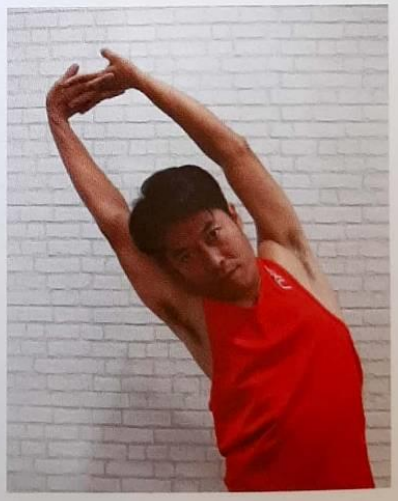
ค้างไว้ในตำแหน่งที่รู้สึกตึง 10-15 วินาที ก่อนกลับมาสู่ท่าเริ่มต้น ทำซ้ำ 2-3 ครั้ง และยืดกล้ามเนื้อท่านี้อย่างน้อย 2 ครั้งต่อวัน และควรทำทุกวัน

ท่าที่ 4 ท่ายืดกล้ามเนื้อลำตัว

ท่าเริ่มต้น: อยู่ในท่ายืน หรือนั่ง

วิธีการ: ประสานมือกันไว้ พร้อมยกแขนขึ้นเหนือศีรษะโดยให้ข้อศอกเหยียดตรง ออกแรงเหยียดแขนขึ้นด้านบนจนรู้สึกตึง ค้างไว้ 5 วินาที

ค่อยๆเอนตัวไปทางด้านขวาในขณะที่แขนยังเหยียดตรง ค้างไว้อีก 5 วินาที และเอนตัวไปด้านซ้ายค้างไว้อีก 5 วินาที



กลับมาสู่ท่าเริ่มต้น ทำซ้ำ 2-3 ครั้ง และยืดกล้ามเนื้อท่านี้อย่างน้อย 2 ครั้งต่อวัน และควรทำทุกวัน

ท่าที่ 5 ท่ายืดกล้ามเนื้อต้นขา และหลังส่วนล่าง

ท่าเริ่มต้น: อยู่ในท่านั่ง

วิธีการ: วางเท้าข้างหนึ่งราบกับพื้น และขาข้างหนึ่งเหยียดตรงไปด้านหน้า พร้อมกระดกปลายเท้าขึ้น 90 องศา ค่อยๆโน้มตัวไปด้านหน้า

ค้างไว้ในตำแหน่งที่รู้สึกตึง 10-15 วินาที ก่อนกลับมาสู่ท่าเริ่มต้น ทำซ้ำ 2-3 ครั้งในขาแต่ละข้าง และยืดกล้ามเนื้อท่านี้อย่างน้อย 2 ครั้งต่อวัน และควรทำทุกวัน

ท่าที่ 6 ท่ายืดกล้ามเนื้อน่อง และฝ่าเท้า

ท่าเริ่มต้น: อยู่ในท่ายืน

วิธีการ: หันหน้าเข้าหากำแพง วางเท้าพิงกำแพงโดยให้ส้นเท้าติดกับพื้น ค่อยๆโน้มตัวไปทางด้านหน้า

ค้างไว้ในตำแหน่งที่รู้สึกตึง 10-15 วินาที ก่อนกลับมาสู่ท่าเริ่มต้น ทำซ้ำ 2-3 ครั้งในขาแต่ละข้าง และยืดกล้ามเนื้อท่านี้อย่างน้อย 2 ครั้งต่อวัน และควรทำทุกวัน

ท่าที่ 7 ท่าเพิ่มความแข็งแรงของกล้ามเนื้อแขน

ท่าเริ่มต้น: นั่ง หรือยืน มือ 2 ข้างถือน้ำหนักขนาด 0.5 กิโลกรัม (ขวดน้ำขนาด 600 มิลลิลิตร ที่ใส่น้ำเต็ม)

วิธีการ: มี 4 ขั้นตอน

1. งอข้อศอกขึ้นช้าๆ

2. เหยียดแขนทั้ง 2 ข้างขึ้นเหนือศีรษะ

3. งอข้อศอกลงช้าๆ จนขวดน้ำแตะกลางหลัง ต่อจากนั้นเหยียดแขนขึ้นเหนือศีรษะ

4. ค่อยๆวางแขนลง กลับสู่ท่าเริ่มต้น

ทำ 10 ครั้ง และทำอย่างน้อย 2 ครั้งต่อวัน และควรทำทุกวัน

คณะผู้จัดทำ

ผศ. ดร.อุษณีย์ พึ่งปาน	อาจารย์ที่ปรึกษาโครงการวิจัย
นางสาวสลิลา เศรษฐไกรกุล	หัวหน้าโครงการ
นางสาวธีรพรรณ ประเสริฐธีรพงค์	นักกายภาพบำบัด
นายธุวานนท์ ชาญกิจจา	นักกายภาพบำบัด
นายศรัณยู ณัฐวัลลภ	นักกายภาพบำบัด
นางสาวอิคลาซียะห์ เปาะสาจิ	นักกายภาพบำบัด

ยืด-เหยียด-ขยับ-หยุด

ยืดกล้ามเนื้อเป็นประจำ

เหยียดส่วนต่างๆของร่างกายสม่ำเสมอ

ขยับร่างกายเบาๆบ้าง

เพื่อ**หยุด**อาการปวดเมื่อยกล้ามเนื้อ

Appendix F: Ergonomic brochure

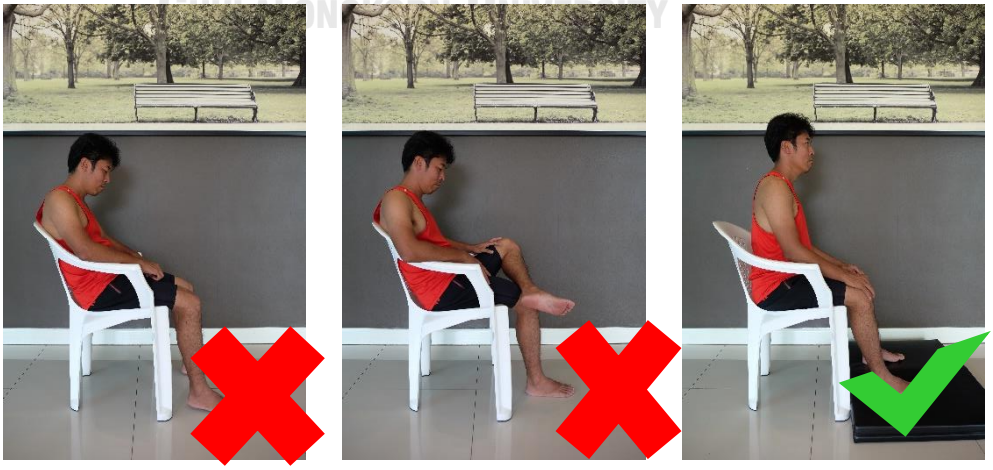
ท่าทางที่ถูกต้อง

การยืน

- อย่ายืนหลังค่อม และไม่ยืนห่อไหล่เพราะจะทำให้ปวดเมื่อยบ่าและลำคอ
- ให้ยืน ยืดตัวตรง ลงน้ำหนักขาสองขางเท่าๆกัน
- ไม่ควรยืนนานต่อเนื่องเกิน 30 นาที ควรเปลี่ยนแปลงท่าทางหรือยืดกล้ามเนื้อด้วย

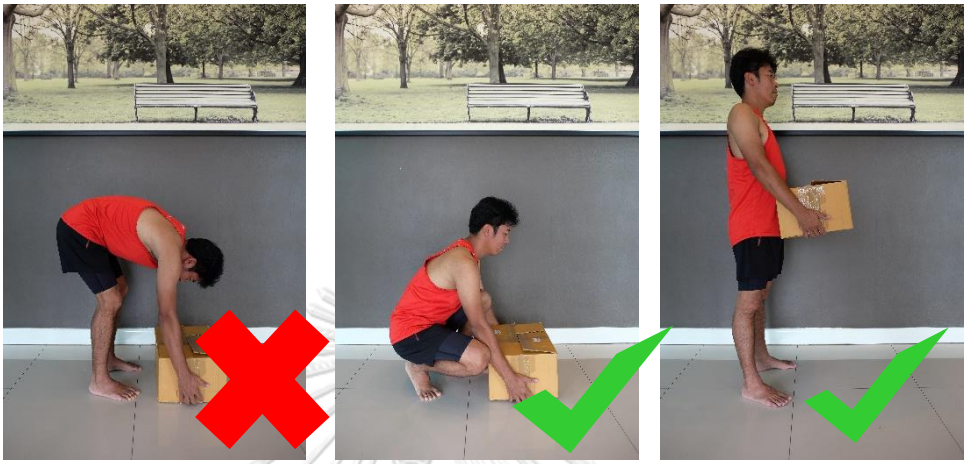
การนั่ง

- ให้นั่งหลังตรง และควรเลือกเก้าอี้ที่มีพนักพิงหลัง
- ความสูงของเก้าอี้ต้องพอดี โดยดูจากเมื่อนั่งแล้วเท้าทั้งสองสามารถวางราบกับพื้น และเข่าทำมุม 90 องศา
- ไม่ควรนั่งนานต่อเนื่องเกิน 30 นาที ควรเปลี่ยนแปลงท่าทางหรือยืดกล้ามเนื้อด้วย

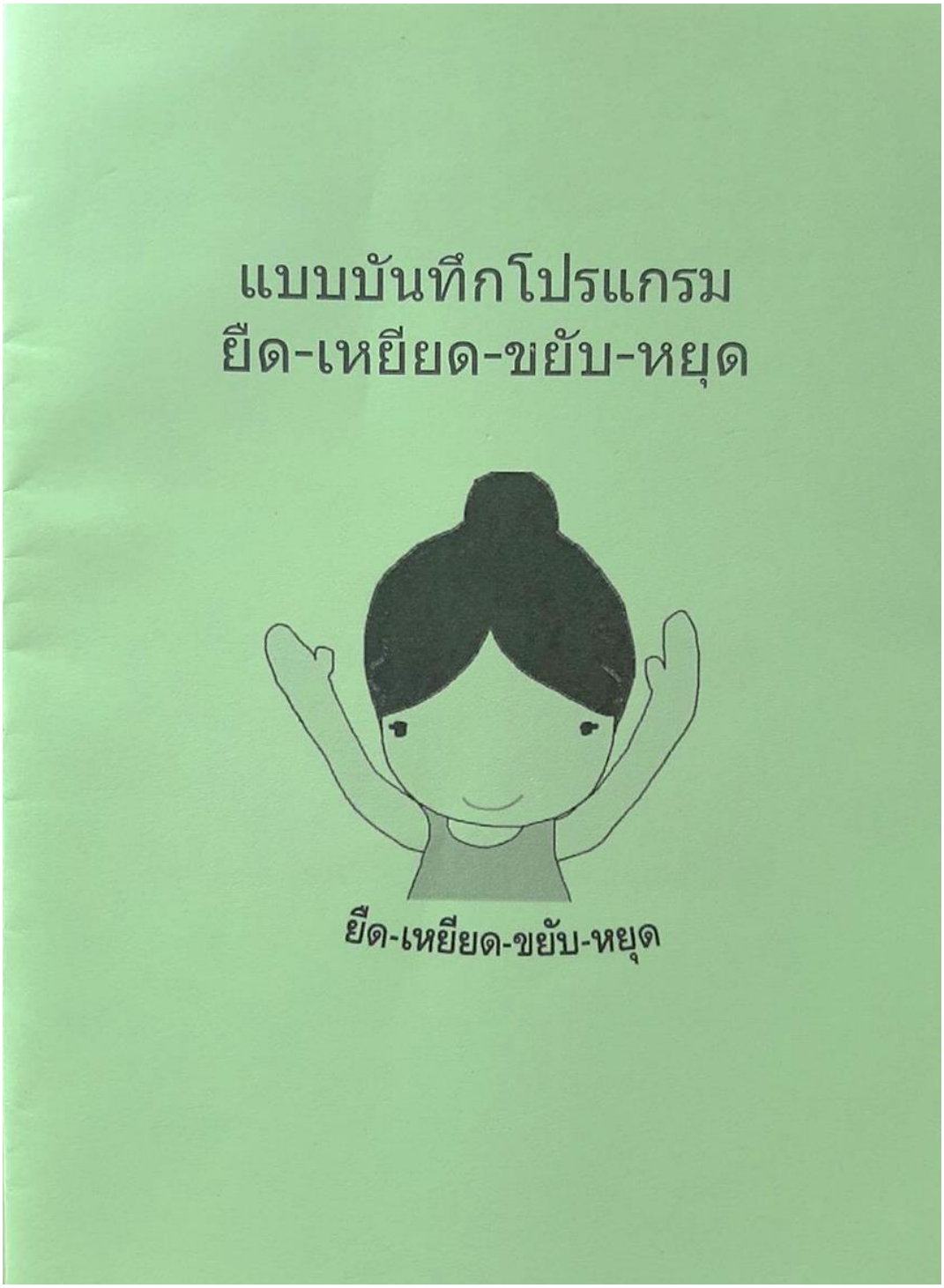


การยกของ

- ไม่ก้มหลังไปยกของ ให้ใช้วิธีย่อเข่าแล้วยกสิ่งของขึ้น
- หากสิ่งของมีความหนัก หรือชิ้นใหญ่ควรยกเกิน 1 คน
- หลีกเลี่ยงการผลัก หรือดันสิ่งของที่มีน้ำหนักมากๆ เพราะจะทำให้ปวดหลัง



Appendix G: Checklist exercise program booklet



การออกกำลังยืดเหยียดกล้ามเนื้อตามโปรแกรม ยืด- เหยียด-ขยับ-หยุด **<u>ควรปฏิบัติเป็นประจำทุกวัน อย่างน้อยวันละ 2 ครั้ง</u>**เพื่อช่วยลดอาการปวดเมื่อยกล้ามเนื้อที่เกิดจากการทำงาน

การยืดกล้ามเนื้อ ยืดไปจนถึงตำแหน่งที่ตึงที่สุด ค้างไว้ 10 วินาที ทำซ้ำ 3 ครั้ง

ท่ายืดกล้ามเนื้อจำนวน 6 ท่า

ท่าที่ 1

ท่าที่ 2

ท่าที่ 3

ท่าที่ 4

ท่าที่ 5

ท่าที่ 6

ท่าออกกำลังกายแขน ทำ 10 ครั้ง

โปรดยืดเหยียดกล้ามเนื้อตามโปรแกรม และกากบาท (×) ลงไปในวันที่ทำ และบันทึกอาการผิดปกติใดๆ (ถ้ามี)

เดือนสิงหาคม 2562

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

เดือนกันยายน 2562

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

เดือนตุลาคม 2562

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

เดือนพฤศจิกายน 2562

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

เดือนธันวาคม 2562

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

เดือนมกราคม 2563

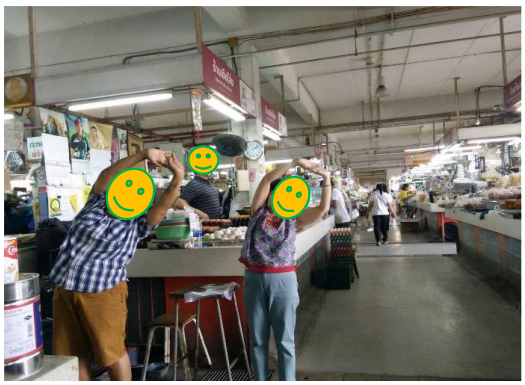
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

ขอบคุณค่ะ

Appendix H: Picture of data collection

A. Samyan Market

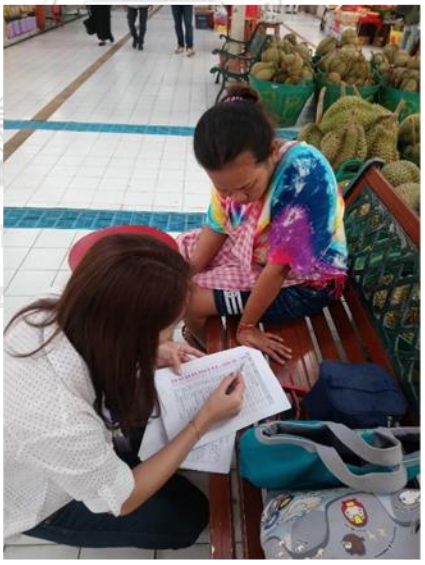
1. Conducting Self Static Stretching Strengthening program by physical therapists




คุณพักตร์พรรณอร ตัณยาธิคม (พร) ห้องพิเศษ 2
จำหน่าย ถุงร้อน PP ถุงเย็น PE ไฮเดรน HD PH พับจีบ จับล็อก
ถุงดำ หนังยาง ไมลองเทียม สินค้าเบ็ดเตล็ด ชั่วสารและยิบๆ
ขอขอบคุณทุกท่านที่มาอุดหนุน 02-214-0748, 089-480-7102
เปิดทุกวัน
07.00-17.00น.

2. Physical examination

B. Ortorkor Market



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AWARD RECEIVED	Outstanding students for the academic year 2019