

## CHAPTER 1

### INTRODUCTION

#### 1. Rationale

Weightlifting is a sport in which competitors attempt to lift heavy weights (1). Injuries in weightlifting, that are not only the soft tissue injuries, but also the spinal and discal injuries (2). The anatomical areas that can be at the high risk of injury for weightlifting include low back, knee and shoulder. The loads that used in weightlifting may put the back at risk of injury (2). The back injuries in weightlifting are dependent on mechanism of lifting and stability of spinal structures during the tasks. Stability and control mobility of core muscles are needed to reduce the risk of injuries in weightlifters (3, 4). To promote stability of the spine during performing the task, Panjabi's spinal stability concept should be recognized (5).

Concept of spinal stability consists of 3 components: First, the passive subsystem that consists of vertebrae, intervertebral discs, spinal ligaments, joint capsules, and the passive properties of the muscles. Second, the active subsystem that consists of active properties of muscles and tendons. Third, the neural subsystem that consists of proprioceptors and other neural control components (5, 6). These three subsystems work together to achieve stability during movement (5). Dysfunction of one or more of the stabilizing components results in an attempt to compensate by one or two of the other components in order to keep the spine stabilized (5, 6). Dysfunction of the passive subsystem may be due to mechanical injury or degenerative disorder. Compensation will follow in the active and neural subsystems which are only 2

components that can be trained and adapted (5-7). There are some evidence to show the link between lumbopelvic instability and low back pain. Much of the research in the area of LBP has focused in identifying altered recruitment patterns of trunk and back muscles (8). The correct recruitment pattern is important in order to provide stability to the lumbo-pelvic region before initiating movement. The stability of the lumbo-pelvic complex is generated mainly by deep muscles such as the transversus abdominis (TrA), the lumbar multifidus (LM), and internal oblique (IO) (9). Improving the stability of the lumbo-pelvic region especially in weightlifter population may help to prevent the musculoskeletal injuries and risks. It may also improve the recovery rate of tissue damage and symptoms among weightlifters. Therefore, it is a clear need for further investigation on this research question.

In addition, one of therapeutic managements for relieving back pain among athletes is sport massage. The sports massage is very popular especially in athletes, athletic trainers, coaches, as well as sports physiologists (10). Sport massage techniques are thought to produce local increase in skeletal muscle blood flow via several mechanisms including release vasodilators, and decrease reflex in sympathetic tone (10). It has been claimed by athletes and masseurs that sport massage can facilitate the healing process, reduce swelling, pain and muscle soreness (11). The mechanical action of the hands on cutaneous and subcutaneous structures may also promote blood and lymph circulations to supply oxygen and remove waste products or the mediators of pain (12-14).

Different sports also have different demands and use different groups of muscles and patterns. Therefore, it can not be generalized the result of sport massage for all

types of sports. Unfortunately, there have no research evidence determine the effects of sport massage in weightlifters.

The potential therapeutic effects for improving the perception of musculoskeletal pain may be the concept of using active strategy (i.e.,lumbopelvic stability training) as well as the passive strategy (i.e.,sport massage). However, there has no evidence to support the combination of these 2 strategies (active and passive) in improving musculoskeletal pain perception especially in high risk athletes population such as weightlifters.

Whether or not the sport massage in combination with lumbopelvic stability training can help to relieve pain, promote healing process or facilitate the recovery rate of musculoskeletal pain symptom in Thai national weightlifters is still unknown. This study may be helpful in management program, prevention of repetitive trauma and promotion of healing process. It may be part for excellence and success of Thai women national weightlifters.

## **2. Operational definition**

### **2.1 Lumbopelvic stability training**

Lumbopelvic stability training is core stability exercise that becoming common in management of rehabilitation. There are synonyms for core stability such as dynamic stabilization, lumbar stabilization, trunk stabilization, motor control (neuromuscular training), or neural spine control (15). Core stability exercise can improve lumbopelvic control by restore coordination, strength, endurance and control of trunk muscles. The local stabilizing system or the deep muscles are the stabilizers

of spine such as transversus abdominis (TrA), lumbar multifidus (MF), and internal oblique (IO) that work together for the stabilization mechanism. The stabilization mechanism involves the intra-abdominal pressure (IAP) and the thoracolumbar fascia (TLF) which associated with transversus abdominis (TrA) muscle contraction. During the contraction of transversus abdominis (TrA), the tension of thoracolumbar fascia will increase. Moreover, co-contraction between transversus abdominis (TrA) and lumbar multifidus (MF) muscle will enhance the increasing of intra-abdominal pressure (IAP) and limit the intersegment motion of spine (15). This mechanism will provide the core stabilization or the lumbopelvic stability.

### **2.1.1 The local stabilizing system (the deep muscles)**

#### **a) Transversus abdominis (TrA) muscles**

Transversus abdominis (TrA) is the deepest of the abdominal muscles that consists with the outer two abdominal layers (internal and external oblique). These muscles originate from the internal surface of the ribs, iliac crest, thoracolumbar fascia, and inguinal ligament and insert in the linea alba, pubic crest, and pectin pubis.

The function of transversus abdominis (TrA) is to stabilize the low back and pelvis before movement of the arms or legs. The transversus abdominis (TrA) helps to compress the ribs and viscera, providing the thoracic and the pelvic stability during dynamic movement and it also provides internal pressure for core stability.

b) Lumbar multifidus (MF) muscles

Lumbar multifidus (MF) is the deep layer of intrinsic muscles that originates from the ilium and sacrum, the transverse processes of T1-T3 and the articular processes of C4-C7 and insert into the spinous processes of all the vertebrae up to the axis. Lumbar multifidus (MF) are considered as a deep layer back muscles (i.e., superficial, intermediate, and deep). Lumbar multifidus (MF) plays a role as a synergist of transversus abdominis (TrA) during co-contraction to increase spinal segmental stabilization that has been shown to be active throughout a full range of motion of the lumbar spine and during movements of the lower and upper limbs.

c) Internal oblique (IO) muscles

Internal oblique (IO) is the intermediate muscle layer of the abdomen, lying just underneath the external oblique and just superficial to the transverse abdominal muscle. Internal oblique (IO) muscles originate from thoracolumbar fascia, inguinal ligament and posterior portion of the pubic crest and insert in the linea alba, the inferior border of ribs and the pubis. The internal oblique performs two major functions. First, it acts as an antagonist (opponent) to the diaphragm, helping to reduce the volume of the thoracic (chest) cavity during exhalation. Secondly, its contraction rotates and side-bends the trunk by pulling the rib cage and midline towards the hip and lower back of the same side. It acts with the external oblique muscle of the opposite side to achieve this torsional movement of the trunk.

Principle of core stability exercise to improve lumbopelvic stability is based on the neural adaptation concept of McGill (16) that a new motor skill consists of three stages of motor learning. First is the cognitive stage, second is the associative of learning stage, and finally is the autonomous of stage of learning.

### **2.1.2 The Fitts and Posner Three-Stage Model (Leaning Stages Model)**

#### **a) Cognitive stage**

Cognitive stage is the beginning or initial stage on the learning stage continuum that the beginner focuses on cognitively oriented problems. Additionally, the learner must engage in cognitive activity by listening to instructions and receiving feedback from the instructor. Performance during this first stage is marked by a large number of error and lack of consistency.

#### **b) Associative stage**

Associative stage is an intermediate stage on the learning stage continuum that McGill (16) referred to this stage as a refining stage. The learner will change the skill at this stage because the person has learned to associate certain environmental cues with the movement required to achieve the goal of the skill. The learner makes fewer and less errors. During this stage, performance variability begins to decrease and the learner acquires the capability to detect and identify some of their own performance errors.

### c) Autonomous stage

Autonomous stage is the final stage on the learning stage continuum. After much practice and experience, some people move into this stage that the skill has become almost automatic or habitual. Additionally, these skilled performers can detect their own errors and adjust to correct them.

#### **2.1.3 Evaluation of core stability**

Exercise for the transversus abdominis (TrA) and lumbar multifidus (MF) muscles is an important component in improving core stability. Therefore, the clinical tests and evaluation of core stability are important. However, it is difficult to directly measure the complex motion of the lumbopelvic region. So, the indirect method is appropriate for evaluate in both research and clinical settings.

Electromyography (EMG) techniques have been used for determining the characterized activation of core muscles such as transversus abdominis (TrA). Although, EMG can not be used comfortably in clinical setting because there are difficulty of recording deep muscle near abdominal cavity and EMG is inability to separate transversus abdominis (TrA) activity from the internal oblique (17).

Real-time ultrasonography which is a non-invasive technique, demonstrates a real-time ultrasound imaging (RTUI) of muscle activation. Real-time ultrasound imaging (RTUI) has been shown to be a reliable and valid technique to measure change in muscle geometry and can be used to assess and improve the activation of muscle. However, real-time ultrasonography is the expensive measurement and needs special skills for operating. It is not a simple non-invasive tool for clinical tests.

The non-invasive method using pressure biofeedback unit (PBU) has been induced to assess lumbopelvic stability clinically. Pressure biofeedback unit (PBU) consisted of pressure transducer and air fill reservoir. The stabilizer pressure biofeedback unit (PBU) has been used to monitor the lumbopelvic stability which detect in pressure changes. This non-invasive tool is inexpensive, reliable, and easily applied, therefore it is suitable to use for assess lumbopelvic stability. Hagins (18), Phrompaet (19), and Pansuwan (20) used of pressure biofeedback (PBU) protocols to assess the ability of trunk muscles for core stabilization. They found that it is reliable (ICCs = 0.86) and suitable for evaluating changes in both clinical and research setting.

## **2.2 Sport massage**

Sports massage is a manual technique that used widely among athletes in general approaches, such as preparation for competition, between competitions and recovery after competition. Coaches, athletic trainers, athletes, and sports physiologists believe that massage can provide several benefits to the body such as reduced muscle tension, improve blood and lymph circulation (10). In addition, sport massage may enhance performance and recovery, as well as promote relaxation through biomechanical, physiological, neurological and psychological mechanisms.

### **2.2.1 Promotional or event of the sport massage**

Promotional or event massage is usually given at events for amateur athletes that consist of pre-event, intercompetition, and post-event massage (21).



a) Pre-event massage

Pre-event massage or warm-up massage can be used to enhance the preparation of the body for physical activity. Sport pre-event massage should be general, nonspecific, light, and warming. The masseuses should avoid friction, deep or heavy strokes, and techniques should be pain-free.

1. To prepare muscle for exertion by increasing the circulation to specific areas and mobilizing soft tissue.
2. To aid warm-up effect that is about warming the body prior to activity.
3. Psychological effect to prepare mentally or decrease stress before competition.

b) Intercompetition

When there is prolonged competition it will be necessary to provide intercompetition massage. The techniques are short, light, and relaxing.

1. To promote recovery after exercise because there will be waste products in the tissues. Massage can stimulate venous and lymphatic return.
2. To refresh the competitor from the prolonged competition.
3. To prevent muscle cramp and spasm during the competition.

c) Post-event massage

Post-event massage or warm-down massage can reduce muscle tension and encourage relaxation. The massage techniques are heavy strokes for encourage

circulation. The masseuses should be aware of possible sprains, strains, and the inflammation.

1. To aid cool down effect that return the body to pre-exercise state as quickly and painless as possible.
2. To promote recovery after exercise and enhance the circulation and assist in removal waste products.

### **2.2.2 The most common form of massage used for athletes (10)**

#### **a) Effleurage**

Effleurage (stroking) is one of technique that more frequently used in sport massage. Effleurage is delivered with the hand following the body in a cephalad direction (towards the head). Effleurage is administered in the direction of lymph and venous flow. Light stroking effleurage is used at the beginning of a session or at the end of treatment that is implemented to induce relaxation.

#### **b) Petrissage**

Petrissage technique consists of muscle squeezing, wringing, picking up and specific kneading. This form of massage can have a stimulating or relaxing effect on a muscle depending on the rate and pressure of massage. Petrissage assists in the removal of metabolic waste products and improves circulation around tissues.

## c) Tapotement

Tapotement, also known as percussion, involves repetitive light striking movement to the skin with the ulnar portion of hand. This technique often performed for stimulating the muscle spindle or Golgi tendon organ that depending on location of treatment.

## d) Friction

Friction massage is a brisk that is administered either transversely or parallels to the fiber direction. Transverse or parallels directions are applied with the finger or thumb to localized region. This technique is often used to break down scar tissue, separate adhered tissue, increase local circulation, or reduce trigger point activity.

## e) Vibration

Vibration is a pre-event technique to stimulate the target muscle group prior to competition. The technique involves tremulous movement that shaking of the body region massage. The purpose of vibration is to stimulate muscle relaxation and increase circulation.

**2.2.3 Precaution of massage (21)**

- a) High temperature or fever (over 38.0 °c)
- b) Allergies (e.g. powder, oil, lotion)
- c) Acute infectious disease (e.g. measles, mumps)

- d) Recent head or neck injury
- e) Pregnancy
- f) Heart and circulatory disorder (e.g. blood clots, deep vein thrombosis, varicose veins)
- g) Undiagnosed lumps, bumps, swellings
- h) Severe bruising, open cuts or abrasions
- i) Dysfunction of the nervous system (e.g. Parkinson's, motor neuron disease)
- j) Cancer
- k) Epilepsy
- l) Rheumatism Arthritis
- m) Asthma
- n) Skin conditions (e.g. eczema, psoriasis, rash, sunburn)
- o) Severe fluctuate blood pressure
- p) Recent back surgery

### 3. Purposes of the study and hypotheses

Purposes:

To evaluate the effects of sport massage in combination with lumbopelvic stability training in perceiving of pain, blood circulation and lumbopelvic stability level among Thai women national weightlifters.

Hypotheses:

The sport massage in combination with the lumbopelvic stability training will decrease pain perception, improve blood circulation and lumbopelvic stability level greater than the sport massage condition.

#### **4. Advantages of the study**

The result of this thesis study may demonstrate the potential physiological effect of the sport massage and the lumbopelvic stability training. These will be the research evidence for better understanding the effect of these 2 methods (passive strategy: massage; active strategy: lumbopelvic stability training). The results from the current research will be useful in management program, prevention of repetitive trauma and promotion of healing process for Thai women national weightlifters. It may be part for excellence and success of Thai women national weightlifting.