PSYCHOLOGICAL AND NEUROPHYSIOLOGICAL EFFECTS OF QIGONG EXERCISE ON OLDER ADULTS WITH CO-OCCURRING DEPRESSION AND CHRONIC MEDICAL ILLNESS

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CERTIFICATE OF ORIGINALITY

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ABSTRACT

The present study explored the psychological effect and its underlying neurophysiological mechanisms of Qigong exercise in relation to its anti-depressive effect. Fifty-seven geriatric subjects with depression and co-existing chronic medical illness were recruited and randomly assigned to the experimental (Qigong) or comparison group (newspaper reading) for 12 weeks. Other than depression and psychological status, blood and saliva samples were collected for assessing serotonin and cortisol levels respectively as neurological biomarkers of depression. The results indicated that subjects practicing Qigong exercise were less depressed and showed significant improvement in self-efficacy and self-concept of physical wellbeing when compared to the newspaper reading group during the intervention period. A positive trend was demonstrated that salivary cortisol, but not blood serotonin, dropped more in the experimental group in the post-treatment. Among those with more severe depression, the reduction in cortisol reached significant level compared with the control. The results supported our hypotheses that Qigong exercise induced anti-depressive effect among older adults with mild to moderate depression with co-occurring chronic medical illness. This may be explained by the down-regulation of Hypothalamas-Pituaity-Adrenal (HPA) activity among those who were relatively more severe in their depression. Suggestions for clinical practice and further studies are made.

PUBLICATIONS ARISING FROM THE THESIS

Chong, C.S.M., Tsunaka, M., Tsang, H.W.H., & Chan, E.P., & Cheung, W.M. (2011). Effects of Yoga on Stress Management in Healthy Adults: A systematic review. *Alternative Therapies in Health and Medicine, 17,* 32-39.

Tsang, H. W. H., Chan, E. P., & Cheung, W. M. (2008). Effects of mindful vs non-mindful exercise interventions on people with depression: a systematic review. *British Journal of Clinical Psychology, 47,* 303-322.

Tsang, H.W.H., Tsang, W.W.N., Jones, A.M., Fung, K.M.T., Chan, A.H.L, Chan, E.P., & Au, D.W.H. (2012). Psychosocial, physical, and neurophysiological effects of a qigong exercise program on older adults with co-occurring depression and chronic medical illness. *Aging and Mental Health*, *0(0),* 1-13.

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CONTENTS

CHAPTER 1 INTRODUCTION

1.1 OVERVIEW OF THE STUDY

Depression presents a major life problem for older adults around the world (Bharucha & Satlin, 1997; Lebowitz et al., 1997) as it reduces their quality of life (Noel et al., 2004). Older adults with chronic illnesses are more likely to suffer from clinical depression (Anderson et al., 2001; Gonzalez et al., 1996; Hance et al., 1995; Leentjens, 2004; Tandberg et al., 1996; Wong et al., 2006). In Hong Kong, the prevalence rate of depression among the elderly is reported to be as high as 5%, which is equivalent to approximately 40 000 people (Depression in Elderly, 2004).

In order to address this predicament, standard forms of treatment such as medication and psychotherapy were employed (Nathan & Gorman, 2002). As the outcomes of mainstream therapeutic approaches such as antidepressants and cognitive-behavioral therapies are not always satisfactory (Settle, 1998; Stravynski & Greenberg, 1992), qigong exercise has been emerging as an alternative intervention (Sancier, 1996).

Previous studies by Tsang and his colleagues (2003; 2006) showed that older adults receiving regular qigong exercise would lead to an alleviation of their depression. Nevertheless, the biopsychosocial mechanism that underpins its clinical effect remains largely unknown. The present MPhil study is construed as the continuation of Tsang's studies which aims to explore the underlying psychophysiological pathways of the therapeutic effects of qigong exercise. The brains of patients suffering from depression have been well documented with irregular activities in the Hypothalamas-Pituaity-Adrenal (HPA) axis which result in an elevation of cortisol in the body. Moreover, neurobiological etiology of depression suggests that depression results from a deficiency of nor-epinephrine (NE) and serotonin (5-HT) (Hecimovic & Gilliam, 2006). This MPhil study therefore aimed at examining the impact of qigong exercise on the HPA axis and the serotonin level of older

adults with depression and chronic medical illness.

1.2 PURPOSE OF STUDY

This proposed study investigated the underlying psychological effects and the underlying neurophysiological mechanisms of qigong for older adults with co-occurring depression and chronic medical illness. The followings are the specific objectives:

1. To explore the outcomes of qigong on improving psychosocial and mental health of older adults with co-occurring depression and chronic medical illness.
2. To explore the neurophysiological mechanism of the anti-depressive effect of qigong.

1.3 SIGNIFICANCE OF STUDY

Geriatric depression is well known to be a significant public health problem (NIH, 1992). It poses an enormous financial burden to society due to costs pertaining to healthcare (Greenberg, Stiglin, Finkelstein, and Berndt, 1993). Clinical and research communities have been wrestling with the search for more effective interventions so as to relieve the societal burden. This study intended to obtain scientific evidence to support the use of qigong practice as an effective, safe, and economically affordable adjunct therapy for older adults with geriatric depression and chronic illness. Meanwhile, we explored the scientific basis of its clinical effects.

CHAPTER 2 LITERATURE REVIEW

2.1 DEPRESSION

Depression is a universal health problem with increasing prevalence and mortality rate which poses a serious threat to human being (Kasen, Cohen, Chen, & Castille, 2003). The World Health Organization (2004) has ranked depression as the fourth leading contributor to global burden of disease and projected and predict that it may escalate to rank second in year 2020. Individuals suffering from depression are overwhelmed with excessive unhappiness and diminished interest or pleasure in many daily activities (APA, 2000a). According to the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR; APA, 2000a), the major criterion for the diagnosis of major depressive disorders is depressed mood or a consistent loss of interest or pleasure in daily activities for at least a period of two weeks. Other symptoms include insomnia, fatigue, agitation, impaired concentration, and oversensitivity to unpleasant situations. The negative emotions may cause impairment in the person's normal relationship, life, social, and work activities. Details of other diagnostic criteria include:

1. Significant weight loss when not dieting or weight gain (e.g., a change of more than 5% of body weight in a month), or decrease or increase in appetite nearly every day. **Note:** In children, consider failure to make expected weight gain.
2. Insomnia or hypersomnia nearly every day.
3. Psychomotor agitation or retardation nearly every day (observable by others, not merely subjective feelings of restlessness or being slowed down).
4. Fatigue or loss of energy nearly every day.
5. Feelings of worthlessness or excessive or inappropriate guilt (which may be delusional) nearly every day (not merely self-reproach or guilt about being sick).

6. Diminished ability to think or concentrate, or indecisiveness, nearly every day (either by subjective account or as observed by others)
7. Recurrent thoughts of death (not just fear of dying), recurrent suicidal ideation without a specific plan, or a suicide attempt or a specific plan for committing suicide.

Depression is a major problem worldwide that affects the late life of individuals (Bryne & Pachana, 2010). Other depression symptoms that would occur to non-demented elderly people include cognitive impairments such as in attention, speed of mental processing, and executive function (Boone, Lesser, Miller et al., 1995; Kiosses, Klimstra, and Murphy, 2001; Lockwood, Alexopoulos, and van Gorp, 2002). The negative emotions may impair the person's normal relationship, life, and social activities. Depression is regarded as the foremost life problem for older adults (Bharucha & Satlin, 1997; Lebowitz et al., 1997). Literature shows that approximately 60% of completed suicides pertained to depression (Isometsä et al., 1995; Shaffer et al., 1996). Nonsuicidal mortality rate may also increase in elderly people who are suffering from depression (Blazer, Hybels, & Pieper, 2001). The risk of death over three years from depression could be increased by twofold. It is suggested depression may be related to increased mortality rate because of increased functional decline and physical illness (Blazer, 2004). Literature reveals negative impact of depression on their quality of life (Noel et al., 2004).

2.2 EPIDEMIOLOGY OF ELDERLY DEPRESSION

Epidemiological studies showed that 3% of the geriatric population worldwide suffered from major depression or dysthmyic disorder (Serby & Yu, 2003). A prevalence study on multiple samples collected from various European countries suggested that 13.5% of older adults suffered from clinically significant depression (Beekman, Copeland, and Prince,

1999). Most investigators reported the global prevalence of clinically significant symptoms to be between 8% and 16% in community samples (Blazer, 2004). Some investigators suggested that the incidence of geriatric depression is even higher in residential aged care settings (Barca, Engedal, Laks, & Selbaek, 2010).

In Hong Kong, a study revealed that the prevalence rate of depression of the elderly in Hong Kong was 5% which translated to approximately 40 000 people (Depression in Elderly, 2004). A large scale epidemiological study reported that the prevalence rates of depression in older Chinese men and women are 11% and 15% respectively (Chi et al., 2005). The causes of elderly depression are often related to loss and stress such as bereavement, retirement, relocation, and financial problem (Alexopoulos and Apfeldorf, 2004). Unfortunately, many symptoms of elderly depression are often neglected by health-care providers due to the bias against late life stressful events (Roose and Sackeim, 2004). Many rehabilitation and health care professionals assume that negative life events such as loss of spouse, relatives, friends, recreational role, deteriorating physical health are "normal" to older adults. Given this wrong assumption, the prevalence rate of geriatric depression may have been under-estimated.

According to Alexopoulos and Apfeldorf (2004), there are four major syndromes of late-life depression:

1. Unipolar major depression
2. Psychotic major depression
3. Depression due to general medical condition
4. Adjustment disorder with depressed mood.

Identification of unipolar major depression is based on the aforementioned diagnostic criteria of DSM-IV-TR. Elderly people suffering from severe depression may experience delusions or hallucinations. Research suggests that ordinary themes of depressive delusions include guilt hypochondriasis, nihilism, persecution, and jealousy. Diagnosis of depression due to general medical condition is limited to illnesses with known etiological agents linked to depression such as degenerative neurological disease, stroke, metabolic conditions, thyroid, parathyroid, adrenal diseases, autoimmune conditions, viral or other infections, and malignancies. Negative life events are significant contributors to depressive symptomatology and may cause adjustment problems among elderly people (Baumgarten, Battista, Infante-Rivard, Hanley, Becker, and Gauthier, 1992).

2.3 CHRONIC MEDICAL ILLNESS AND DEPRESSION

Chronic medical illness is regarded as an etiological factor in the development of depression for elderly people (Blazer, 1998). People with chronic medical conditions are more vulnerable to depression (Noel et al., 2004). Chronic medical illness is defined as "irreversible presence, accumulation, or latency of disease states or impairments that involve the total human environment for supportive care and self-care, maintenance of function, and prevention of further disability" (Curtin & Lubkin, 1995, pp. 6,7). Older adults with chronic medical conditions are more prone to depression (Noel et al., 2004). Examples include Parkinson's disease (7.7% to 25.0%), diabetes (11.0%-26.0%), cardiac diseases (25.0%), and respiratory diseases (7.0%-42%) (Anderson, Freedland, Clouse, & Lustman, 2001; Gonzalez et al., 1996; Hance, Carney, Freedland, & Skala, 1995; Leentjens, 2004; Tandberg, Larson, Aarsland, & Cummings, 1996; Wong, Woo, Lynn, Leung, Tang, & Leung, 2006). Conversely, depression increases the risk of developing chronic medical illnesses. It increases the risk of coronary heart disease and diabetes (Penninx, Guralnik, Ferrucci, Simonsick, Deeg

& Wallace, 1998; Wells et al., 1989; 1999; Rugulies, 2002; Carnethon, Gidding, Nehgme, Sidney, Jacobs, & Liu, 2003) and suicidal attempt (Chiu et al., 2004; Szanto, Prigerson, Houck, Ehrenpreis, & Reynolds, 1997). Such chronic conditions usually lead to functional impairments which in turn magnify the level of depression (Chou & Chi, 2005). All of the above have a substantial negative impact on their quality of life. Many resources are thus needed for social and health care services which result in social and economic burden to society (Simon et al., 2000). In U.S., depression has incurred a cost of 50 billion per annum due to healthcare, suicide, and workplace (Greenberg, Stiglin, Finkelstein, & Berndt, 1993). The above etiological factors and consequences of depression in elderly with chronic medical illnesses are summarized in Figure 1 (Tsang, Cheung, & Lak, 2002).

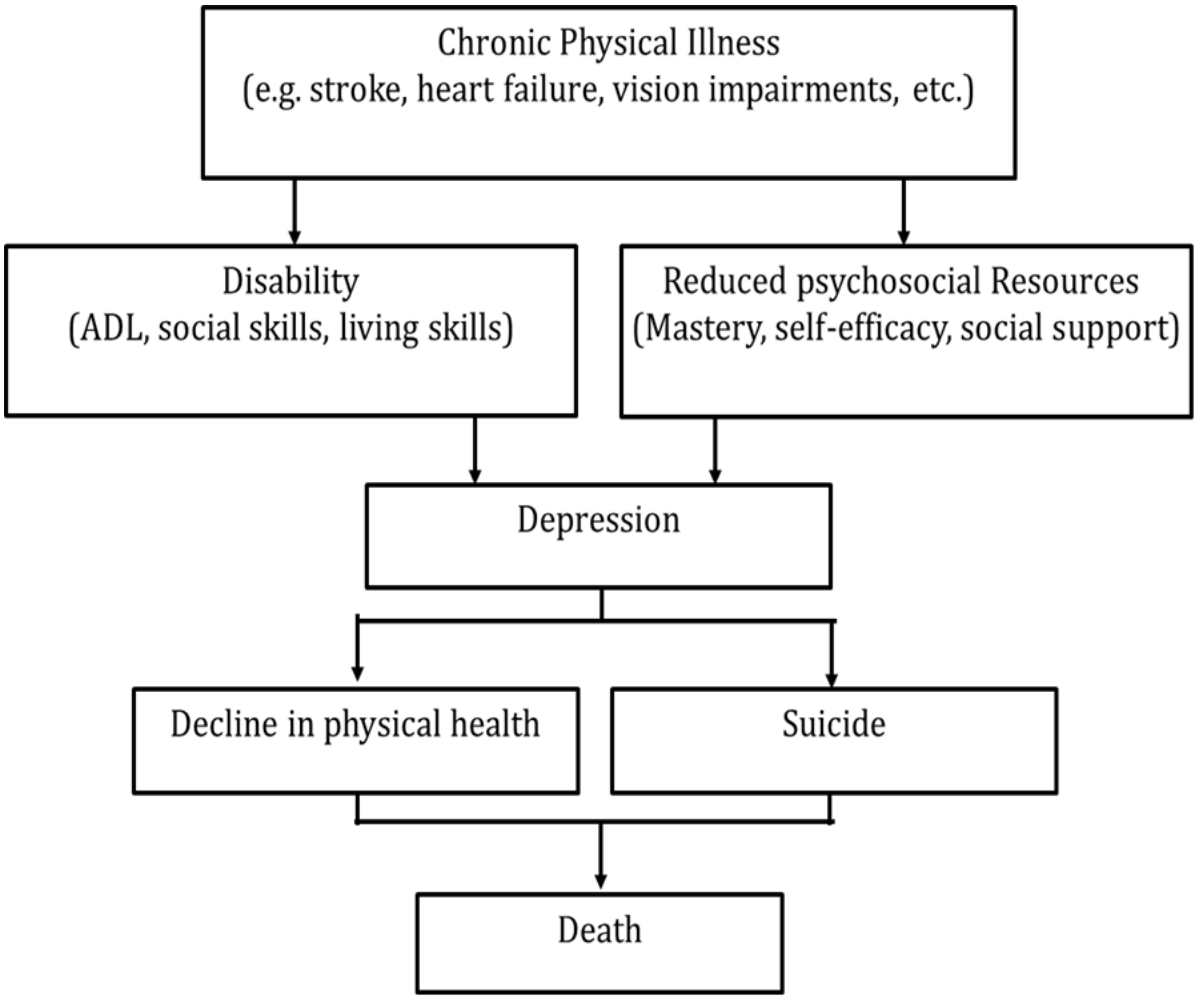

Figure 1. Etiology and Consequences of Depression in Elderly with Chronic Physical Illness (Tsang, Cheung, & Lak, 2002)

2.4 CONVENTIONAL TREATMENT FOR DEPRESSION

Standard forms of treatment for depression mainly consisted of medication and psychotherapy (Nathan & Gorman, 2002). Psychotherapy, antidepressants, and electroconvulsive therapy are the most commonly adopted interventions for depression (Patel, Araya, and Bolton, 2004). Antidepressant medications such as tricyclic antidepressants (TCAs) and selective serotonin reuptake inhibitors (SSRIs) are often prescribed to treat older adults with depression despite the problems of poor compliance and

side-effects (Johnson, 1973; Thompson et al., 1982; Furukawa et al., 2002). Elderly patients with basal ganglia hypersensitivity who are treated with antidepressant medications may be prone to develop delirium (Figiel, Krishnan, Breitner, and Nemeroff, 1989). Chronic use of benzodiazepines may cause sleep disturbance to older adults (Newman, Enrigt, Manolio, Haponik, and Wahl, 1997). Salzman (2004) suggested that side effects, especially headache and sedation, are common in the elderly population due to age-related factors. This may be related to the structural and functional changes in the aging central nervous system (CNS) which may increase the physiological sensitivity to drugs. In addition, drug therapy was found to increase the risk of suicidal thinking, feeling, and behavior in children, adolescents, and young adults (Friedman & Leon, 2007). Tricyclic antidepressants may cause alteration of cardiovascular function in elderly people, and increase the risk of death by producing symptomatic rhythm disturbance (Roose et al., 1986, 1987; Salzman, 2004). Recent research efforts have also revealed that the use of antidepressant medication would increase the risk of bone loss for elderly, which indirectly jeopardize their physical wellness (Diem et al., 2007; Haney et al., 2007).

Similarly, reviews on psychotherapy such as cognitive behavioral therapy (CBT) have demonstrated inconsistent results in treating depression (Gloaguen, Cottraux, Cucherat, and Blackburn, 1998; Parker et al., 2003). The efficacy of psychotherapy is often reduced by poor attendance and premature termination (Ogrodniczuk, Piper, and Joyce, 2006). A meta-analysis concluded that cognitive therapy failed to demonstrate superior efficacy in treating depression (Wampold, Minami, Baskin, and Callen Tierney, 2002). Gatz et al. (1998) remarked that psychotherapy should not be considered an evidence-based treatment for elderly people.

More importantly, the relapse and remittance rates of depression ranged from 50% to 80% (Alexopoulos & Apfeldorf, 2004). These figures clearly demonstrated the

unsatisfactory results of mainstream interventions. As a result, researchers and clinicians have been looking for effective adjunct therapies that may improve the problem of depression.

2.5 ALTERNATIVE TREATMENT FOR DEPRESSION

Among the array of possibilities, physical exercise is a promising approach as an alternative to conventional treatment. As to the elderly population, physical exercise has the advantages of improving health condition, increasing opportunities for social contacts, increasing cerebral function, enhancing mood, increasing self-esteem, and improving self-efficacy (Shephard, 1990). Apart from physical health (Sancier, 1996; Lee, Lee, Choi, & Chung, 2003; Duncan et al., 2003; Brenes et al., 2007), it has been shown to have positive effects on relieving depressive symptoms. For the past few decades, a number of studies have examined the effects of physical exercise on depression (Martinsen, Medhus, and Sandvik., 1985; Weyerer, 1992; Singh, Clements, & Fiatarone, 1997; Pollock, 2001; Sexton, Sogaard, & Olstad, 2001; Tsang et al., 2002; Trivedi, 2006). Some studies reported that structured physical exercise programs have positive effects on depressive symptoms (Martinsen, 1989; Barbour & Blumenthal, 2005; Dunn et al., 2005). Participants in the physical exercise group were reported to be more likely for partial or full recovery, and less likely for relapse as compared to the medication group (Babyak et al., 2000). A few clinical trials reported that the outcomes of physical exercise intervention are as effective as traditional pharmacological treatments (Blumenthal et al., 1999; Janakiramaih et al., 2000). The advantages of physical exercise as a low cost intervention and with minimal side effects qualify itself to be a promising adjunct therapy for people with depression.

2.6 MINDFUL EXERCISE

Mindful physical exercise is a special kind of physical exercise with an additional element on the state of mind. It has recently emerged as a therapeutic intervention for improving psychosocial well being of individuals. According to IDEA Mind-body Fitness Committee (1997-2001), mindful physical exercise is characterized by "*physical exercise executed with a profound inwardly directed contemplative focus"*. Physical exercise is considered mindful if it: (a) has a meditative/contemplative component that is noncompetitive and non-judgmental; (b) has proprioceptive awareness, which involves low- to moderate-level of muscular activity with mental focus on muscular movement; (c) is breath-centering; (d) focuses on anatomic alignment, such as spine, trunk, and pelvis, or proper physical form; and (e) concerns energy-centric as awareness of individuals' flow of intrinsic energy, vital life force, qi, etc. (Forge, 2005).

Combining all of the above components, mindful physical exercise has been shown to provide an immediate source of relaxation and mental quiescence (Forge, 2005). Scientific evidence shows that medical conditions such as hypertension, cardiovascular disease, insulin resistance, depression, and anxiety disorders respond favorably to mindful physical exercises (Khalsa, 2004). Systematic reviews suggested that mindful physical exercise is effective in alleviating stress related disorders (Chow & Tsang, 2007; Tsang, Chan, & Cheung, 2008). Our review (Tsang, Chan & Cheung, 2008) found that all of the 12 reviewed randomized controlled trials (RCT) showed positive therapeutic effects on depression and depressive features. By comparing various forms of mindful exercise such as qigong and yoga, we discovered that the therapeutic effects of mindful exercise on depression were as effective as medication and electroconvulsive therapy (ECT). Another review of complementary and alternative medicine (CAM) for psychological symptoms reported that mind-body interventions are effective in treating depression, anxiety, and insomnia in their 10 out of 12

selected studies (Meeks et al., 2007).

With the above framework, Yoga and Qigong are two major streams of mindful physical exercise. The principle of Yoga is to achieve integration of mind, body, and spirit. Hatha Yoga is a branch of Yoga, requiring vast repertoire or physical postures during sitting, standing or lying on the floor, along with specific breathing patterns. Other than physical movement, participants are required to maintain a "homeostasis" of mind and body, which refers to the relaxation of body tension with quieting of thoughts. Similarly, Qigong exercise is a system of self-practicing physical exercise which includes healing posture, movement, self-massage, breath work, and meditation. All forms of Qigong are featured on balance, relaxation, breathing, and good posturing. The movements of Qigong are executed at very low energy expenditure levels. Specific breathing pattern applies to Qigong. The breathing style of Qigong is slow and deep, in order to achieve body relaxation, clearing of mind, and additionally maintenance of health. Figures 2 illustrates the essential therapeutic components of Qigong exercise. The previous study by Tsang et al. (2003) suggested that Chinese older adults are more resistant to exercise therapy with a western cultural origin (e.g. Yoga). In contrast, clinical observation supported that Qigong is more attractive and acceptable among Chinese elderly people. In order to enhance cultural compatibility, Qigong exercise was selected for this current study.

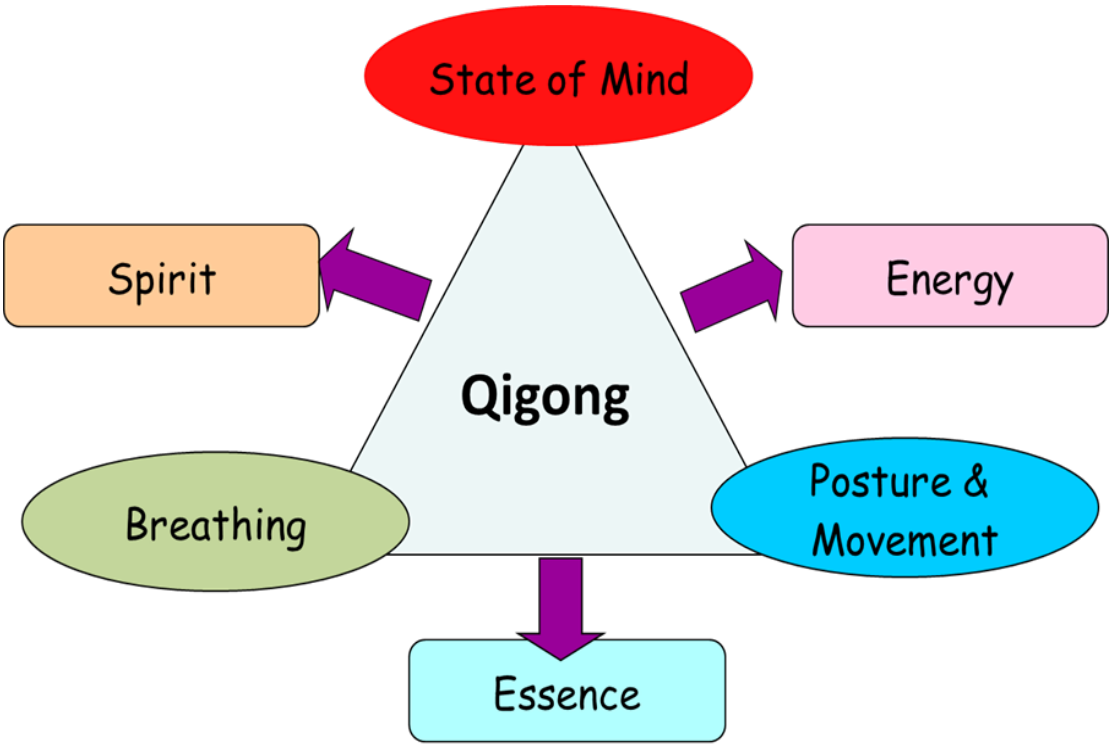

Figure 2. The Essential Therapeutic Components of Qigong Exercise

2.7 QIGONG AS COMPLEMENTARY AND ALTERNATIVE MEDICINE

Tsang, Cheung and Lak (2002) made a comprehensive historical review on Qigong. Based on their description, Qigong has a long history with diverse schools in China. According to Zhang (1990), Qigong has various names such as Xingqi, Promoting and conducting qi; Fuqi, Taking qi; Tuina, Expiration and Inspiration; Daoyin, Inducing and conducting qi; Anqiao, Massage; Shushu, breath-counting; Zuochan, Sitting Meditation; Shiqi, Living on qi; Fingzuo, Sitting Still; Wogong, Lying Exercises in ancient times. Qigong has a history of several thousand years with its origin in 2357–2256 BC. In the times of Yao, people realized that dancing could promote and strengthen a person's health. Lu's Spring and Autumn Annals stated that dancing was created accordingly to remove stagnancy and obstruction of the body. Some dances were then developed gradually into physical and breathing therapies that constituted the earliest forms of Qigong. In the process of fighting

against nature, ancient people realized that certain actions, breathing, and sounds had regulating effects on functions of the human body. For example, extending the limbs could dissipate heat, huddling up the body could defend against cold. In Zhou Dynasty (11th century BC–771 BC), there were records of Qigong on ancient bronze objects. Lao Zi and Zhuang Zi, philosophers of the 6th century BC, mentioned that blowing and puffing, exhaling and inhaling, getting rid of the stale and taking in the fresh, contracting like the bear and stretching like the bird, all helped prolong life. Jade Pendant Inscription on Qigong, a historical relic of the early Spring and Autumn and Warring States periods (770 BC–221 BC), recorded the training method and theory of Qigong. Among the historical relics unearthed from the Han Tomb at Mawangdui, Changsha in the Hunan Province of China, there was a silk painting of Daoyin Illustration from the early Western Han Dynasty period (202 BC–220 AD). It displayed 44 colored Daoyin illustrations which showed exercises for inducing, promoting and conducting qi. In the Han Dynasty, *The Yellow Emperor's Classic of Internal Medicine*, the earliest general medical collection in China, expanded Qigong's principle, training methods, and effects. Zhang Zhongjing, an outstanding physician of the Han Dynasty, documented the use of Qigong in treating diseases. His contemporary, renowned physician Hua Tuo developed a set of fitness exercises called 'The Five-Animal Play' (Wuqinxi), which mimicked the movements and gestures of the tiger, deer, bear, monkey, and bird to better circulate blood and prevent diseases.

Other records on Qigong are found in different dynasties. In modern times, a Qigong sanatorium was founded in 1955 in the city of Tangshan in Hebei Province to study the clinical effects of Qigong therapy. In 1959, the Ministry of Public Health of the People's Republic of China held the First National Meeting to exchange experience in Qigong in Beidaihe in Hebei Province. Since 1978, scientific research methodogy has been adopted in Beiging and Shanghai to study Qigong.

Qi was stated as the function of the tract-channel system of the human body to promote a normal passage or circulation of blood and qi according to *The Yellow Emperor's Classic of Internal Medicine* (Huang Ti Nei Jing). It has been practiced for more than two thousand years in China. The term Qigong was created in the 1950s. It is an art for both the body and mind which takes many forms and styles. Although it is difficult to define Qigong, there is no doubt that the basic components include concentration, relaxation, mind exercises, breathing exercises, body posture, and movement.

According to Dong and Esser (1990), Qigong is an ancient Chinese system of 'breathing' or 'vital energy' mind control exercise that has positive effect on health. They think that Qigong is the collective name for many ancient Chinese exercises that allow people to gain control over qi which could be regarded as the life energy distributed through invisible channels in the body. Practice of Qigong can help prevent and cure diseases, increase strength, resist premature senility, and ensure long life. For the concept of qi, the literal translation is air or breath. In many ancient Chinese medical texts, qi was conceptualized as the air found in nature and inside the body. The Emperor's Classic states that 'true qi comes from the heavens, and is further nourished by acquired qi which fills the body'. A person's true qi is therefore composed of yuan qi, which exists when a person is born, and jing qi, which is acquired from the environment substances such as food, water or air. Li and Sun (1997) claimed that Qigong is designed to train and direct qi of the body through physical and mental exercises. A human associates the mind with certain postures and breathing movements to regulate the function activities of the body and maintain a dynamic equilibrium. They have tried to explain the term Qigong as 'to work with qi.' It is a method to regulate the body, breathing and mind. Regulation of body refers to the adjustment of body postures and relaxation exercises; regulation of breathing refers to respiration exercises and the conducting of qi; and regulation of mind refers to managing mental

activities and exercising concentration and relaxation of the mind.

Qigong can be both simple and complex. It is difficult to give a clear definition of Qigong, but it is possible to identify the common features of it (Brown and Knoferl, 2001). They identified three main features of Qigong: posture and movement, state of mind, and breathing. The aim of practicing Qigong is to cultivate qi to help the organism stay healthy and vital. In China, health and longevity are determined by strength, balance and cultivation of the three treasures: jing (essence), qi (energy) and shen (spirit). Qigong focuses on these three treasures to represent a holistic view of the human being.

Zhang (1990) stated that Qigong is the art of training qi. It is a kind of physical and mental self-exercise bringing into play the subjective initiative. The practitioner associates his/her mind, postures and breathing, and acts on the whole organism to achieve the aim. People tried to classify Qigong based on different training methods. There are five major traditions of training in Qigong: Taoist, Buddhist, Confucian, medical and martial arts. In actual practice, many of these schools overlap. The Taoist school lays emphasis on the training of both the body and the mind which stress the relation between the individual and the environment. The Buddhist school gives precedence to the cultivation of the mind and the moral will. The Confucian school emphasizes setting the conceptual mind right, honesty of higher thought, and altruism. The medical school of Qigong training aims chiefly at curing illness with an ultimate aim of hygiene and the prolongation of life. The martial arts school aims at strengthening of the body to resist attack and teaching of striking the enemy for protection. As far as the training methods are concerned, Qigong can be divided roughly into two categories: Static Qigong and Dynamic Qigong. Static Qigong is also called Jing Gong or Passive Qigong. Static Qigong is done mostly sitting, lying down and standing. There is hardly any outer movement and it is an internal body training approach with physical stillness without physical body motion which focuses on relaxation, stillness, mind concentration and

breath-counting. Dynamic Qigong is also called Dong Gong or Active Qigong. Dynamic Qigong is done mostly standing or moving, occasionally sitting. There is outer movement, which is balanced by inner stillness and centeredness. It focuses on the coordination among movement, a quiet state of mind, and breathing.

In 2001, the Chinese government showed great interest in regulating Qigong. The State Sport General Administration of China founded the Chinese Health Qigong Association and presented the newly developed four Health Qigong exercises with research cooperation with the Peking Sport University. The four recognized Health Qigong exercises are:

- Yì Jīn Jīng (Tendon-changing Classic),
- Wu Qin Xi (Frolics of Five Animals),
- Liu Zi Jue (The Art of Expiration in Producing Six Different Sounds),
- Ba Duan Jin (The Eight-Section Brocades)

The rationale of Qigong promotion is to fulfill people's needs of promoting their physical and mental health, and to develop traditional Chinese national culture further.

Qigong has recently been widely applied in medicine as an alternative treatment for conditions ranging from hypertension, stroke, heart function, microcirculation, to mental disorders (Sancier, 1996). A randomized controlled study found that Qigong was effective in treating patients with long-term neck pain and decreased disability caused by the pain (Lansinger, Larsson, Persson, and Carlsson, 2007). In the past decade, a growing body of evidence showed that Qigong was effective in alleviating depression (Cheung et al., 2005; Hui, Wan, Chan, & Yung, 2006; Kjos & Etnier, 2006). Recent review also showed that Qigong was effective in alleviating depression (Tsang, Chan, & Cheung, 2008). The study by Tsang et al. (2003) using Baduanjin found that Qigong enhanced self-perception in

psychosocial health of elderly with chronic physical illness. Another RCT (Tsang, Fung, Chan, Lee, & Chan, 2006) demonstrated that depressed elderly people showed significant improvement in mood, self-efficacy and personal well being, and physical and social domains of self-concept after eight weeks of regular Qigong practice. Moreover, the improvement was shown to generalize to the daily tasks domain of self-concept after 16 weeks of Qigong practice. The primary and secondary effects of Qigong practice are illustrated in Figure 3. Similar findings are also obtained in other research groups (Cheung et al., 2005; Hui, Wan, Chan, & Yung, 2006; Kjos & Etnier, 2006).

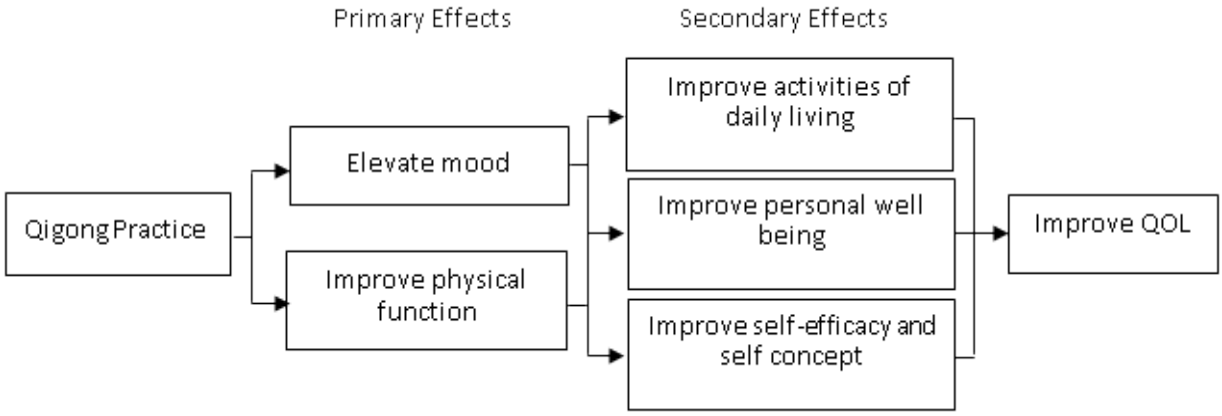

Figure 3 The Primary and Secondary Effects of Qigong Practice

This study is an extension to the previous study by Tsang et al. (2003; 2006). As previous studies have found that the Eight-Section Brocades, a recognized Health Qigong, is less physically and cognitively demanding compared to other forms of Qigong exercise such as Tai Chi (Tsang et. al, 2002; 2003; 2006), it remains to be used as the intervention protocol in this study.

The Eight-Section Brocades first appeared in Tao Hung-ching's record on Cultivating Longevity. It is thought that Chung-li chuan, who studied with Tao, had received the

transmission of these eight forms and revised them as the Eight-Section Brocades. Other theories suggest that the Eight-Section Brocades is a collection of various Daoyin exercises. Eight-Section Brocades has two training methods: the Sitting-Style Eight-Section Brocades and the

Standing-Style Eight-Section Brocades. From a clinical point of view, this can be practiced by more vulnerable people who have poor standing balance or who are wheelchair-bound.

The Standing-Style Eight-Section Brocades are:

1. Prop Up the Sky with Both Hands to Regulate the Triple Warmer

   兩手托天理三焦

2. Draw a Bow on Both sides like Shooting a Vulture

   左右開弓似射鵰

3. Raise Single Arm to Regulate Spleen and Stomach

   調理脾胃須單舉

4. Look Back to Treat Five Strains and Seven Impairments

   五勞七傷往後瞧

5. Sway Head and Buttocks to Expel Heart-Fire

   搖頭擺尾去心火

6. Pull Toes with Both Hands to Reinforce Kidney and Waist

   兩手攀足固腎腰

7. Clench Fists and Look with Eyes Wide Open to Build up Strength and Stamina

   攢拳怒目增氣力

8. Rise and Fall on Tiptoes to Dispel All Diseases

   背後七顛百病消

2.8 NEUROPHYSIOLOGICAL MECHANISMS OF ITS ANTIDEPRESSIVE EFFECT

It has been suggested that neuroanatomical and functional abnormalities are more frequent in elderly people suffering from major depression (Sackeim, 2004). Apart from psychosocial perspective, psycho-physiological research (Lee, Kang, Lim, & Lee, 2004) suggested that Qigong reduced stress via its effect on suppressing plasma concentrations of corticotrophin, cortisol, and aldosterone of the participants. A recent review (Ng & Tsang, 2009) suggested that Qigong had positive effects on the physiological system by increasing the number of white blood cells and lymphocytes, stroke volume, lowering of total cholesterol, systolic and diastolic blood pressure etc. Another study suggested participants who practiced Qigong were found to have significant reduction of inflammation indicated by inflammation biomarker - c-reactive protein (Oh, Butow, Mullan, & Clarke, 2008).

Based on earlier research and clinical observation, Tsang and Fung (2008) postulated three plausible psychobiological pathways that may explain the stress reduction and anti-depressive effect of Qigong. First, Qigong increases the supply of tryptophan that leads to an increase in brain serotonin synthesis and release, which then exerts a similar effect to serotonin selective reuptake inhibitors (SSRI). Second, the mindful relaxation effect of Qigong reduces stressful signals to the limbic system which thus down-regulates the Hypothalamic-pituitary-adrenal axis (HPA) activity and further decreases the release of adrenal glucocorticoid. Third, reduction of stress from Qigong exercise leads to up-regulation of Brain-derived Neurotropic Factor (BDNF) and down-regulation of adrenal cortisol. The study tested the first two hypotheses proposed by Tsang and Fung (2008). Figure 4 summarized the three plausible psychobiological pathways that may explain the stress reduction and anti-depressive effect of Qigong.

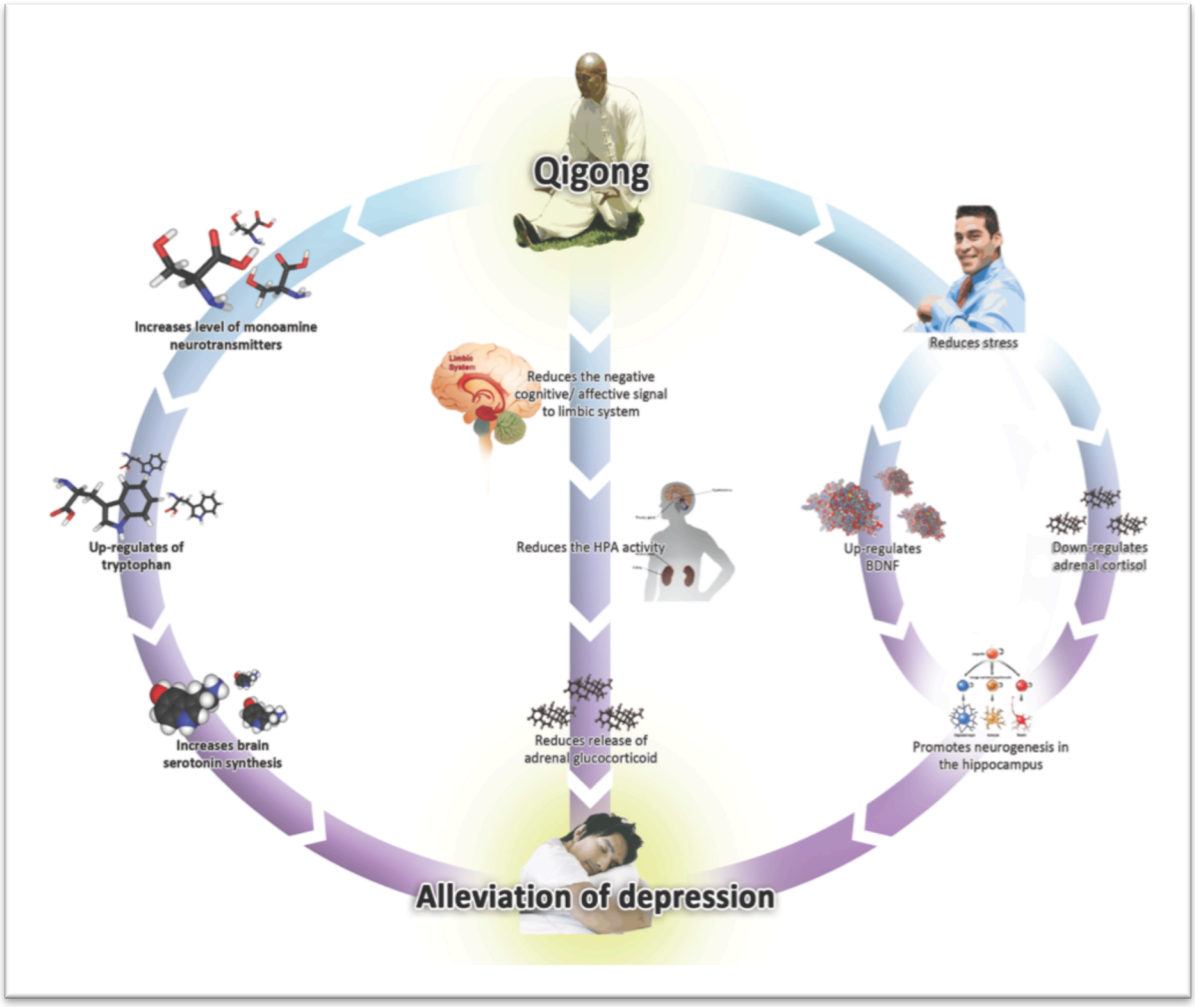

Figure 4 Three Plausible Psychobiological Pathways that may Explain the Stress Reduction and Anti-depressive Effect of Qigong

2.9 THE MONOAMINE HYPOTHESIS

Studies by Tsang et al. (2006) showed that the effect of Qigong was similar to classical anti-depressants and serotonin selective reuptake inhibitors (SSRI) (Stahl, 2000) in that the effect would manifest in a couple of weeks and fade away when the intervention ceased. Such phenomenon prompted us to hypothesize that the effect involved the monoamine neurotransmitters. The monoamine hypothesis is well accepted as the essential neurobiological etiology of depression which suggests that depression results from a deficiency of nor-epinephrine (NE) and serotonin (5-HT) (Hecimovic & Gilliam, 2006). Anti-depressants act by increasing their level in the synapse of neurons in relevant

neuropathways. As a result, the first hypothesis is that Qigong increases the level of monoamine neurotransmitters in the brain of participants. This parallels the conclusions of systematic reviews of available evidence on exercise literature (Arent, Landers, & Etnier, 2000; Sjosten & Kivela, 2006). Johnsgard (2004) suggests that exercise increases the supply of tryptophan by our brain. Coupled with the induced free fatty acid release, it has the effect of up-regulating the circulating levels of tryptophan in the bloodstream. The outcome is that exercise allows more tryptophan to enter the brain tissues. Animal and human studies on the other hand suggest that increased level of tryptophan as a consequence of exercise results in increased brain serotonin synthesis and release which mirrors the effect of SSRIs. A study by Kiive et al. (2004) showed that the plasma prolactin concentration in depressed patients increased after acute exercise which provided preliminary evidence to the hypothesis that exercise up-regulates serotonin level.

2.10 HYPOTHALAMIC-PITUITARY-ADRENAL AXIS AND DEPRESSION

The HPA axis is a stress responsive system containing feedback loops and forward-stimulating arms to regulate the production of glucorticoids. In well-functioning individuals, stress perceived by the limbic system will trigger off signals to neurons in the paraventricular nucleus (PVN) of the hypothalamas to secrete corticotropic releasing factor (CRF) which then stimulates the release of adrenocorticotrophic hormone (ACTH) from the anterior pituitary gland. ACTH stimulates the synthesis and release of glucocorticoids, particularly cortisol, from the adrenal cortex which is essential for the body to prepare for the fight or flight reaction in face of stress. In addition, the HPA axis is implicated in mood regulation and cognitive functioning (Keller, Buckley, and Schatzberg, 2004). Cortisol in the bloodstream, under usual physiological conditions, exercises a negative feedback on the HPA axis which inhibits its further release via the hippocampus (Tsang and Fung, 2008). In

depression, the negative feedback is impaired probably due to the reduction in glucocorticoid receptor sensitivity (Modell, Yassouridis, Huber, & Holsboer, 1997). This leads to an excessive activation of the HPA axis and increased glucocorticoid release into the body. It is suggested that disruption of glucocorticoid levels results in disturbance of cognition, mood, neurophysiological changes, neurotransmitter activity alteration, and neuroanatomical changes (Sapolsky et al., 1985, 1986). Recent study confirmed that over-secretion of ACTH and cortisol secretion is related to the presence of depression (Stahl, 2000). Prolonged increased concentration of glucocortocoids resulting from depression is harmful and may damage the hippocampus. A recent review (Herbert et al., 2006) suggested that increased glucocorticoids and hippocampus atrophy may be associated with the expressions of 5-HT receptors which may account for the manifestations of depressive symptoms. It is in line with volumetric studies on the brain which showed a significant loss in the volume of hippocampus in people with depression (Bremner et al., 2000; Sheline, 2006). Videbech and Ravnkilde (2004) suggested people suffering from unipolar depression were observed with an average loss of hippocampal volume ranging from 8% to 10%. Qigong is a mindful exercise which helps the mind to calm down and reduce the negative cognitive or affective signals to the brain. In this way, we hypothesize that Qigong reduces stressful signals to the limbic system and thus reduces the HPA activity resulting in the reduction of release in adrenal glucocorticoid. Patients suffering from depressive mood were found to have a significant increase in brain prefrontal activation asymmetry and reduction of depressive mood (Chan, Cheung, Tsui, Sze, and Shi, 2009). Previous studies also showed that individuals who practiced Qigong have marked reduction of plasma ACTH and cortisol (Lee, Kang, Lim, & Lee, 2004; Ryu et al., 1995). Most cortisol in blood is binding to globulin. Free cortisol contributes approximately only 1 to 2 % in plasma. Salivary cortisol, on the other hand, is considered to be free. Cortisol is stable in saliva and measurement of salivary cortisol was

found to be accurately reflecting the concentration of unbound cortisol in blood without extraction (Laudat et al., 1988). Given the above, only the saliva concentration of cortisol was measured in this study.

2.11 HYPOTHESES

1. Qigong exercise reduces depressive symptoms and improves psychological functioning of participants.
2. Qigong increases release of serotonin (5-HT) in the brain.
3. Qigong reduces the HPA activity resulting in the reduction of release of adrenal glucocorticoid.

CHAPTER 3 METHODOLOGY

3.1 PARTICIPANTS

All subjects were recruited from the day clinic of a mental hospital, various non-government care and attention homes, and elderly community centers in Hong Kong since September 2007. A total of 57 participants completed the treatment program out of a sample of 71. The loss of subjects was mainly due to absence because of medical and personal reasons. Other reasons included passing away, health deterioration, returning home, or moving to another care and attention home. There were 19 males and 38 females. The mean age of the participants was 81.42. 96.5% were married. Among the married population, 58.2% were widowed. There were no significant differences between the two groups in their age, education level, marital status, diagnosis of psychiatric conditions, and chronic medical conditions (*p*s>.16). All participants fulfilled the selection criteria listed as follows.

The selection criteria for eligible participants were: (a) aged 65 or above, (b) had a DSM IV diagnosis of major depression by certified psychiatrists or Score 6 or above in the Geriatric Depression Scale, (c) suffered from a chronic medical illness such as Parkinson's disease, COPD, heart disease, etc., (d) had no change of medication or its dosage within four weeks prior to intervention, and (e) had no obvious cognitive and language impairments. The Mini-mental State Examination (MMSE; Folstein, Folstein, & McHugh, 1975) was used as a screening tool to assess the cognitive function of the potential candidates which was to make sure that the participants were cognitively intact and able to follow instructions required by assessments and interventions.

3.2 INSTRUMENTS

Various measurements were applied for the screening procedure and the recording of participants' psychological and physiologic effects. All of the psychological instruments have been validated using Chinese samples, and with statistically sound psychometric properties. The instruments were as follows:

3.3 SCREENING INSTRUMENTS

1. The Mini-mental Status Examination (MMSE; Folstein, Folstein, & McHugh, 1975) is a 30-point brief cognitive test in measuring orientation, memory, and arithmetic. It is commonly used for screening clients for the presence of dementia. The cut-off score for older adults who have low literacy level is 20 (Chiu, Lee, Chung, & Kwong, 1994). Individuals who scored lower than 20 were excluded from this study. This scale demonstrated high sensitivity and specificity for use in Hong Kong (Chiu, Lee, Chung, & Kwong, 1994). This instrument was used as the screening tool in this study for the presence of cognitive impairments.
2. The Geriatric Depression Scale (GDS; Yesavage, et al., 1983) is a 15-item questionnaire to assess the degree of depressed mood in participants. A score of 8 or above indicates probable depression. This scale was validated in Hong Kong and had satisfactory reliability (Lee, Chiu, Kwok, & Leung, 1993). It was used in our previous studies (Tsang et al., 2003; 2006). Respondents were required to answer questions with responses of 'Yes' or 'No'. Such simplicity allowed the scale to be used with ill or moderately cognitively impaired individuals. Individuals who scored 6 or above were included for this study. The questions were asked by the assessor and answers were given by the clients themselves.

3.4 PSYCOSOCIAL AND FUNCTIONAL ASSESSMENTS

1. The Hamilton Rating Scale of Depression (HRSD; Hamilton, 1967) is a 21-item scale which rates the severity of depression. Depressive symptoms such as depressed mood, insomnia and agitation are measured. The Chinese version of HRSD has been validated with satisfactory reliability on the Chinese population (Zheng et al., 1988). In the present study, a sum score of more than 13 indicates probable depression. The assessor asked all questions and answers were given by clients' caretaker, case manager, or health and medical practitioner who were familiar with the clients' general well-being and activities of daily living. Different from the Geriatric Depression Scale, the Hamilton Rating Scale of Depression obtained objective information from health professionals regarding the depressive features of the clients.
2. The Geriatric Depression Scale (GDS; Yesavage, et al., 1983), please see the above description.
3. The 10-point Visual Analogue Scale (VAS; Wallerstein, 1984) was used to assess participants' level of discomfort resulted from their chronic medical illness.
4. Barthel Index (BI; Mahoney & Barthel, 1965) is a reliable scale to measure participants' level of independence in performing daily living tasks. It consists of 10 items with higher scores representing better independence.
5. The Chinese General Self-efficacy Scale (CGSS; Zhang & Schwarzer, 1995) is a 10-item scale to measure how confident the participants are regarding their ability to deal with novel or demanding situations. The scale consists of four responses ranging from '1' (not at all true) to '4' (exactly true) to assess how confident the respondents were regarding their abilities to deal with novel or demanding situations. The total score of the items ranged from 10 to 40 to estimate the self-

efficacy of the respondents. Chiu and Tsang (2004) validated this scale locally and reported very good to excellent internal consistency and test re-retest reliability.

6. The Personal Well Being Index (PWI; Lau, Cummins, & Mcpherson, 2005) is a reliable scale to assess subjective well being of participants. It contains 11 items, and the PWI score is the mean of the seven life domains.
7. The General Health Questionnaire- 12 (GHQ-12; Goldberg & Williams, 1998) contains 12 items to detect the psychological and general health of participants. The reliability and validity of the Chinese version of the GHQ have been established by Chan and Chan (1983).
8. The Self-concept Scale (ASSEI; Tam, 1995) consists of 55 items to measure the self-esteem of participants in the physical, social, ethical, familial, and intellectual domains. The overall reliability of this scale was high (Tam & Watkins, 1997).

3.5 PHYSIOLOGICAL ASSESSMENTS

1. Saliva samples were collected in 50ml centrifuge tube (BD Bioscience, CA, USA). The sample was refrigerated before the test. Cortisol was found to be stable in the saliva for several days (Kahn et al., 1988). The salivary cortisol assays were performed according to the manufacturer's instruction. (Assay Designs, MI, USA) The reported cortisol level was measured in nanograms per milligram of protein (ng/mg). The samples were then processed within 2 hours in the laboratory of Applied Biology and Chemical Technology. They were centrifuged in 4 degree Celsius at 5000g for 15 minutes. The supernatant (without any sputum) was drawn into an eppendorf and stored at -20 degree Celsius.

CORTISOL ELISA

The saliva samples were allowed to reach room temperature. 50µl samples were diluted to 250µl with assay buffer and 2.5µl of Steroid Displacement Reagent was added to each sample. 100µl of cortisol standard was added to 900µl of assay buffer to make up a 10,000pg/ml standard (Standard #1). 500µl of #1 was added to 500µl of assay buffer to make up #2 and so on to #7. The standard was 10,000pg/ml, 5000pg/ml, 2500pg/ml, 1250pg/ml, 625pg/ml, 313pg/ml, 156pg/ml. 100µl of assay buffer was added to NSB and the B_0 (0pg/ml standard) wells. 100µl of standards #1 to #7 were added to appropriate wells. 100µl samples were added to appropriate wells. 50µl assay buffer was added to NSB wells. 50µl blue conjugate was added into well except total activity well and blank wells. Another 50µl yellow antibody was added into each well except blank, total activity and NSB wells. The plate was incubated at room temperature for 2 hours on a 500rpm shaking micro-plate shaker. 25ml washing buffer concentrate was diluted to 500ml buffer with deionized water. After 2 hours, all wells were emptied and washed with 400µl diluted wash buffer for 3 times. After the final wash, the plate was emptied and firmly tapped on a lint free paper towel to remove any remaining wash buffer. 5µl of blue conjugate was added to the TA wells. 200µl pNpp substrate solution was added to every well and the plate was incubated at room temperature for 1 hour without shaking. Finally, the plate was read in a plate reader with a 405nm filter. The reading of every well was subtracted by the mean absorbance of blank wells. The standard curve was plotted with subtracted absorbance against log concentration. Absorbance of samples was converted back to cortisol concentration by referring to the trend line of the standard curve. The true cortisol concentration was found by multiplying the dilution factor. The

cortisol amount was found by dividing the cortisol concentration to protein concentration.

2. Peripheral blood samples were collected in a 15ml plain centrifuge tube. Collected blood samples were processed within 2 hours after venipuncture at The Polytechnic University laboratory of Applied Biology and Chemical Technology. Clotted blood samples were centrifuged at 3500g for 15 minutes at 4 degree Celsius. The supernatant and serum were collected for analysis. Around 2ml to 3ml of serum (without fatty tissue) was harvested in 5ml blood. The serum was stored in eppendorf at -20 degree Celsius.

SEROTONIN 5-HT ELISA

The serum samples, standards and controls were allowed to reach room temperature. 25µl of each item was mixed with 500µl acylation buffer and 25µl acylation reagent and incubated for 15 minutes at room temperature. 25µl acylated standards, controls and samples were pippetted to the serotonin microtiter plate. 100µl serotonin antiserum was pippetted to all wells on the plate and the sample was incubated for another 30 minutes on an orbital shaker shaking at approximately 600 revolutions per minute. The plate was then washed with 500 fold diluted wash buffer for 3 times. Each well was washed with 300µl of diluted buffer. It was done with the aid of immuno-washer. 100µl conjugate was added to the wells and incubated in an orbital shaker for 15 minutes shaking at 600 revolutions per minute. Each well was then washed with 300µl, 500 fold diluted wash buffer 3 times again. 100µl substrate was pipetted into all wells. The plate was covered by aluminum foil to avoid direct contact with sunlight that may cause heat pollution. Then the plate was incubated in the orbital shaker for 15 minutes

shaking at 600 revolutions per minute. The absorbance was read by a microplate reader with 450nm filter. A standard curve with mean absorbance against log concentration was plotted. The concentration of each sample was calculated by putting the mean absorbance into the standard curve. The expression of serotonin was calculated by dividing the serotonin concentration with protein concentration.

3.6 PROTEIN BRADFORD ASSAY

The level of protein concentration is different among blood and saliva samples. Both saliva and blood samples were processed via individual protein Bradford assay. 1mg/ml of BSA was diluted to the following concentration with deionized water as standard: 0.05mg/ml, 0.1mg/ml, 0.2mg/ml, 0.25mg/ml, 0.4mg/ml, 0.5mg/ml. Serum and saliva samples were warmed to room temperature. 1µl serum was diluted to 250µl and 10µl saliva was diluted to 100µl with deionized water. 6ml Bradford reagent was diluted to 30ml.

10µl deionized water was applied to the B_0 well of a microtiter plate. Each standard was applied to the standard wells and samples were applied to sample wells in triplet. 200µl diluted Bradford reagent was added to all the wells on the microtiter plate with a multi-channel pipette. 10 minutes later, absorbance was measured with a microplate reader with a 595nm filter.

All the readings were subtracted by the mean value of B_0. The mean absorbance of each standard was calculated and a linear curve against protein concentration was plotted. The exact protein concentration of the sample was calculated by dividing the slope of curve and multiplying by the dilution coefficient.

3.7 INTERVENTIONS

Participants from the experimental group were required to practice the Eight Section Brocades (Tsang, Cheung, & Lak, 2002; Tsang et al., 2003; 2006) under the supervision of trained Qigong instructors for 12 weeks, three times a week, with each session lasting for 45 minutes. All instructors were trained by a certified Traditional Chinese Medicine (TCM) practitioner with an expertise in health Qigong. Every instructor attended four compulsory theoretical and practical lessons and passed a standardized examination certified by the TCM practitioner before they were allowed to offer Qigong sessions to the participants. Details of the training protocol are described in Appendix I. After the training, the TCM practitioner judged the performance of the trainee on the Eight Section Brocades by a tailor-made Fidelity Scale (Appendix II). The Fidelity Scale was used to rate the performance by accuracy of movement and coherence of movement for all eight forms of Eight Section Brocades. The certification process consisted of two sections. In Section 1, the TCM practitioner examined if the trainee was able to demonstrate the full set of Eight Section Brocades with accuracy, coherence, and correct breathing pattern. In Section 2, an experienced Qigong researcher with an occupational therapy qualification inspected the clinical skills and techniques of the trainee in coaching and leading the research participants to follow the intervention protocol (Appendix IIIa and b). The trainee must achieve ALL performance standards in the scale in order to be certified as Qigong instructor for this study. Participants in the comparison group joined a newspaper reading program led by a certified occupational therapist or a trained Research Assistant with a psychology background.. The programs were conducted in their corresponding day clinic of mental hospital, various non-government care and attention homes, and elderly community centers. The duration and frequency of treatment were identical for both experimental and comparison groups.

3.8 QIGONG PROTOCOL

The Eight-Section Brocades, a widely recognized Health Qigong protocol, was employed by this study (Tsang et. al, 2002). It is one of the most common forms of Qigong used as mindful exercise (Kuei, 1993). Similar to other forms of mindful exercise, the components of Eight-Section Brocades included healing posture, movement, self-massage, breath work, and meditation, which emphasized balance, relaxation, breathing, and good posturing (Tsang et al., 2008). The exercise was broken down into eight different sets of movement, with each focusing on treating different parts of the body and qi meridians. Traditionally, the Eight-Section Brocades could be practiced in either standing posture or sitting posture, which allowed vulnerable individuals who were immobilized or having poor standing balance to practice as well (Tsang et al., 2002). Participants in the comparison group participated in an educational program which was run by a research assistant with the same treatment intensity as the experimental group. Upon completion of this 12-week intervention, both groups received ongoing assessments for another 8 weeks.

3.9 PROCEDURE

Single blindedness was employed in this study as to group assignment of treatment procedure and data collection. The participants were randomly assigned to either the experimental group or comparison group following random numbers generated by SPSS. Stratified analysis was applied to ensure homogenous distribution of gender, age, and diagnosis between the experimental and comparison groups. Statistical analyses indicated that there were no significant differences between the two groups in all aspects of demographic details. Informed consent from participants was obtained before data collection. Trained, blind, and independent assessors performed assessment to the participants using instruments listed above.

Psychological and functional assessments were mandatory. The participants were allowed to opt if the assessment was conducted at the participants' center OR at The Hong Kong Polytechnic University. Participants were allowed to select if they received physiological tests that included the saliva tests (level 2) and/or the blood tests (level 3) administered by a biomedical expert of the Chief Supervisor's team. Psychological assessments were conducted at intake, 6 weeks after intervention, immediately towards the completion of the Qigong intervention, 4 weeks, and 8 weeks after the completion of intervention. Physiological assessments were conducted only at intake, immediately towards the completion of the Qigong intervention, and 4 weeks after the completion of intervention. Assessments included dropped out cases to comply with the principle of intention-to-treat (Montori & Guyatt, 2001). The procedure of data collection is summarized in Figures 5 and 6

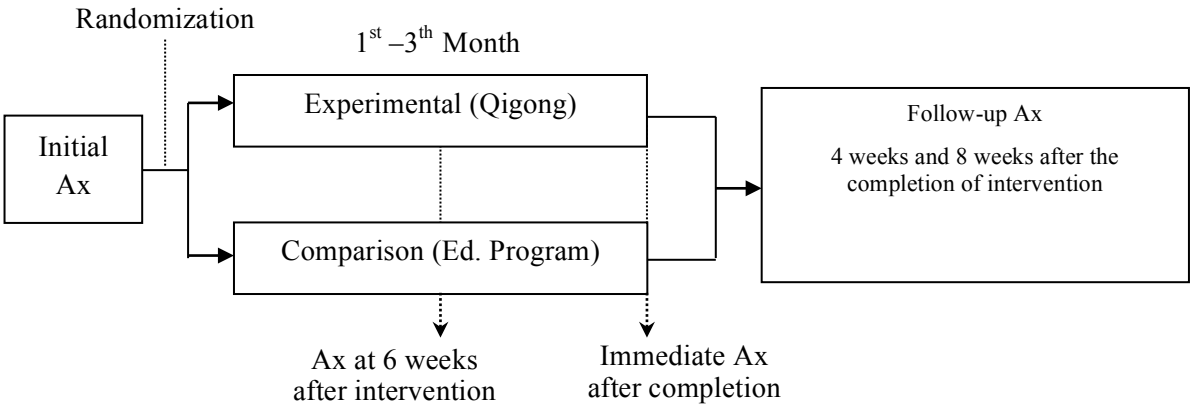

Figure 5. Procedure of Data Collection (Psychological assessment)

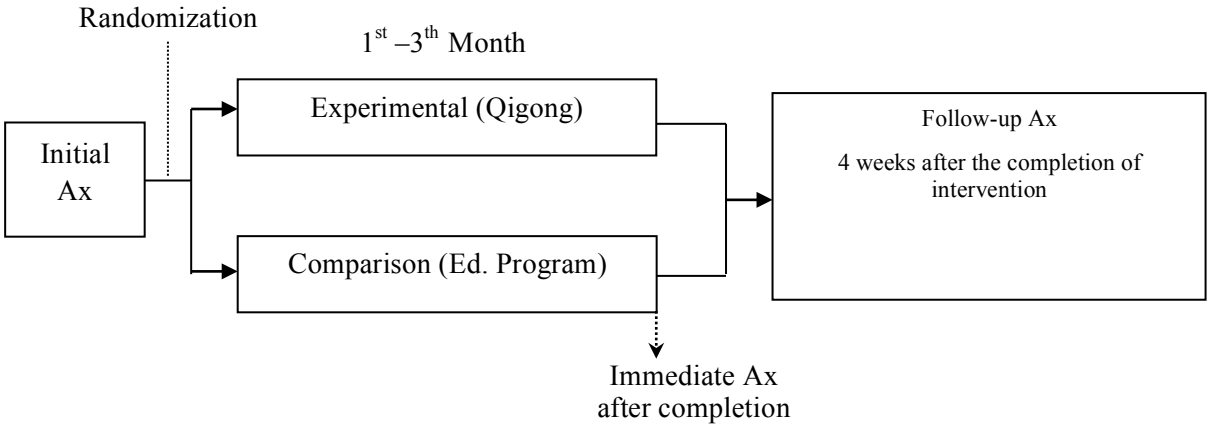

Figure 6. Procedure of Data Collection (Physical and Physiological assessment)

3.10 DATA ANALYSIS

Descriptive and frequency statistics were used to summarize the demographic data of the participants and their scores of the assessments at different time intervals. The baseline scores were established from the pre-treatment assessment results. Independent-Samples T-Test was employed to determine if there were significant differences in the baseline scores between the experimental group and the comparison group. Repeated-measures ANOVAs, with contrast analysis, were used to determine if significant difference occurred between the scores in baseline and that of different stages of treatment among the experimental and comparison groups. The above analyses included the dropout participants from both groups to comply with the principle of intention-to-treat analysis for RCT (Montori & Guyatt, 2001). For all significance testings, the two-tailed *p*-value was taken for the implication of a significant difference at .05 level.

CHAPTER 4 RESULTS

4.1 DEMOGRAPHIC BACKGROUND

Table 1 presents the demographic background of both groups of participants excluding the dropout cases. The ratio between female and male participants was 2:1. T-test analysis revealed no significant difference between the mean ages of both groups. Among the 57 participants, 17 participants were diagnosed with major depression and the remaining 40 participants were diagnosed with various degrees of depressive features. They were all suffering from different chronic medical illnesses such as arthritis, chronic pain, chronic obstructive airway disease (COAD), Cough-variant asthma (CVA), Hypertension, Parkinson's disease etc. Chi Square analysis indicated that there were no significant differences between the two groups in all aspects of demographic details.

Table 1. Demographic Characteristics of Participants

	Comparison (*n*=24)	Experimental (*n*=33)	Total (*n*=57)	*T*	X^2	*p*-value
Age Mean (*SD*)	81.00 (5.07)	81.73 (7.66)	81.42 (6.65)	.43		.67
Gender					1.30	.26
Male	10	9	19			
Female	14	24	38			
Education					1.16	.56
Illiterate	8	14	22			
Primary	15	18	33			
Secondary	0	1	1			
Marital Status					.05	.82
Married-Spouse alive	8	8	16			
Married-Spouse deceased	15	24	39			
Missing	1	1	2			
Diagnosis-psychiatric					.30	.99
Depression	7	9	16			
Depressive features	17	24	41			
Diagnosis-physical					5.18	.16
Arthritis	1	2	3			
Chronic Pain	11	13	24			
COAD	0	3	3			
CVA	0	2	2			
Hypertention	4	11	15			
Parkinson	3	0	3			
Others	17	24	41			

Note: COAD: Chronic Obstructive Airway Disease; CVA: Cough-Variant Asthma

4.2 PSYCHOLOGICAL OUTCOMES

4.2.1 DEPRESSION SCALES

Table 2 presents the results of the treatment effects on the psychological outcomes assessed by two depression rating scales. No significant differences were found for both depression scales between the experimental and comparison group at the baseline condition *(Geriatric Depression Scale: t=-.72, df=55, p=.47; Hamilton Rating Scale of Depression: t=-1.0, df=55, p=.32)*. Repeated-measures ANOVA of the Geriatric Rating Scale (GDS) between groups complied with the assumption of sphericity (Mauchly's W=.87, p=.59). The main effect of time on GDS score (*F=.97, df=4, 52, p=.43*) and the interaction effect between the two groups and their GDS scores at different time intervals (*F=1.19, df=4,52, p=.33*) were not supported.

As to the repeated-measures ANOVA of Hamilton Rating Scale of Depression (HRSD) between groups, Huynh-Feldt correction was made with the degrees of freedom due to violation of the sphericity assumption (Mauchly's W=.52, p<.001, ε=.79). As supported by the significant main effect of time on the HRSD scores (*F=3.24, df=4, 52, p=.01*), both the experimental and comparison group manifested a decreasing trend in HRSD score across time. However, the interaction between the two groups and their HRSD scores at the five time intervals was insignificant (*F=.31, df=4, 52, p=.87*). Taken together the decreasing trend in HRSD scores observed for both groups, a positive treatment effect of similar magnitude between the experimental group and the comparison group is indicated.

In order to examine and compare the treatment integrity of the Qigong protocol and newspaper reading protocol, further screening was performed and cases that fulfilled the following two criteria were vigorously selected: (a) with Geriatric Depression Scale score 8 or above; and (b) with diagnosis of clinical depression. With these criteria, the

pool size was reduced to 38 cases, having 17 cases in the comparison group and 21 cases in the experimental group. T-test indicated that there were no significant differences for both depression scales between the experimental and comparison group at the baseline condition *(Geriatric Depression Scale: t=-.88, df=36, p=.39; Hamilton Rating Scale of Depression: t=.54, df=36, p=.59).* Results of the repeated-measures ANOVA indicated group x time interaction between the two groups at five different time intervals and showed overall significance in Geriatric Depression Scale (*F=2.77, df=4,33, p=.04*). The drop of score was observed only in the experimental group. By contrasting the treatment effects at different time intervals between the two groups using bonferroni post hoc analysis at the pre-treatment assessment results as the baseline for comparison, the experimental group showed more significant reduction of their depressive symptoms than the comparison group in the midway of the treatment program (F=7.40, p=.01, η^2=.75). In the post-treatment condition. The difference in treatment effect between the two groups was significant (F=11.68, p=.002, η^2=.91). The treatment contrast at the first and second follow-up assessments after the treatment programs also shows significant difference between the two groups (first follow-up: F=7.4, p=.01, η^2=.76; second follow-up: F=5.26, p=.03, η^2=.61). Results at all time intervals reflect treatment effect between the two groups after the 12-week treatment period in favor of the experimental group who practiced Qigong regularly during that period.

Results of the Repeated-measures ANOVA indicated that group x time interaction for Hamilton Rating Scale of Depression with adjusted selection criteria was not significant (*F=0.46, df=4,33, p=.76*). Table 3 presents the adjusted selection criteria results of the treatment effects on the psychological outcomes assessed by the two depression rating scales. Table 4 presents the comparison of scores between the experimental group and comparison group at pre-assessment and different stages of

assessment using bonferroni post hoc analysis.

Table 2. Scores of Psychological Assessments of the Comparison and Experimental Group at Five Different Stages

		Comparison (*n*=24)		Experimental (*n*=33)		Interaction effect (Time × Group)		
	Time	*M*	*SD*	*M*	*SD*	*F*	*dfs*	*p-value*
Geriatric Depression Scale (GDS)						1.19	4,52	.33
	Pre	7.92	3.36	8.55	3.06			
	Mid	8.92	4.05	7.36	4.16			
	Post	8.96	3.97	7.76	4.12			
	1st	8.88	4.20	8.24	4.21			
	2nd	9.42	4.2	8.58	4.12			
Hamilton Rating Scale of Depression (HRSD)						.31	4,52	.87
	Pre	8.54	5.52	7.00	6.00			
	Mid	6.88	4.20	4.42	3.58			
	Post	6.08	3.63	4.12	4.54			
	1st	6.00	4.31	3.88	4.79			
	2nd	5.83	4.35	4.27	3.04			

Notes: Pre – Pre-Treatment (Baseline), Mid – Midway of Treatment, Post – Post-Treatment, 1st – 1st Follow-up, 2nd – 2nd Follow-up.

Table 3. Scores of Psychological Assessments of the Comparison and Experimental Groups at Five Different Stages with Adjusted Selection Criteria

		Comparison (*n*=17)		Experimental (*n*=21)		Interaction effect (Time×Group)		
	Time	*M*	*SD*	*M*	*SD*	*F*	*dfs*	*p-value*
Geriatric Depression Scale (GDS)						2.77	4,33	.04*
	Pre	8.72	3.69	9.71	3.30			
	Mid	9.41	4.03	7.14	4.61			
	Post	10.29	3.65	7.52	4.18			
	1st	9.71	4.13	7.57	4.43			
	2nd	10.24	4.25	8.57	4.39			
Hamilton Rating Scale of Depression (HRSD)						.46	4,33	.76
	Pre	8.94	6.34	7.81	6.58			
	Mid	7.41	4.24	5.10	3.53			
	Post	6.76	3.51	3.81	3.64			
	1st	6.94	4.05	4.52	5.11			
	2nd	6.12	3.92	4.62	2.92			

Notes: Pre – Pre-Treatment (Baseline), Mid – Midway of Treatment, Post – Post-Treatment, 1st – 1st Follow-up, 2nd – 2nd Follow-up
* Statistical significant at .05 level

Table 4. Comparison of Scores Between the Comparison and Experimental Group at Pre-assessment and Different Stages of Assessment using Bonferroni Post Hoc Analysis

	Mid-way	Post-treatment	First follow-up	Second follow-up
Geriatric Depression Scale	X	X	X	X
F	*7.40*	*11.86*	7.40	5.26
p-value	*.01**	.002*	.01*	.03*
Power	.75	.91	.76	.61

X: significant difference found

* : significant difference found

4.2.2 PSYCHOSOCIAL AND FUNCTIONAL ASSESSMENTS

Table 5a, 5b and 5c present the details of results on other psychosocial and functional scales. No significant differences were found for all psychological assessments between the experimental and control group at the baseline assessment (p=.09 to .84). With the original sample size, there was also no significant interaction effect on all psychosocial and functional scales between the experimental and control group. When the case selection criteria was vigorously adjusted (with Geriatric Depression Scale score 8 or above and with diagnosis of clinical depression), significant interaction effect was observed for the Chinese General Self-efficacy Scale and the Physical well being domain of the Self-concept Scale. Repeated-measures ANOVA revealed significant group x time interaction between the two groups at the five different time intervals in the Chinese General Self-efficacy Scale (*F=3.97, df=4,32, p=.01*) and in the Physical well being domain of the Self-concept Scale (*F=3.15, df=4,32, p=.02*). Other psychosocial and functional assessments showed no significant interaction effect.

Bonferroni post hoc analysis of the Chinese General Self-efficacy Scale at the pre-treatment assessment with the baseline for comparison, the experimental group showed significant difference that was better than the comparison group at all time intervals of the treatment program. Significant difference was found in the post-treatment condition of physical well being domain of the Self-concept scale (F=6.8, p=.01, η^2=.72). Results at all time intervals reflected treatment effect between the two groups after the 12-week treatment period in favor of the experimental group who practiced Qigong regularly during that period. Table 6 presents the comparison of scores between the comparison and experimental group at pre-assessment and different stages of assessment.

Table 5a. Scores of Psychosocial and Functional Assessments of the Comparison and Experimental Group at Five Different Stages

		Comparison (*n*=24)		Experimental (*n*=33)		Interaction effect (Time × Group)		
	Time	*M*	*SD*	*M*	*SD*	*F*	*dfs*	*p-value*
Barthel Index (BI)						3.04	1,54	.09
	Pre	77.21	27.33	89.78	15.28			
	Mid	78.42	25.16	84.84	21.39			
	Post	77.75	27.92	89.41	17.08			
	1st	77.71	28.09	89.63	17.10			
	2nd	78.75	27.44	86.84	18.47			
10-point Visual Analogue Scale (VAS)						.39	1,53	.54
	Pre	4.71	3.00	5.81	2.60			
	Mid	5.50	2.52	4.81	2.96			
	Post	5.38	2.67	5.74	2.79			
	1st	5.42	3.12	6.42	2.49			
	2nd	5.46	2.95	5.39	2.74			
Chinese General Self-efficacy Scale (CGSS)						.10	4,32	.33
	Pre	22.42	7.00	20.69	4.65			
	Mid	21.17	7.21	21.88	6.88			
	Post	17.75	6.96	19.25	6.62			
	1st	19.58	6.83	21.31	8.72			
	2nd	18.00	6.28	21.44	7.71			
Personal Well Being Index (PWI)						.25	1,54	.62
	Pre	50.92	13.94	52.44	19.19			
	Mid	50.25	17.43	52.03	14.49			
	Post	45.75	21.78	49.38	16.83			
	1st	46.96	19.09	45.63	16.33			
	2nd	46.13	17.90	50.69	16.91			
General Health Questionnaire (GHQ)						.76	1,53	.39
	Pre	2.92	3.94	2.55	2.32			
	Mid	2.63	3.67	3.00	3.91			
	Post	4.29	4.41	2.65	3.31			
	1st	3.79	3.84	2.48	3.60			
	2nd	4.25	4.55	3.48	4.23			

Table 5b. Scores of Psychosocial and Functional Assessments of the Comparison and Experimental Group at Five Different Stages

	Comparison (*n*=24)		Experimental (*n*=33)		Interaction effect (Time×Group)		
Time	*M*	*SD*	*M*	*SD*	*F*	*dfs*	*p-value*
Self-concept Scale							
Personal Quality					.37	1,54	.55
Pre	18.12	3.66	18.19	3.95			
Mid	18.13	2.64	17.44	2.70			
Post	18.04	3.57	17.56	4.04			
1st	18.50	3.58	17.94	2.64			
2nd	17.67	3.48	17.31	2.19			
Family relationship					.22	1,54	.65
Pre	33.13	6.84	31.38	9.15			
Mid	32.83	5.93	31.59	6.72			
Post	31.50	7.57	32.72	8.06			
1st	34.50	6.78	32.66	6.85			
2nd	32.04	6.67	31.91	6.80			
Social relationship					.04	1,54	.84
Pre	29.79	4.31	31.22	4.60			
Mid	30.17	4.61	30.19	3.62			
Post	30.38	3.65	29.97	4.68			
1st	30.29	4.19	30.84	4.55			
2nd	29.96	3.38	29.22	3.46			
Daily tasks					1.86	1,54	.18
Pre	10.71	2.05	11.28	2.32			
Mid	10.38	2.32	11.38	2.20			
Post	10.42	1.74	11.09	1.86			
1st	10.67	2.26	10.84	1.85			
2nd	10.25	2.05	10.72	1.95			
Leisure					.72	1,54	.40
Pre	10.71	2.12	10.97	1.80			
Mid	10.42	2.00	9.97	1.98			
Post	10.13	2.17	10.63	2.45			
1st	10.04	2.44	10.31	2.33			
2nd	9.75	2.64	10.91	1.86			
Material					.09	1,54	.77
Pre	13.50	3.65	13.94	3.32			
Mid	14.13	3.18	14.06	2.65			
Post	13.71	2.87	13.66	3.48			
1st	14.08	3.27	14.25	2.96			
2nd	13.42	2.95	13.91	2.84			
Physical well being					.14	1,54	.71
Pre	12.42	2.48	12.03	2.42			
Mid	12.13	2.38	12.34	2.60			
Post	12.08	2.00	12.81	2.58			
1st	12.96	2.56	12.34	2.22			
2nd	11.88	2.35	12.88	2.80			

Table 5c. Scores of Psychosocial and Functional Assessments of the Comparison and Experimental Group at Five Different Stages

	Comparison (*n*=24)		Experimental (*n*=33)		Interaction effect (Time×Group)		
Time	*M*	*SD*	*M*	*SD*	*F*	*dfs*	*p-value*
Self-concept Scale							
Others					.35	1,54	.56
Pre	26.04	5.01	26.16	5.54			
Mid	26.29	4.60	26.22	5.42			
Post	27.00	4.55	25.91	6.68			
1st	28.00	4.87	25.88	5.61			
2nd	26.88	4.61	26.66	5.03			

Table 6. Comparison of Scores between the Comparison and Experimental Group at Pre-assessment and Different Stages of Assessment using Bonferroni Post Hoc Analysis

	Mid-way	Post-treatment	First follow-up	Second follow-up
Chinese General Self-efficacy Scale	X	X	X	X
F	*7.86*	*4.30*	7.61	14.53
p-value	*.008**	.046*	.009*	.001*
Power	.78	.52	.77	.96
Self-concept Scale – Physical well being	X	X	X	X
F	*2.2*	*6.80*	.004	2.9
p-value	*.15*	.01*	.95	.10
Power	.30	.72	.05	.38

X: significant difference found

* : significant difference found

4.3 PHYSIOLOGICAL OUTCOMES

Table 7 summarizes the results of physiological assessments. The sample size for the physiological assessments was reduced because of non-participation of some recruited participants. Significant difference was found between the two groups for their cortisol levels at the baseline condition (p=.04), but no significant difference was observed for their serotonin levels (p>.05). The sphericity assumption was matched for the repeated-measures ANOVA of cortisol levels between groups (Mauchly's W=.99, p=.82). The main effect of time on cortisol levels was insignificant (*F=2.04, df=2,44, p=.14*). Similarly, the interaction effect between the two groups and their cortisol levels at different time intervals (*F=.39, df=2,44, p=.68*) was not significant.

For the repeated-measures ANOVA of blood serotonin levels between groups, Greenhouse-Geisser correction was made with the degrees of freedom due to violation of the sphericity assumption (Mauchly's W=.39, p<.001, ε=.62). Although a decreasing trend of serotonin levels was observed for both groups, the main effect of time on serotonin levels was not supported (*F=.59, df=2,34, p=.56*). The interaction effect between the two groups and their blood serotonin levels was insignificant (*F=.07, df=2,34, p=.94*). The results suggested that the 12-week Qigong program and the newspaper reading program have led to a decreasing trend of blood serotonin level with similar magnitude, and therefore significant group difference in treatment effect in reducing the blood serotonin level in favor of the experimental group was not supported.

Again, further screening was performed and cases that fulfilled the following two criteria were vigorously selected: (a) with Geriatric Depression Scale score 8 or above; and (b) with diagnosis of clinical depression. With applied control of age and center type as cofounding variables, significant difference was observed in the repeated-measures ANCOVA of cortisol measurement between the two groups (*F=5.68, df=1,28, p=.02*) at

two different time intervals (Pre and Post). Decrease in cortisol level was observed in the experimental group, while an adverse effect with an increase in cortisol level was shown in the comparison group. However, repeated-measures ANCOVA showed no significant difference between the groups for serotonin level (*F=.16, df=1,20, p=.69*). Table 8 summarizes the results of physiological assessments with adjusted inclusion criteria.

Table 7. Physiological Indicators of the Comparison and Experimental Group at Three Different Stages

		Comparison (Cortisol: *n*=21; Serotonin: *n*=14)		Experimental (Cortisol: *n*=27; Serotonin: *n*=25)		Interaction effect (Time×Group)		
	Time	*M*	*SD*	*M*	*SD*	*F*	*dfs*	*p-value*
Cortisol						.39	2,44	.68
(ng/mg)	Pre	8.63	9.84	17.08	16.88			
	Post	10.03	22.03	12.08	9.98			
	1st	6.34	8.88	13.95	10.19			
Serotonin						.07	2,34	.94
(ng/mg)	Pre	1.45	1.88	1.51	1.77			
	Post	1.32	1.38	1.04	1.28			
	1st	1.11	1.44	.93	.96			

Notes: Pre – Pre-Treatment, Mid – Midway of Treatment, Post – Post-Treatment, 1st – 1st Follow-up.

Table 8. Physiological Indicators of the Comparison and Experimental Group at Two Different Stages with Adjusted Inclusion Criteria

		Comparison (Cortisol: *n*=17; Serotonin: *n*=11)		Experimental (Cortisol: *n*=15; Serotonin: *n*=13)		Interaction effect (Time × Group)		
	Time	*M*	*SD*	*M*	*SD*	*F*	*dfs*	*p-value*
Cortisol (ng/mg)						5.68	1,28	.02*
	Pre	6.04	6.39	11.26	24.40			
	Post	11.26	24.40	12.35	11.07			
Serotonin (ng/mg)						.16	1,20	.69
	Pre	1.84	2.00	1.25	1.47			
	Post	1.58	1.83	1.24	1.70			

Notes: Pre – Pre-Treatment, Post – Post-Treatment

* Statistical significant at .05 level

CHAPTER 5 DISCUSSION

Results from the Geriatric Depression Scale (GDS) with the original sample showed an anti-depressive effect of Qigong exercise for the experimental group during the 12-week period of Qigong program. The scores collected at the post intervention interval reflected participants who practiced Qigong exercise were less depressed. This finding aligned well with our previous research findings (Tsang et al., 2003; 2006) in support of the anti-depressive effect of Qigong exercise for older adults with co-occurring depression and chronic medical illness. The result is also consistent with the study by Kjos and Etnier (2006) that Qigong exercise would decrease the level of depression, thus increase the level of psychological well being of individuals. More importantly, this is in support of the first hypothesis that Qigong exercise reduces depressive symptoms and improves psychological functioning of participants. However, results from the first and second follow up assessments showed that this effect vanished after the completion of the intervention. Such phenomenon could be explained by several possibilities. First, the treatment period may be not long enough to produce a sustainable treatment effect. Second, the treatment effect would exist as long as the intervention continues and the effect would diminish once the treatment stopped or when participants stopped practicing during the follow-up period. On the other hand, adverse effect was observed among the subjects who joined the newspaper group. In fact they were more depressed after they entered the newspaper group.

Results from the Hamilton Rating Scale of Depression (HRSD) obtained from certified health professionals who were familiar with the clients' mental health status did not support a significant treatment effect in favor of the experimental group. Both groups had a drop in the scores which was associated with reduced severity of depression. Figure 8 shows the comparison of HRSD scores between the experimental group and comparison group. Although the results were not significant, the decrease was greater in participants who

practiced Qigong exercise. As the HRSD is an observant measurement taken by case managers or case caretakers, adding the factor that those case workers were not blinded from knowing which treatment program was prescribed to the participants due to ethical and administrative requirements, it is possible that the case workers might have perceived that there was a positive treatment effect to the participants as long as they have received treatment. Given that a larger magnitude of decrease was observed in the Qigong exercise group, the possibility that Qigong exercise may have produced a greater treatment effect than the newspaper group cannot be neglected. This of course has yet to be further studied for confirmation.

In terms of the biomarkers, the inclusion criteria were adjusted in the data analysis process in order to identify the differences in the treatment outcome of both the qigong exercise and newspaper reading groups. If the degree of depression was not tightly controlled, the significant effects did not manifest. Fortunately, after the criteria were restricted (diagnosis with clinical depression and with GDS score 8 or above at the pre treatment interval) for further analysis, more significant results were obtained that included self-efficacy and physical ability.

To conclude, the above findings provided some additional support to the anti-depressive effect of Qigong among older adults with depression and chronic illness and are in agreement with our first hypothesis.

The present study went beyond clinical effects and provided a better understanding on the neurophysiological mechanism that may account for the anti-depressive effect of Qigong. Following the theoretical paper by Tsang and Fung (2008), salivary cortisol level and blood serotonin (5-HT) level were tested as physiological correlates of the anti-depressive effect of Qigong. This study found a decrease in salivary cortisol level in the experimental group in the post-treatment condition. But this finding applied to those who were more severely

depressed. This has probably indicated that the participants practicing Qigong exercise had a down regulation in their HPA activities compared to the newspaper reading group participants. Given that the participants were older adults who suffered from chronic medical conditions and depression over the years, and assuming their health conditions would not have drastic improvement within the short period of 12 weeks, the decreased level of cortisol may likely to be resulted from decreased stressful signals to the limbic system brought by Qigong exercise. This provided empirical evidence to our hypothesis three that Qigong practice reduces the HPA activity resulting in the reduction of release of adrenal glucocorticoid. Such effect was not observed in the comparison group. Results from the 38 participants produced a significant finding for a drop in the salivary cortisol which favored with the Qigong exercise group. On the other hand, a decreasing trend of blood serotonin level with similar magnitude was observed in both groups; therefore difference in treatment effect in favor of the Qigong exercise program was not seen. In other words, the second hypothesis was not supported by findings of the present study.

Taken together, this study has provided partial evidence in support for the neurophysiological mechanism that explains the effect of Qigong exercise program on alleviating depression among older adults with co-occurring depression and chronic medical illness. According to the model set out by Tsang et al. (2002), this may be due to the improvement in physical competence. This result has actually been obtained by this study although this is only a proxy measure. Further studies are needed to use direct physical measurements to ascertain if this pathway to explain the anti-depressive exists.

The seminal nature of this study is that results of the current study went beyond the clinical effects of Qigong. It unraveled the underlying neurophysiological mechanisms for its anti-depressive effects. The first hypothesis listed on p.24 that Qigong would improve functional and psychological functioning of participants was supported from our data.

Participants who practiced Qigong exercise were significantly less depressed when compared to the comparison group. The reduction of salivary cortisol level reflected a reduction of stressful signals to the limbic system and thus down-regulated the HPA axis activity. This finding aligns with and provides support to the third hypothesis listed on p.24 on HPA activity postulated earlier by Tsang and Fung (2008) and echoes findings from Lee et al. (2004) and Ryu et al. (1995). However, our data pertaining to the blood serotonin (5-HT) level did not support the second hypothesis listed on p.24 that the treatment effect of Qigong exercise was akin to SSRIs which would result in a greater reduction in blood serotonin level, as suggested in the previous studies (Huges et al., 1996; Figueras et al., 1999; Moreno et al., 2006; Wipfli, Landers, Nagoshi, & Ringenbach, 2009). In fact, it has been suggested serotonin may be confounded by various factors such as dietary habits and medication (Badawy, 2010). Given that the elderly participants were profiled with various medical conditions and prescribed with different medications that were not controlled in this study, this may have led to the insignificant results in serotonin measurement. Moreover, this may have also been caused by the limitation of small sample size.

An interesting phenomenon for psychological data is that the anti-depressive effects of Qigong exercise disappeared during the follow-up period when the intervention stopped. This is to suggest that Qigong, as a low-cost adjunct therapy for older adults with depression, has to be practiced regularly on a long-term basis. A recent randomized controlled study also suggested that Qigong exercise must be practiced in a long period of time with good compliance in order to achieve significant treatment effect (Ng, Tsang, Jones, So, & Mok, 2011). From a clinical point of view, clients should be encouraged for continual practice. Further studies on how to improve their compliance to the therapeutic suggestions shall be conducted. Research with larger sample size that test different dosages of Qigong exercise program should be conducted.

Although impressive results were obtained in this study, there are limitations that should be observed with caution. First, HRSD did not show any significant findings between the two groups. As HRSD is highly dependent on case caretakers' subjective judgment and all caretakers were not blinded from group allocation of the participants, this may have added to the confounding variables that made the results insignificant. In addition, a recent study reported discrepancies between GDS and HRSD in assessing depressive symptoms of elderly people. The study by Jonhston et al. (2007) may explain the different readings that were found in the current study. Second, the hypothesis that the practice of Qigong would result in significant reduction in salivary cortisol levels was only preliminarily supported in this study. In particular, the salivary cortisol levels between the two groups were found to be significantly different at the baseline condition (p=.04). Additional analysis adjusting for the initial difference between groups has further upheld the hypothesis of a potential difference in treatment effect on the reduction of cortisol levels in favour of the experimental group. Moreover, it should be noted the salivary samples were only collected once from each subject at each time interval due to limited resources. As cortisol levels in the body follow a diurnal variations in normal individuals (Vis, Westerhuis, Hoefsloot, Roelfsema, Hendriks, and Smilde, 2012), it is recommended in future studies to collect more samples per day in order to get more reliable and valid readings on cortisol awakening responses. Third, the external validity of the current study is limited by the fact that it was comparing exercise program with non-exercise intervention (newspaper reading). Future study should compare Qigong exercise with other forms of physical exercise or mindful exercise to identify and validate the specific therapeutic effects of Qigong exercise. Fourth, partly due to the limitation of sample size, a path analysis of the possible indirect effect of the reduction in cortisol and serotonin levels on the alleviation of depression symptoms was not performed. In future studies, the path analysis of the direct or indirect effect of different psychophysiological mechanism on

the alleviation of depression within a larger sample shall be considered. Fifth, the principle of double blindedness was not followed due to various constraints such as ethical requirements and administrative regulations in day hospital and care & attention home for elderly. Finally, as mentioned, the level of serotonin may have been affected by dietary habits and medication (Badawy, 2010). However, these aspects were not controlled. The above limitations shall be addressed in further studies with improved methodological designs.

Conclusion

To conclude, based on the findings of the present study, the twelve weeks of regular Qigong practice alleviated some depressive features of older adults with co-occurring mild to moderate depression and chronic medical conditions. The alleviation of depression may be explained by the neurophysiological effects of Qigong. Psychologically, Qigong reduces depressive moods and enhances psychological well-being and self-efficacy (Tsang et al., 2002) of depressed individuals which supports our first hypothesis. Physiologically, it provided a preliminary evidence to show the down-regulation of HPA activity and thus reduction in cortisol levels which partially supports our third hypothesis. This is more obvious among those with more severe depression. Although the second hypothesis that Qigong acts in a way similar to SSRI in reducing blood serotonin level is yet to be confirmed, the current study provided additional evidence to Qigong as an adjunct intervention for older adults with depression and chronic physical illness. Finally, Qigong is recommended to be used as a complementary and alternative intervention among older adults with depression and/or chronic medical illness in both hospital and community settings. It enjoys the advantage of being not expensive, easy to learn, and culturally relevant, and evidenced based. Further studies however are needed to explore its scientific basis.

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Appendix I
Individual Sessions:

Individual Session	Theme	Duration	Contents	Responsible Persons
1	Learning the fundamental concepts of ESB Practicing natural breathing and mindfulness	20 mins 15 mins 15 mins 10 mins 30 mins 30 mins	What is qigong and ESB History Beneficial effects of ESB Break Practicing natural breathing Practicing mindfulness	Qigong Practitioner
2	Practicing movement 1 to 4	5 mins 20 mins 20 mins 10 mins 20 mins 20 mins 25 mins	Demonstration of movement 1 to 4 by the qigong practitioner Practicing movement 1 Practicing movement 2 Break Practicing movement 3 Practicing movement 4 Reviewing movement 1 to 4	Qigong Practitioner
3	Practicing movement 5 to 8	10 mins 5 mins 20 mins 20 mins 5 mins 20 mins 20 mins 20 mins	Reviewing movement 1 to 4 Demonstration of movement 5 to 8 by the qigong practitioner Practicing movement 5 Practicing movement 6 Break Practicing movement 7 Practicing movement 8 Reviewing movement 5 to 8	Qigong Practitioner
4	Reviewing movement 1 to 8 Learning the skills and techniques in delivering ESB groups to elderly	60 mins 60 mins	Practicing and reviewing movement 1 to 8 Teaching the skills and techniques in holding the ESB groups to elderly with depression and comorbid chronic medical illness	Qigong Practitioner Research Personnel

Appendix II

Fidelity Scale for Eight Section Brocades Training
Phase I: Movement and Breathing

Trainee: _____

Date: _____

Quality Assurance done by: _____

Movement	Accuracy of movement		Coherence of Movement	
	Yes	No	Yes	No
1. Prop up the sky with both hands to regulate the triple warmer				
2. Draw a bow on both sides like shooting a vulture				
3. Raise single arm to regulate spleen and stomach				
4. Look back to treat five strains and seven impairments				
5. Sway head and buttocks to expel heart-fire				
6. Pull toes with both hands to reinforce kidney and waist				
7. Clench fists and look with eyes wide open to build up strength and stamina				
8. Rise and fall on tiptoes to dispel all diseases				
Breathing				
	Yes	No		
9. Perform natural breathing				

Please tick "✓" as appropriate.

Note
The trainee should demonstrate all domains correctly in order to proceed to the "on-the site" training at the elderly home.

Appendix IIIa

Fidelity Scale for Eight Section Brocades Training
Phase IIa: Conducting ESB group (Movement 1 to 4)

Trainee: _____

Date: _____

Quality Assurance done by: _____

	Yes	No	NA
1. Introduce himself/ herself and rundown of the group clearly			
2. Give instructions to participants clearly			
3. Able to assist participants in need			
4. Provide appropriate feedback to participants			
5. Assure safety precaution in group			
6. Sensitive to the fatigue of participants			
7. Able to demonstrate			
7a. Movement I clearly			
7b. Movement II clearly			
7c. Movement III clearly			
7d. Movement IV clearly			

Please tick "✓" as appropriate.

Note
The trainee should not have any "✓" in the column "NO" in order to proceed to "Part IIb: Conducting ESB group (Movement 5 to 8)".

Appendix IIIb

Fidelity Scale for Eight Section Brocades Training
Phase IIb: Conducting ESB group (Movement 5 to 8)

Trainee: _____

Date: _____

Quality Assurance done by: _____

	Yes	No	NA
1. Able to demonstrate			
1a. Movement V clearly			
1b. Movement VI clearly			
1c. Movement VII clearly			
1d. Movement VIII clearly			

Please tick "✓" as appropriate.

Note
The trainee should not have any "✓" in the column "NO" in order to hold the qigong groups independently.