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Bewertung der Auswirkungen von Tai Chi auf die körperliche Fitness und psychische Gesundheit älterer Menschen

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Evaluating the effects of Tai Chi on physical fitness and mental health of the elderly

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Abstract

The aims of this study are to examine the effects of 24-form Tai Chi exercise in six months on physical fitness, blood pressure and perceived health as well as sleep quality, cognitive performance and balance ability of older people living in dwelling community. This study is also aimed to compare differences in physical fitness and subjectively rated health between German and Vietnamese older adults in terms cross-cultural study between Vietnamese and German samples.

The subjects were divided randomly into two groups, Training group and Control group. The subjects were expected to consent or volunteer. Participants in Training group (forty eight subjects ranging in age from 60 years to 80 (69.02±5.16) were assigned 6-months Tai Chi training in Vinh city, Vietnam. Participants in the control group (forty eight subjects ranging in age from 60 years to 79 (68.72±4.94) were instructed to maintain their routine daily activities and not to begin any new exercise programs. The SFT were used in an empirical process to assess the physical fitness. Blood circulations (heart beat, systole blood pressure, diastole blood pressure) and some anthropometrical indices (BMI, WHR, weight, height) were checked. The SF-36 was used to assess the changes of physical and mental health. Trial making test (cognitive performance), Pittsburgh sleep quality index, the falls efficacy scale, and valuation of life were also tested in intervention periods. German sample included 159 people aged 72±6.1 living in 11 different cities of Germany.

Results showed that 24 week Tai Chi program can be an alternative form of exercise for older adults. The 24-form Tai Chi brings physical and psychological benefits to older adults. Strength, aerobic fitness, flexibility, dynamic balance of people who engaged in Tai Chi program were remarkably improved. Blood pressure was also significantly improved except diastole blood pressure. The scores of self-report health in two domains of Short form 36 of Tai Chi group were better than Control group. This proved that physical and mental health was much improved after Tai Chi training. There was much improvement in balance and cognitive performance in Tai Chi group. Sleep quality was enhanced with Tai Chi exercise. Tai Chi program has been demonstrating its benefits and effects on maintaining physical and mental functioning of older adults in

community. It also enhances and promotes the elder adults' to participate in Tai Chi in public. This study is also an initial comparison of physical fitness and mental health of the elderly between Vietnam and Germany. The results indicated that the Vietnamese elderly reported a better performance in physical fitness. However, there is no significant change in mental health. These results answer hypotheses that whether Tai Chi exercise would improve physical, mental domains older adult's health as well as it would promote balance, sleep quality and cognitive performance

The study findings present a higher level of motor abilities in Vietnamese participants, which maintain a higher level over the age span and even tent do expand the distance of performance levels to German participants in the higher age group. The consequences for the German sample might results in an earlier loss of independence, social participation and general health. The higher levels of Vietnamese participants reflect a more active lifestyle throughout the whole life span, especially after retirement, which are not only reached by systematic physical activities like sports, but may be the result of a generally more challenging, physically active lifestyle in everyday activities. This could serve as an explanation for the convergence of life expectancy of Vietnam and Germany from birth (e_0) to the age of 60 years (e_{60}), stating that a physically active lifestyle is able to contribute to an extension of life expectancy in older age. German older people would profit by an enhancement of their physical demands in everyday life, and thus could use the potentials of their living conditions to full capacity. Researching the circumstances, situations and stimuli after retirement in different cultures could provide a basis for the future constitution of physically demanding living environments for older people.

Over the 6-month Tai chi program, there was a 18.75% drop-out (not including the follow-up period) in Tai chi group. It is evident that relatively high rate of participants were likely to engage in Tai chi training. The attrition of participation was due mainly to travelling or leaving the city rather than dissatisfaction with the training program. Tai chi is low – technology exercise that can be easily carried out in variety of communities. However, it may be necessary to have skills for performing physical tests, because some participants found difficult to understand and perform the tests. Measurements for all physical tests should be more accurate and need more accurate devices in the laboratory with specialized machines. Some of the questionnaires are directly translated from English

to Vietnamese which may lead participants to difficulty to have in understanding some of the questions.

The study has a small sample size, a low-frequency training schedule of only twice per week. The Follow-up period should be longer in order to examine how long the effects of Tai Chi remain. Furthermore, we have used two research groups, while the Tai Chi group received treatment but the control group did not. The social effects and biased opinions resulting from individuals in both groups might be raised. It should be, therefore, comparative design that account for equal condition of intervention. Moreover, all participants come from urban areas which may not be representative for the whole Vietnamese population. This study also presents an initial step toward cross-cultural analysis of functional ability among the aged between Germany and Vietnam in the comparison of differences in physical fitness and subjectively rated health between German and Vietnamese older adults. Further research may take different directions or determinants such as health, social conditions and lifestyle. There are descriptive data differences in socio-demographic variables, especially in the examined age groups, and an imbalance of the total number of recruited participants between Vietnam and Germany.

EVALUATING THE EFFECTS OF TAI CHI ON PHYSICAL FITNESS AND MENTAL HEALTH OF THE ELDERLY

Chapter 1 Introduction

1.1 Background and significance of the study

With increasing age, health and the health-related to quality of life tend to decline. This process is especially pronounced beyond an age of around 60 year. It manifests itself in the form of a higher incidence and prevalence of certain diseases and also through more severe symptoms of some of the diseases which occur in other age group as well (Pfaff, 2009). The certain physiological changes occur predominantly in advanced age. Diseases with long periods of pre-clinical latency are more prevalent in older age. The incidence and the prevalence of chronic diseases of long duration or repeated exposition increase with age (Kruse et al., 2002).

The assessment of functional ability has become an essential issue of the health studies among elderly individuals because many of the problems from which the older people suffer tend to be chronic rather than acute. There have been studies on effects of physical activities on health of the elderly, and few studies comparing measures of functional ability among the elderly in different cultures. As measures of functional ability in daily life are sometimes used for deciding whether elderly people can live in their home or not, it is very important to be able to distinguish between activities that are performed by everybody, and activities that are dependent on sex and culture.

The elderly populations are growing in many countries and will continue to increase in the coming years. According to the United Nation (2004) there are approximately 610 million people of the age of 60 and over (10% of the world population in 2000), and this number is expected to grow to about 1.9 billion people (or 22% of the

world population) in 2050. Aging is becoming an important issue in the research of our society of this century.

The study of patterns of functional ability in different cultures is important as increasing knowledge about cultural variation in aging gives better understanding of the process of normal aging. Cultural differences may influence elderly people's functional ability in several ways. There may be difficult perceptions of the severity of certain experiences. Attitudes toward elderly people and gender roles may vary between cultures. It is also dependent on development of differentiated perceptions of old age and aging (Kruse & Schmitt, 2012). Their housing conditions may be different. Problems with mobility are more serious if you live on the fifth floor with no elevator and if there is no public transportation close by. Elderly people in different cultures may vary in disease patterns and actual biological, physiological function related to different lifestyle.

Life expectancy is a global phenomenon, which is not equally developed in all countries of the world. It is the expected number of years of life remaining at a given age and is denoted by e_x, which means the average number of subsequent years of life for someone now aged x, according to a particular mortality experience. It has been documented that life expectancy is affected by many factors such as environment, lifestyle, health condition, and physical activity. Previous findings showed that avoiding a sedentary lifestyle during adulthood not only prevents cardiovascular disease independently of other risk factors, but also substantially expands total life expectancy and the cardiovascular disease-free life expectancy for men and women (Oscar, 2005). Moreover, Peto & Whitlock (Peto, 2010) indicated that morbid obesity and cigarette smoking each shorten life expectancy by approximately 10 years, and moderate obesity shortens it by approximately 3 years. Examining the relation between smoking and life expectancy, Haybittle (Haybittle, 1966) showed that the life expectancy of non-smokers is about 6 years higher than that of those who smoke heavily. In addition, Conway & Cronan (1992) concluded that smoking is a detriment to physical fitness even among relatively young, fit individuals. It is also suggested that smokers will have lower physical endurance than nonsmokers, even after differences in the average exercise levels of smokers and nonsmokers are taken into account. It is stated that "environment quality affects life expectancy and longevity" (Mariani, Perez-Barahona, & Raffin, 2009).

Similar to many developing countries in Southeast Asia, Vietnam is in the post-demographic transition, in which the transition from high fertility and mortality to low fertility has already occurred and the age-sex structure of the population has undergone major changes. The life expectancy for Vietnam residents increased across the years. The rate of people who are 65 years old and older was 6 percents in 1999 and it increased up to 7 percent in 2009. The rate of Aging increased from 18% in 1989 to 24% in 1999 and 37% in 2009 which is 30% higher than that of the Southeast area. It showed that the trend of aging in Vietnamese population has been getting quicker in three past decades (General statistics office of Vietnam, 2010). Furthermore, in Vietnam, people aged from 60 years or above are defined as older persons or elderly people. In 1979 elderly people accounted for 6.9% of the total population, and in 2006 the total of elderly people estimated at 7.7 million accounted for 9.2% of the total population and the young people aged from 0-14 accounted for 26%. Amongst the elderly, elderly women account for 58%. The importance of the issue becomes clearer when the projected increase in the numbers of elderly people is compared with those in the past and seen within the context of the growth in the total population (The Commitee for population-family-children of Vietnam, 2002).

The population of Vietnam is approximately 87.84.000 (2011). The number of elderly people increased by 2.5 million during 1979-1999, accounting for almost 8 percent of the total number of the people newly added to Vietnam's population. The percentage of the elderly in 2005 and 2006 were 8.9% and 9.2% respectively. The increments are projected to be much higher with 16.8% in 2029 and the following years. It also means a significant increase in the number of the elderly compared with the working age population (between 15 and 59 years of age). There was one elderly person for every eight working age people in 1999 (The Commitee for population-family-children of Vietnam, 2002). Approximately ninety percent of Vietnamese are Buddhist. The Buddhism involves a life philosophy that man was brought to this life to suffer. Suffering stems from the craving of the ego, wealth, fame and power (Dihn & Huynh., 2006). Vietnamese people tend to be excessively polite and delicate. Frank honest and speaking up are often considered rude, so many Vietnamese hide their true feelings or fears (Sindler, 2006). Vietnamese people greatly respect educated individuals, particularly physicians. Doctors are considered experts, thus there is an expectation for a diagnosis and treatment at the first visit. Death

and dying of a family member or loved one is an emotional lengthy process in the Vietnamese community, with many associated rituals. Mental illness is considered shameful in Vietnamese culture. Family members are often hidden away by their families of placed in a hospital. Some believe that “mental health” is a punishment or torture for a previous life’ crime therefore, they must suffer and will not seek medical attention. The leading causes of death for all ages of Vietnam are cerebrovascular diseases, transport accidents, chronic lower respiratory diseases, liver cancer, lung cancer, hypertensive diseases, tuberculosis, ischemic heart diseases (Ngo et al, 2010).

The population of Germany is approximately 81.859.000 (2011), making it the 16th most populous country in the world. Germany's population is characterized by zero or declining growth (Haupt & Kane, 2004). The total fertility rate has been rated around 1.4 in 2010 (the highest value since 1990 and has recently even been estimated at 1.6 after accounting for the fact that older women contribute more to the number of births than in previous statistic models, and total fertility rates increased in younger generations. Fertility was closely linked to educational achievement (with the less educated women having more children than the educated ones). Persons who adhere to no religion have fewer children than Christians, and studies also found that among Christians the more conservative ones had more children than the more liberal ones. Germany has one of the world's highest levels of education, technological development, and economic productivity. Older German people’ average life expectancy has increased as well. The average life expectancy has steadily been improving in the last decades which leads to life expectancy at birth (e_0) in Germany is 80 (women: 82.44; Men: 77.82) years (Statistisches Bundesamt, 2009a). According to estimates reported by Germany, German gained 3.2 years in life expectancy. With men showing a greater gain than women: 3.6 years and 2.9 years, respectively. Risk factors are estimated to contribute differently to the burden of illness and health population. The degree to which the German population is exposed to five of these risks are: Tobacco, blood pressure, alcohol, cholesterol, overweight, low fruit and vegetable intake, physical inactivity, illicit drugs, and unsafe sex (WHO, 2002). The main causes of death in 2001, for non-communicable diseases accounted for about 88% of deaths in Germany; external causes for just 5% and communicable diseases for about 1% ((WHO, 2002) However, people are usually well informed about their health status, the positive and

negative effects of their behaviour on their health and their use of health care services (WHO, 2004). The population will shrink to between 65 and 70 million by 2060 (depending on the level of net migration) (Statistisches Bundesamt, 2009b). "As the result of longevity and low fertility rates, the elderly population in Germany has increased dramatically over the years it is predicted to increase from 7 percent of the total population in the last century to over 10 percent by 2020" (recited from Dallinger, 2012)). Germany is also the third-highest number of international migrants worldwide, about 5% or 10 million of all 191 million migrants (International migration, 2006). Christianity is the largest religion in Germany, with 51.5 million adherents (62.8%) in 2008 (EKD statistik, 2007). Religious affiliation is as follow: Roman Catholics, 34%; Protestants, 34%; Muslims, 3.7%; and unaffiliated or other, 28.3%. Roman Catholics are more numerous in southern Germany (Country file report, 2008).

According to data of the two observed countries, it can be seen that there are striking differences between Germany and Vietnam in environmental pollution, leading causes of death, smoking, drinking, health care and some major diseases. It has been documented that the air-transported respirable dust is 50μ/m^3 in Germany and 8050μ/m^3 in Vietnam (Fuller, 2007; Umweltbundesamt (Hrsg), 2011). The total percentage of people engaging in smoking in Germany is 8.7% for men and 13.7% for women, whereas 49.0% for men and 2.4% for women smoke in Vietnam (GATS, 2010; Robert Koch-Institut (Hrsg), 2011c). Burger (Burger, 2003) stated that the rate of alcohol drinkers in Germany is 53.3% in men and 53.7% in women, while it is 87.3% in men and 10.2% in women in Vietnam (Giang, 2008). The average life expectancy has steadily been improving in the last decades which leads to life expectancy at birth (e_0) in Germany is 80 (women: 82.44; Men: 77.82) years in average which is approximately 8 years higher than that in Vietnam (women: 74.92; Men: 69.72) (Statistisches Bundesamt, 2009a). Moreover, life expectancy at age of 60 (e_{60}) in Germany is 20 years for men and 25 years for women, while it is 19 years for men and 21 years for women in Vietnam (United Nations, 2004). These differences in life expectancy between the two countries, therefore, may be due to the effects of air pollution, smoking and health care conditions. However, a question is raised whether an active lifestyle has an impact on life expectancy in e_{60} and age group.

Knowledge concerning the benefits of physical activity for older people is based primarily on studies of traditional exercise intervention such as aerobic activity. The increasing popularity of alternative and complementary modes of physical activity leads to questions concerning the extent to which, they, too, are beneficial for older people. One such activity is Tai Chi which has deep historical roots in Chinese martial arts. Tai Chi is becoming increasingly popular in Asian countries as both an ideal exercise for lifelong well being and as a complementary therapy in healthcare settings that serves the geriatric population.

It has been well-documented that many physical changes and psychological changes are associated with aging (Shephard, 1997). Exercise can improve cardiovascular function; lessen risk factor of cardiovascular disease, lead to strength improvement, balance and flexibility. Moreover, the psychological functions like cognitive such as memory, depression, perception of control of the elderly are also improved (Mazzeo et al., 1998). Tai Chi appears to improve physiological function and fear of falling in the elderly (Zhang et al., 2006), self-efficacy (Li et al., 2001). Tai Chi exercise also has an effect on pain, balance, muscle strength, and perceived difficulty in physical functioning (Song, Lee, Lam, & Bae, 2007). Li (2000) also concluded that the 6 month Tai Chi exercise program was effective for improving functional status in healthy, physically inactive older people. A self-paced and self-controlled activity such as Tai Chi has the potential to be an effective, low-cost means in improving functional status in older persons (Li et al., 2001). In this study, Short Form-36 was used to evaluate the physical function of older adults. The results showed that Tai Chi is likely to improve functional limitations based on the participant self-rated ability. It promoted strength, balance, and improved overall physical functioning. Study on reduction in fear of falling through intense Tai Chi exercise training is seen in older adults. In addition, Sattin (2005) indicated that Tai Chi led to a significant reduction in fear of falling that a control group and he also suggested that Tai Chi should be considered in any program designed to reduce fall and fear of falling in transitionally frail older adults. Furthermore, Tai Chi participants tended to have a lower rate of falls. It is also concluded that Tai Chi is a balanced exercise that integrated key components of modern exercise training. Tai Chi is beneficial to psychological and physiological functions. Additionally, Tai Chi can be prescribed as an alternative exercise program for

selected patients with cardiovascular, orthopedic or neurological disease, and can reduce the risk of falls in elderly individuals (Lan, Lai, & Chen, 2002).

It showed in another study that a six month program of Tai Chi Chuan afforded a significant improvement of performance of memory complaints in the elderly with mild cognitive impairment (Kasai et al., 2010). Moreover, a number of excellent review articles exist showing evidence that Tai Chi generates various health benefits for individuals of varying age groups and patient populations (Lan et al., 2002; Li, Hong & Chan, 2001; Wang, Collet, & Lau, 2004; Wayne et al., 2004; Wu, 2002). According to Rózánska-Kirschke (2006), general fitness establishes the quality of life, but it often decreases with age. Therefore, it becomes vital to find out the method of evaluation of individual fitness level to design a targeted program. Physical fitness parameters such as strength, flexibility, co-ordination and endurance can be measured by the Fullerton Functional Fitness Test, invented by Rikli & Jones (2001) in the lifespan Wellness clinic at California State University in Fullerton. Furthermore, by using the Short Form-36 and exploring eight indicators related quality of life (Ware & Sherbourne, 1992), the specific problems, per health-related quality of life indicator, can be identified. The 36-item short-form was constructed to survey health status in the Medical Outcomes Study. It was designed for use in clinical practice and research, health policy evaluations, and general population surveys. It is also a survey used to assess the change in multiple dimensions of health status involving physical-, social-, and role-functioning, bodily pain, mental health and health perception that includes a 36-questionnaire in which people are asked to answer all the questions that they think are true for their health status. Each older subject is given a MOS-36 questionnaire to fill in what he/she think about their real health circumstances.

To date, the aging population tends to increase in Vietnam. It would be necessary to find ways and measures to maintain or improve the normal physical functioning and mental health of the elderly. There are many people living in community-dwelling in Vinh City engaging in Tai Chi. However, there have not been comprehensive systematic studies deal with effects of Tai Chi on physical function and perceived health as well as fall balance, cognitive performance and sleep quality of Vietnamese older adults. Our study was to investigate and examine the effects of Tai Chi on physical fitness, perceived health, balance, cognitive performance, sleep quality and blood pressure of the elderly. In addition,

there has not been any study on cross-physical fitness between Vietnamese and German samples. As aforementioned, cultural differences may influence elderly people's functional ability in several ways. There may be difficult perceptions of the severity of certain experiences. Therefore, it would be the initiatively observational research that may lead to further cultural aspects of study between the two countries in the future.

1.2 Aims of intervention

The more people grow older, the more difficult people have to face in daily life such as physical, mental problems, sleeping disturbance, falls, quality of life, cognitive performance and physiological changing. In addition, the assessment of functional ability has become an essential issue of the health studies among elderly individuals. Cultural differences, to some extent, influence the function performance in daily life of the elderly. Therefore, with the reasons and backgrounds mentioned above, this study is addressed to the following aims:

The primary aim of this study was expected to indicate the effect of Tai Chi exercise on physical fitness, mental health, balance ability as well as have good impact blood pressure, cognitive performance, and sleep and life satisfaction of the elderly. In this study we attempted to address the effects of Tai Chi exercise by undertaking a randomized controlled trial on older subjects. An observational and comparative study on physical and mental health domains between Vietnamese participants and German participants was also carried out. The secondary aims are to:

- To investigate the current situation of Tai Chi training of older people in Vinh city
- To identify whether Tai Chi exercise improves the physical fitness in the elderly
- To assess the effect of Tai Chi exercise on blood pressure
- To identify whether Tai Chi exercise improves the physical and mental functioning
- To assess the balance ability of the elderly with Tai Chi training
- To assess the cognitive performance of the elderly with Tai Chi training
- To assess the quality of sleep of the elderly with Tai Chi training
- To assess the valuation of life of the elderly with Tai Chi training
- To identify whether Tai Chi exercise improve the balance ability of the elderly

- To compare the results of SFT and SF-36 of the elderly in Vietnam with those of the elderly in German Red Cross.

Research questions:

Are there any effects of the 24-form Tai Chi on various physical aspects of the elderly?

Are there any effects of 24-form Tai Chi on mental functional aspects?

Is 24-form Tai Chi good for improving sleep quality?

Is 24-form Tai Chi good for enhancing blood pressure, valuation of life, and cognitive performance?

How are the physical and mental performance levels between Vietnamese and German samples?

1.3 Hypotheses

- Tai Chi group shows a better physical fitness than that in the control group.
- Tai Chi group has a better effect on physical and mental functioning in comparison with the control group.
- Tai Chi improves blood pressure in Tai Chi group in comparison with the control group.
- Tai Chi promotes the balance ability in Tai Chi group than that in the control group.
- Tai Chi improves quality of sleep, valuation of life, and cognitive performance.
- There are significant differences in physical and mental assessment between Vietnamese and German participants

1.4 Leading constructs

1.4.1 Health

The WHO has defined health as a "state of complete physical, mental and social well-being and not merely the absence of disease or infirmity"(Constitution of the World Health Organization, 1948). According to Ware (1987) the concept "quality of life" (QOL) has been adopted to distinguish the old health definition "absence from disease" from the new definition described by the world health organization (WHO) including mental and social well-being dimensions. However, QOL encompasses many things not related to

health (Ware, 1987). Health-related quality of life may be seen as the parts of QOL related to an individual's health (Bergland & Narum, 2007). Ware (1987) also suggests five distinct dimensions to be included when measuring health related quality of life (HRQL): physical health, mental health, everyday functioning in social and in role activities, and general perceptions of well-being. Hays et al (2002) define HRQL as "the extent to which health impacts an individual's ability to function and his/her perceived well-being in physical, mental and social domains of life".

1.4.2 Aging

Aging can be defined as "a progressive functional decline, or a gradual deterioration of physiological function with age, including a decrease in fecundity" (Partridge & Mangel, 1999) and the intrinsic, inevitable, and irreversible age-related process of loss of viability and increase in vulnerability (Bowen & Atwood, 2004). Aging is also implied as "a different process of change in different dimensions of the person" (Kruse & Schmitt, 2007). In addition, "Aging is a popular, general term that describes advancing through the life cycle, beginning at birth and ending at death. Aging is commonly used by the general population to describe the process of getting older. As such, aging can include the developmental stages of pre-adulthood. Scientifically, however, aging is the process of gradual decline that occurs beginning in middle adulthood and continuing to death. As a result, many gerontologists prefer the more descriptive term senescence" cited in Blackburn & Dulmus (2007, p.19).

1.4.3 Blood pressure

Blood pressure is the pressure exerted by circulating blood upon the walls of blood vessels, and is one of the principal vital signs. Everyone has to have some blood pressure. It is absolutely necessary to get blood to our vital organs and muscles. During each heartbeat, blood pressure varies between a systole and diastole pressure (Health and life). The blood pressure in the circulation in principally due to the pumping action of the heart (Caro, 1978). Blood pressure can rise when one is excited or nervous or exercise. It may become low in sleep. A person's blood pressure is usually expressed in terms of the systole

pressure of the systolic pressure over diastolic pressure and is measured in millimeters of mercury (mmHg) with standard 120/80.

1.4.4 Mental health

WHO (2010) stated that "Mental health is an integral and essential component of health. It is a state of well-being in which an individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and is able to make a contribution to his or her community. In this positive sense, mental health is the foundation for individual well-being and the effective function of a community". Multiple social, psychological, and biological factors determine the level of mental health of a person at any point of time. For example, persistent socio-economic pressures are recognized risks to mental for individuals and communities; the clearest evidence is associated with indicators of poverty, including low levels of education. Poor mental health is also associated with rapid social change, stressful work conditions, gender discrimination, social exclusion, and unhealthy lifestyle, risks of violence and physical ill-health and human rights violations. There are also specific psychological and personal factors that make people vulnerable to mental disorder. There are some biological causes of mental disorder including genetic factors and imbalances in chemicals in the brain. Lastly, mental health is a socially constructed and socially defined concept; that is, different societies, groups, cultures, institutions and professions have very different ways of conceptualizing its nature and causes, determining what is mentally healthy, and deciding what interventions if any, are appreciate (WHO, 2010)

1.4.1 Quality of life and health related quality of life

Quality of life can be defined in many ways; it is an amorphous concept that has a usage across many disciplines such as geography, literature, philosophy, health, economics advertising, health promotion and the medical and social sciences. Health related quality of life is largely based on multidimensional perspective of health as physical, physiological and social functional and well-being, along with the lines of the WHO's (1948) definition of health: a "state of complete physical, mental and social well-being and not merely the absence of disease or infirmity". Ware (1987) has argue that five health concepts are

inherent in this definition: physical health, mental health, social functional, role functioning and general well-being. As cited in WHO (1997): "Quality of life is defined as an individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns. It is broad ranging concept affected in a complex way by the person's physical health, psychological state, level of independence, social relationships, personal beliefs and their relationship to salient features of their environment". Valuation of life was found to be positively associated with how long a person would want to live with various degrees of limitations in physical functioning, cognitive functioning, and pain (Lawton et al., 1999).

1.4.2 Physical activity

Physical activity has been defined as "bodily movement resulting from the contraction of skeletal muscle that increases energy expenditure above the basal level" (Carpersen, 1989). In addition, Skelton (2001) stated that "physical activity describes any body movement that substantially increases energy expenditure. It is commonly divided into occupational and leisure activity. Physical activity can range from everyday actions or leisure activities such as swimming, dancing, cycling or sporting and exercise opportunities provided in gyms and fitness centers".

1.4.3 Physical exercise

Physical exercise has defined as "physical activity that is planned, structured, and repetitive in nature" (Marcus & Forsyth, 2003). Physical exercise is any bodily activity that enhances or maintains physical fitness and overall health or wellness. It is performed for various reasons. These include strengthening muscles and the cardiovascular system, honing athletic skills, weight loss or maintenance and for enjoyment. Furthermore, physical exercise is described as "a planned and structured activities where repetitive body movements are made to improve or maintain components of fitness" (Skelton, 2001).

1.4.4 Physical fitness

The term *physical fitness* is defined as "a sufficient physical fitness level to manage daily living activities safely and independently without fatigue" (Daley & Spinks, 2000). A decline in functional ability (endurance, agility, strength, flexibility) is seen with the advancing age and causes difficulties in daily living activities. Furthermore, older adults tend to be less active with advancing age. Physical fitness comprises two related concepts: *general fitness* (state of health and well-being) and *specific fitness* (a task-oriented definition based on the ability to perform specific aspects of sports or occupation). Physical fitness is generally achieved through exercise.

1.4.5 Muscular strength

Some fitness experts stated that maintaining muscular strength should be the number one fitness concern of older adults (Fiatarone & Evans, 1993; M. Nelson et al., 1994). Lower-body strength is needed for normal activities such as climbing stairs, walking distances, or getting out of a chair or bathtub. Upper-body strength is important to carry groceries, lifting a suitcase, picking up a grandchild or a pet, and for many other common tasks. Maintaining strength and muscle function is also important because of the role it plays in helping to reduce the risks for falls and fall-related injuries (Brown et al., 1995; Brown, Sinacore, & Host, 1995).

1.4.6 Aerobic Endurance

An adequate level of aerobic endurance (the ability to sustain large-muscle activity over time is necessary to perform many everyday activities such as walking, shopping, sightseeing while on vacation, or participating in recreational or sport activities. How much work our body can do and how much energy we have is related to how much oxygen we can take in and use. Although it has been estimated that a VO_2 max (a common measure of oxygen consumption/aerobic capacity) of 15 to 18ml x kg x min is necessary to maintain independent living status, declines associated with inactive lifestyle often progress below this point prior to age 80 (Shephard, 1997). Clearly, aerobic endurance is an important

fitness component for older adults. The research also shows that increased exercise can lead to substantial improvement in aerobic endurance in older adults (Mazzeo et al., 1998).

1.4.7 Flexibility

As cited in Plowman & Smith (2008, p578), flexibility is defined as "the range of motion in a joint or series of joints that reflects the ability of the musculotendon structure to elongate within the physical limitations of the joint". It is also cited "There are two basic types of flexibility: static and dynamic. Static flexibility refers to the range of motion about a joint with no consideration of how easily or quickly the range of motion is achieved. Dynamic flexibility refers to the resistance to motion in a joint that will affect how easily and quickly a joint can move through the range of motion and, more recently, as the rate of increase in tension in a contracted or relaxed muscle as it is stretched".

1.4.8 Agility/dynamic balance

As cited in Rikli & Jones (2001, p.16) "Combined agility (involving speed and coordination) and dynamic balance (maintaining postural stability while moving) is important for a number of common mobility tasks that require quick maneuvering such as getting on and off a bus in a timely manner; moving out of the way to avoid getting hit by a car or other objects, or getting up quickly to answer a phone call, go to the bathroom or attend to something in the kitchen. Also, adequate agility/dynamic balance is needed for safe participation in many recreational games and sports".

Chapter 2 Literature review

2.1 Aging and physical changes associated with aging

Aging is implied as “a different process of change in different dimensions of the person” (Kruse & Schmitt, 2007), and aging can also be defined as “a progressive functional decline, or a gradual deterioration of physiological function with age, including a decrease in fecundity” (Partridge & Mangel, 1999) and the intrinsic, inevitable, and irreversible age-related process of loss of viability and increase in vulnerability (Bowen & Atwood, 2004). Furthermore, as cited in Blackburn & Dulmus (2007, p.19) that “aging is a popular, general term that describes advancing through the life cycle, beginning at birth and ending at death. Aging is commonly used by the general population to describe the process of getting older. As such, aging can include the developmental stages of pre-adulthood. Scientifically, however, aging is the process of gradual decline that occurs beginning in middle adulthood and continuing to death. As a result, many gerontologists prefer the more descriptive term senescence”. As cited in Lata et al (2007, p.111-113), there are various physiological changes which occur as we age are: At the age of 20 to 30 there are declines in strength of muscle groups. There is reduction in muscle mass that makes strength decrease with age. Some losses in muscle fiber number also take place with aging. There is also normal atrophy of the heart muscle, calcification of heart valves, and loss of elasticity in artery walls. Weight changes with aging are not totally predictable but in general, a person tends to gain weight up to about age 60 and then weight tends to steadily diminish. There is also change in muscular-skeletal system, There is an isometric and dynamic loss of strength (30 percent by age 70) and to a less extent, reduced speed of movement and endurance, physical work capacity, thus, declines. There is a change in joints and their components that strongly effects on flexibility such as change in tendons, ligament, cartilage and fluid. It is also cited in Lata et al (2007, p.111-113) , there is a change in respiratory system such as the airway and lung tissue become less elastic with reduced cilia activity, decreased oxygen uptake and exchange, reduction of the ability to breathe deeply.

Figure 2.1. Musculoskeletal system changes associated with aging**,** *taken from Jadin (2005)*

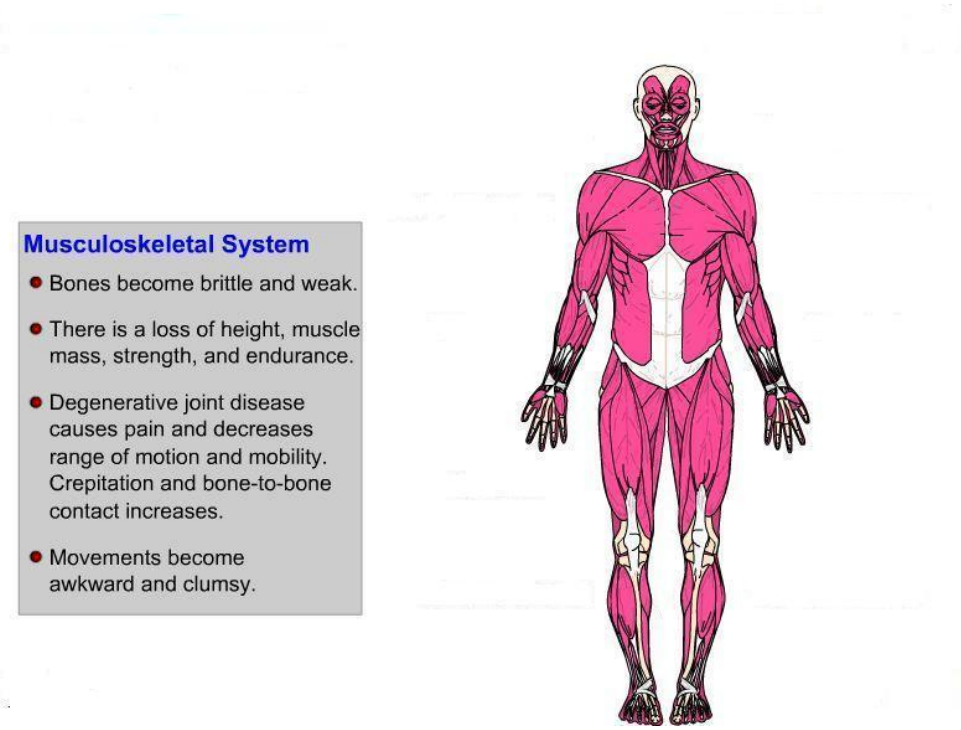


Figure 2.2. Respiratory system changes asscociated with aging, *taken from Jadin (2005)*

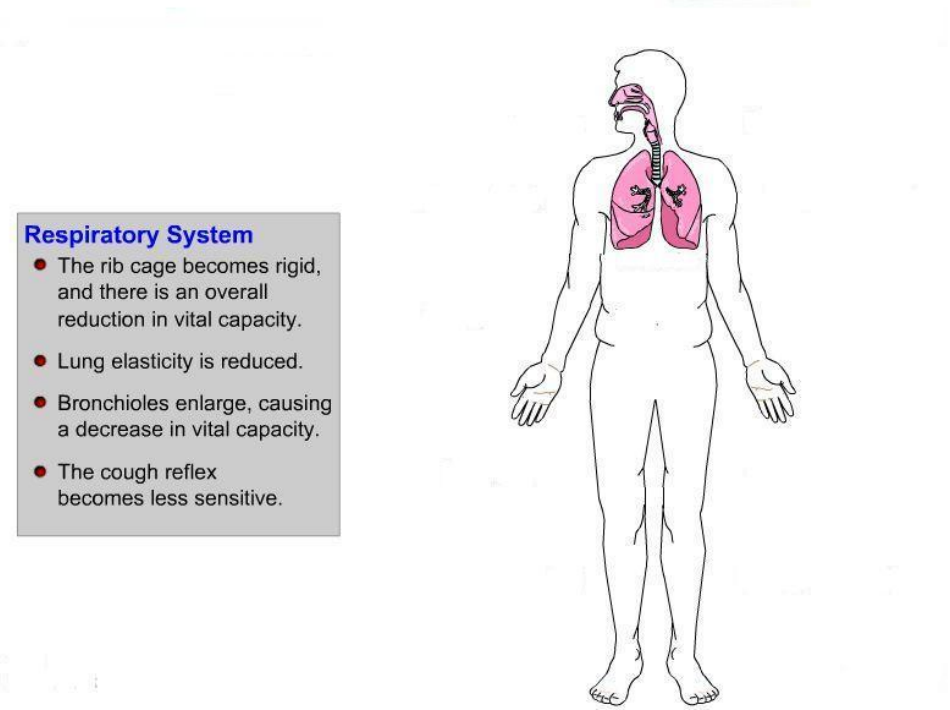
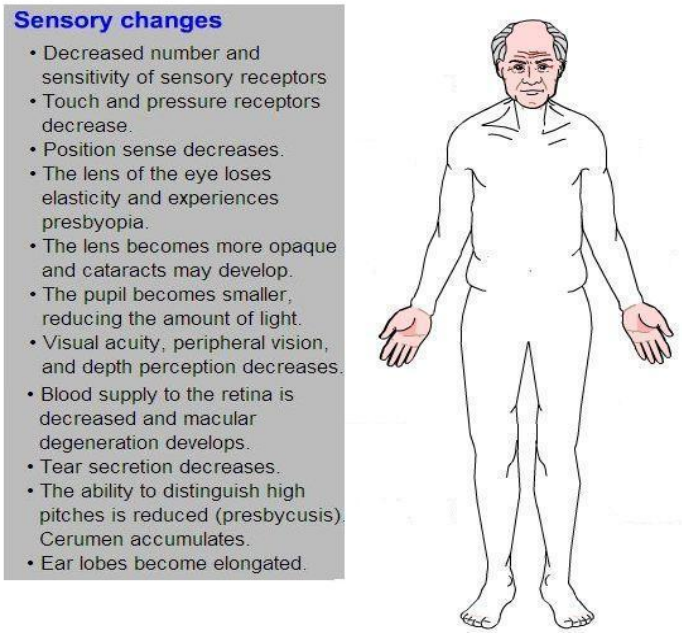


Figure 2.3. Sensory changes with aging associated with aging, *taken from Jadin (2005)*



Pupil begins to decrease in size and there is decreased response to light. Cognitive function changes with age (as also cited in Lata W alia (2007)), individual loses nerve cells over time that effect on intelligence such as ability to comprehend new information, to think abstractly, to make rational decisions, numeral ability, verbal fluency. People have more problems in memory when they get older. There is increased impairment to accumulate new information relatively recent experience.

Figure 2.4. Cardiovascular system changes with aging, *taken from Jadin (2005)*

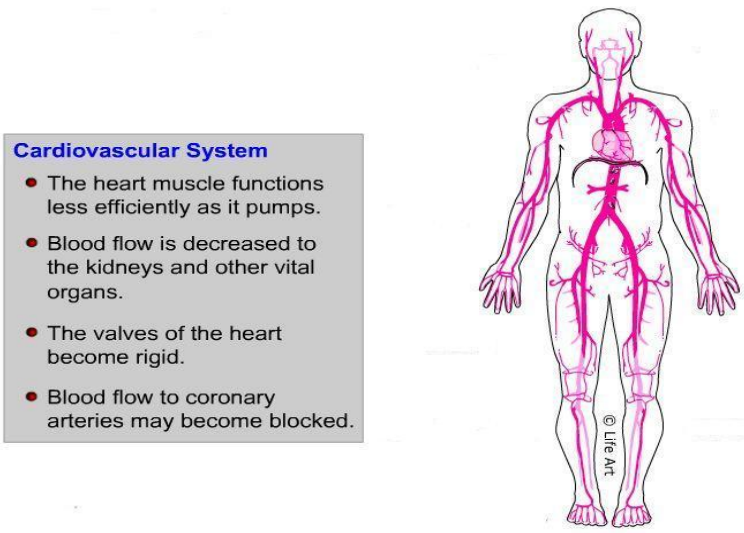
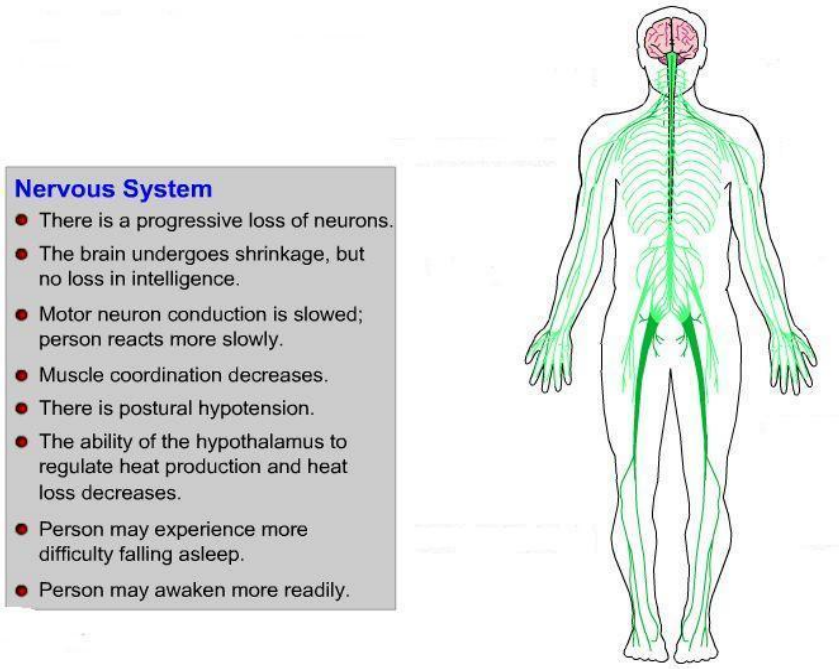


Figure 2.5. Nervous system changes associated with aging, *taken from Jadin (2005)*



2.1 Effects of physical activities for the orderly's health

Physical activity might have good benefit for many kinds of chronic conditions prevalent among older people (Batty & Lee, 2004; Chavannes, Vollenberg, van Schayck, & Vouters, 2002; M. A. Singh, 2004). One of the key to healthy aging has been shown is the maintenance of a physically active lifestyle. Regular physical activity has been shown to reduce the risk of premature death and disability from a number of health conditions in older age (Mummery, Schofield, & Gaperchione, 2004; Taylor et al., 2004; Wagner, LaCroix, Buchner, & Larson, 1992).

Benefits from regular exercise include improved bone health and, thus, reduction in risk from osteoporosis; improved postural stability, thereby reducing the risk of falling and associated injuries and fractures; and increased flexibility and range of motion (Mazzeo et al., 1998). The evidence also suggested that involvement in regular exercise can also provide a number of psychological benefits related to preserved cognitive function, alleviation of depressive symptoms and behavior, and an improved concept of personal control and self-efficacy. Aveiro et al (2006) concluded that the physical activity is

efficient in improving balance performance, gait velocity and ankle muscle strength among elderly women with osteoporosis. The world health organization (Wordl Health Organization, 2000) suggested that it is both beneficial and cost-effective to help sedentary individuals residing in the community to take up moderate level of physical activity. More benefit is likely to be gained from activating the sedentary than from persuading those who are already active to become more active.

Tokarski (2004) reported that regular physical activity is also necessary for maintaining muscle strength, coordination, joint function and flexibility. In other research, DiPietro (2001) concluded that sedentary behavior is an important risk factor for chronic disease mobility and mortality; however, there is encouraging evidence that moderate levels of physical activity may provide protection from certain chronic diseases. Thompson et al (2003) reported that a physically active lifestyle can play a role in preventing the physical deterioration associated with aging and a sedentary lifestyle. Furthermore, aerobic exercise in older adults can have a beneficial effect on the performance of speeded tasks that rely heavily on executive control (Smiley-Oyen, Lowry, Francois, Kohut, & Ekkekakis, 2008). High levels of muscle activity are a characteristic of age-related declines in postural stability and that such activity is correlated with short-term postural sway (Laughton et al., 2003). DiPietro (2001) added that regular participation in activities of moderate intensity (such as walking, climbing stairs, biking, or yard-work/gardening), which increase accumulated daily energy expenditure and maintain muscular strength, but may not be of sufficient intensity for improving fitness, should be encouraged in older adults. In another study, Cress (Cress et al., 1999) had a randomized controlled study with 49 independent living men and women. The result showed that compared to control group, the exercise group showed a significant increase in maximal oxygen consumption and muscle strength. He concluded that independent older adults gain meaningful benefits from several months of exercise training. The public health importance of physical activity may be related not just to its role in preventing decline, but also to its role in enhancing physical function.

It cannot be denied that physical activities are necessary for all people. Nelson et al (2007) stated that virtually all older adults should be physically active. An older adult with a medical condition for which activity is therapeutic should perform physical activity in a

manner that treats the condition. In addition, an older adult with medical conditions should engage in physical activity in the manner that reduces risk of developing other chronic diseases. Physical activity should be one of the highest priorities for preventing and treating disease and disability in older adults. Physical activity is well known to have beneficial effects on mobility, and it is widely thought that one of the ways in which physical activity may benefit mobility in the elderly is through its effects on lower extremity muscle structure and function. With the prospective study of 890 ambulatory older persons without dementia who underwent annual clinical evaluations to examine change in the rate of mobility over time, it is concluded that respiratory muscle strength is associated with mobility decline in older persons independent of lower extremity strength and physical activity, clinical interventions to improve respiratory muscle strength may decrease the burden of mobility impairment in the elderly (Buchman et al., 2008). With a randomized controlled trial, of 202 people aged 60 and over, Lee et al (2007) concluded that among hypertensive older people, a six-month community based walking intervention was effective in increasing their exercise self-efficacy and reducing systole blood pressure.

Exercise has therapeutic benefits for almost all community-dwelling older adults, especially those suffering from the most prevalent chronic illnesses. Its benefits include reduction in morbidity and mortality, and enhanced physiological capacity, leading to improvements in overall functioning (Bean et al., 2009). Participation in a physically active lifestyle during midlife appears to be critical to the maintenance of high physical function in people who are fit and well enough to work and to do or do not report any long-standing illness (Hillsdon, Brunner, Guralnik, & Marmot, 2005).

2.1.1 Exercise and physical activity for psychological health and well-being

In addition to the effects on physiological variables and a variety of chronic diseases and conditions, there is now strong evidence that exercise and physical activity have a significant impact on several psychological parameters and well-being (Spirduso, 1995). Both higher physical fitness (Blumenthal et al., 1989; Camacho, Roberts, Lazarus, Kaplan, & Cohen, 1991; Simonsick et al., 1993) and participation in aerobic exercise training are

associated with a decreased risk for clinical depression or anxiety (Mather et al., 2002). Exercise and physical activity have been proposed to impact psychological well-being through their moderating and mediating effects on constructs such as self-concept and self-esteem (Folkins & Sime, 1981). However, other pathways may also be operative, such as reduction in visceral adiposity along with associated elevation in cortisol (Porter & Landfield, 1998). In addition, for many seniors, aging is associated with a loss of control over one's own life are known to be related to psychological health and well-being, exercise scientists have begun to focus on the relationship between activity and various indices of psychological control, self-efficacy, and perceived competency (McAuley & Rudolph, 1995) reviewed the literature examining the relationship between physical and self-efficacy in older adults. They conclude that most well-controlled exercise training studies result in significant improvements in both physical fitness and self-efficacy for physical activity in older adults. Several studies suggest that moderate-intensity physical activity may be more effective than either low-or high-intensity training regiment (King, Taylor, & Haskell, 1993; McAuley et al., 2000).

2.1.2 Physical activity for cognitive functioning, and aging

It is documented in (Chodzko-Zajko et al., 2009), several cross-sectional and prospective cohort studies have linked participation in regular physical activity with a reduced risk of dementia or cognitive decline in older adults. It is reported that aerobic fitness training enhances the cognitive vitality of healthy but sedentary older adults (Colcombe & Framer, 2003). Several studies have compared the individual and combined effects of physical and mental exercise interventions (Fabre et al., 2002; Oswald et al., 1996). These studies found cognitive benefits to be larger with the combined cognitive and aerobic training paradigms. Moreover, it is documented that new learning and memory strategies can compensate at least in part for deficits in sensory and motor functions ((Kruse & Schmitt, 2001).

2.1.3 Physical activity and quality of life in old age

The quality of life is a psychological construct, which has commonly been defined as a conscious judgment of the satisfaction an individual has with respect to his/her own life

(Pavot, Diener, Colvin, & Sandvik, 1991). Several reviews suggested that resistant exercise training can improve several indices of psychological health and well-being including anxiety, depression, overall well-being, and quality of life (Arent, Landers, & Etnier, 2000; Netz, Wu, Becker, & Tenenbaum, 2005; Spirduso & Cronin, 2001; Taylor et al., 2004). Improvements in overall well-being and quality of life measures have also been reported after resistance exercise training using moderate and higher-intensity protocols in community-dwelling seniors with minor or major depression (N. Singh, Clements, & Fiatorone, 1997). In a seven-year follow-up study, Ku indicated that leisure-time activity is associated with a reduced risk of significant depressive symptoms in older adults (Ku, Fox, & Chen, 2009). Furthermore, physical activity counseling targeting initially sedentary older people was effective in reducing depressive symptoms among older men and women suffering from minor depressive symptoms (Pakkala et al., 2008).

2.2 Physical exercise and risk of falls

Falling is the sixth leading cause of death among the elderly (Tinetti el at., 1990). Musculoskeletal diseases and visual defects were common medical problems responsible for falls (Shanthi & Krishnaswamy, 2005). Falls are a dangerous matter for the elderly. However, most of them are preventable. Numerous factors, both intrinsic (personal factors) and extrinsic (environmental factors), can cause falls in the elderly and lead to injury. Older persons, often with multiple medical problems, move through their daily routine exposed to many environmental risk factors such as grass, curbs, steps, slippery surfaces and more. Among the intrinsic risk factors that the elderly face are changes in vision and hearing, use of medications, and a declining strength in bones and muscles. As the number of risk factors present increases, so does the risk for falls (Tinetti et al, 1994).

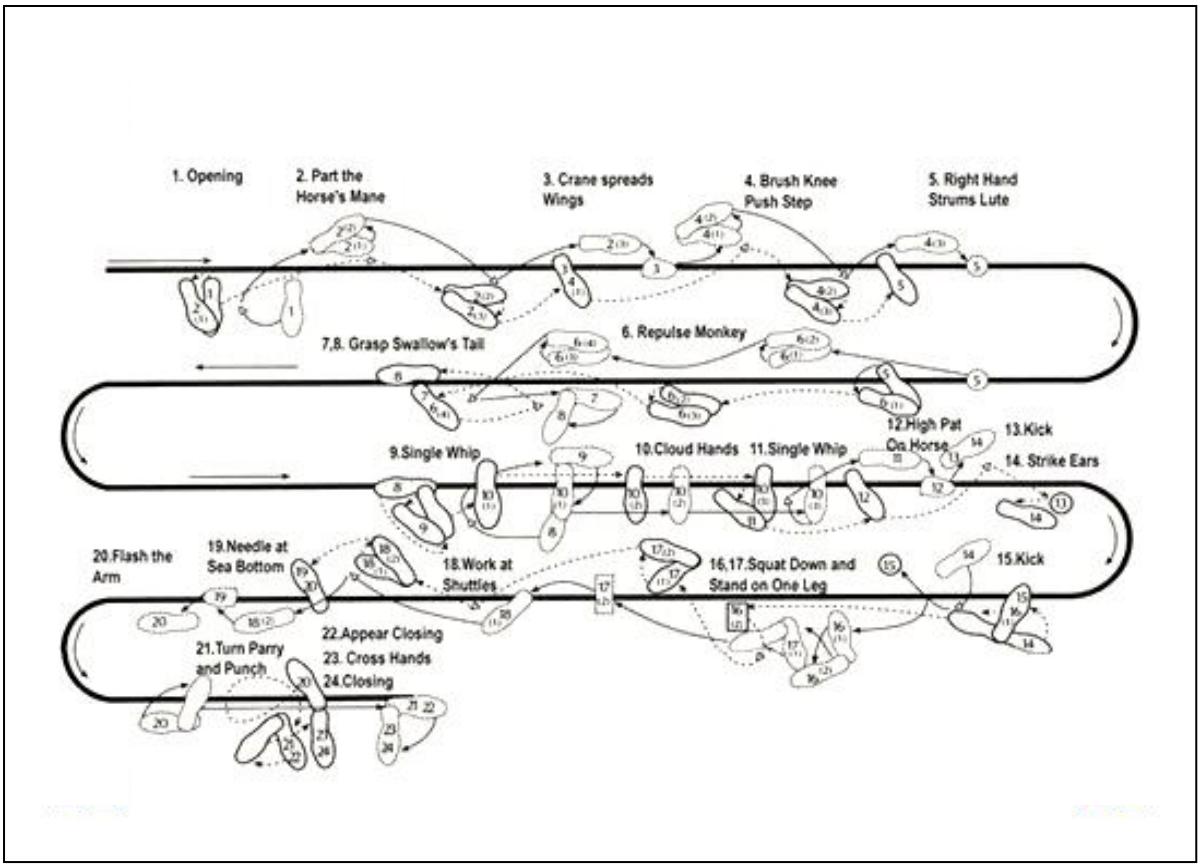
It is very important to ensure that the risk factors in the reduction of the risk and its incidence rate in the elderly should be indentified and assessment methods should be developed (Akyol, 2007). Most of the literature studies focus on the probability of the future falls for individuals who have past fall experience. The level of outdoor physical activity mediates the relation between fear of falling outdoor and outdoor falls. Wijlhuizen et al (2007) suggested that to reduce falls outdoor, older people should first build up their physical abilities in a safe environment before being encouraged to increase outdoor

physical activity.. In another study, it is confirmed that exercise can reduce fall rates in older people and identifies the important components of effective exercise intervention strategies. It confirms the importance of balance training in falls prevention and the need for exercise to be sustained over time (Sherrington et al., 2008).

2.3 Tai Chi

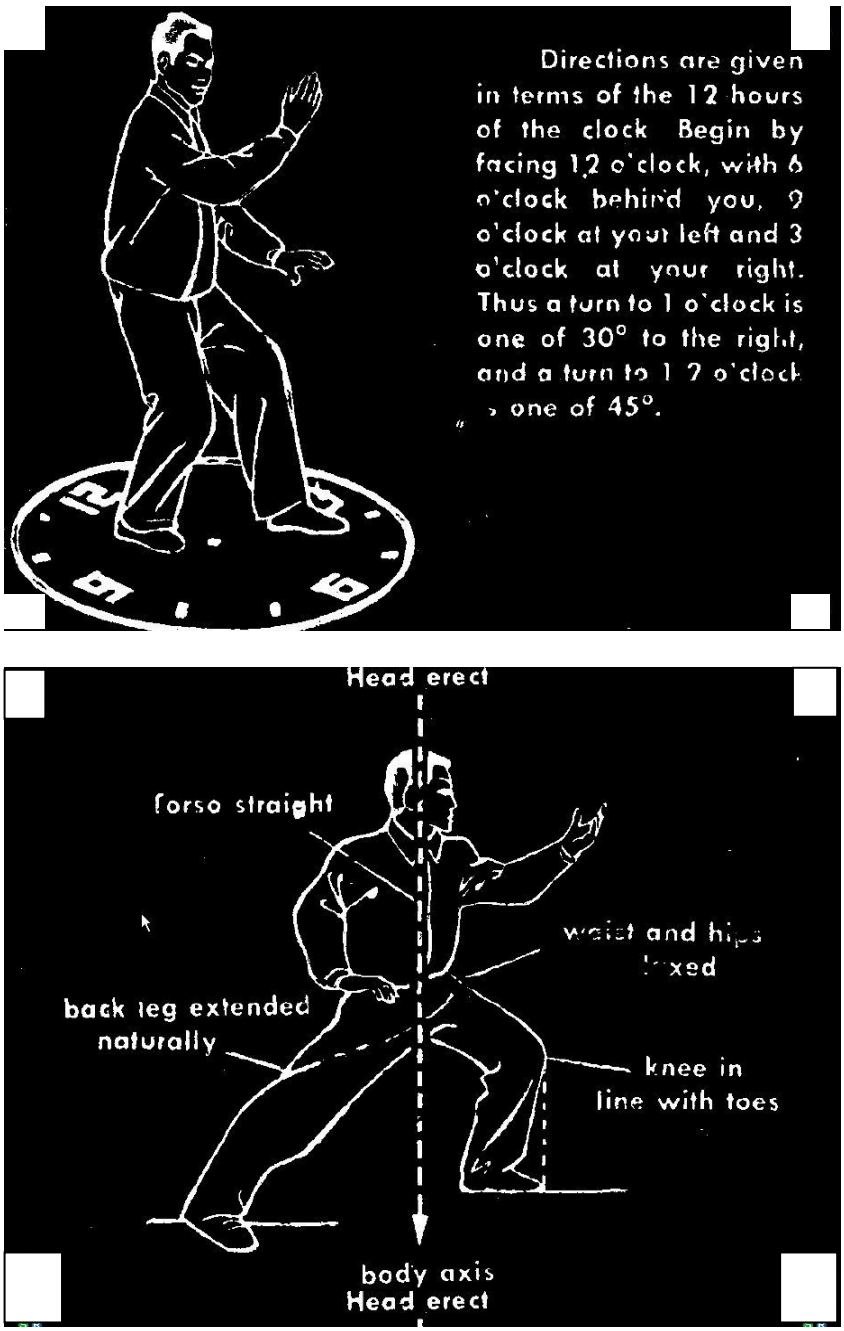
It is documented in the literature that the term *Tai Chi* translates as "supreme ultimate fist", "boundless fist", "great extremes boxing" or simply "the ultimate". Chi means "life-force" or energy. The concept of the Taiji ("supreme ultimate") appears in both Toaist and Confucian Chinese philosophy (Tai Chi Chuan).

Chart 2.1. The Stepping Chart of Tai Chi taken from Zhang Fuxing (1996, p. 65)



Steping chart is started with 1.Opening, 2.Part the horse's mane, 3.Crane spreads wings, 4.Brush knee Push step, 5.Right hand strums lute, 6.Repulse monkey, .7-8.Grasp swallow' tale, 9.Single whip, 10.Cloud hands, 11.Single whip, 12.High pat on horse, 13.Kick with right heel, 14.Strike ears with fist, 15.Kick with lelt heel, 16-17.Squat down and stand one leg, 18.work at shuffles, 19.Needel at sea bottom, 20.Flast the arm, 21.Turm parry and punch, 22.Appear closing, 23.Cross hands, 24.Closing

Figure 2.6. Direction and body position in Tai Chi exercise taken from China National Sport Commission (1983)



Technique (24-form Tai Chi) (see appendix 1)

The 24 posture Simplified Form of tai chi chuan, sometimes called the Beijing form for its place of origin, is a short version of Yang style tai chi composed of twenty-four unique movements.

Tai Chi's theories and practice are believed by these schools to have been formulated by the Taoist monk Zhang Sanfeng in the 12th century, at about the same time that the principles of the Neo-Confucian school were making themselves felt in Chinese intellectual life (Tai Chi Chuan). However, modern research casts serious doubts on the validity of those claims, pointing out that a 17th century piece called "Epitaph for Wang Zhengnan" (1669), composed by Huang Zongxi (1610-1695 A.D) is the earliest reference indicating any connection between Zhang Sanfeng and martial arts must not be taken literally but must be understood as a political metaphor instead. Claims of connection between Tai Chi and Zhang Sanfeng appear no earlier than the 19 century (Henning, 1994).

2.3.1 History of Tai chi

Tai Chi (Taijiquan) originated in China about 300 years ago in the late Ming and early Qing Dynasties (China Sports, 1980) and began as a form of martial arts like boxing. Tai Chi gradually evolved into many different styles. Yang school was the most popular by then. It has been continued to evolve from being originally used as a combative and self-defense form to a health-enhancing exercise, practiced by individuals of all ages to maintain health and prevent disease (Li et al., 2001). The present form of Tai Chi was the result of an effort by the Chinese Sports Committee which, in 1956, brought together four tai chi teachers - Chu Guiting, Cai Longyun, Fu Zhongwen and Zhang Yu - to create a simplified form of tai chi as exercise for the masses. The creators truncated the traditional Yang family hand form to 24 postures; taking between four and eight minutes to perform and to give the beginner an introduction to the essential elements of tai chi chuan.

Yang Tai Chi, which evolved from the Chen school, is probably the most popular Tai Chi style being practiced today (Swaim, 1999; Yu & Johnson, 1999). Yang style movements are performed in a relaxed and flowing manner, with the trunk erect as the axis of all movements, making it immediately suitable for elderly, frail, or disabled populations.

Although there are multiple versions of the Yang style (both short and long, covering 24-, 48-, 88-, and 108 forms (China National Sports Commission, 1983), the 24-form, based on the most popular sequences of the Yang Chengfu School (China Sports, 1980), it is the most readily adaptable to the lifestyle and living situations of older adult populations. It is also the most accommodating, requiring minimal demands of personal strength, speed, endurance, flexibility, and motor skills for participation.

2.3.2 The Origin of the First Combined Forms

After the creation of The 24 Forms (the most popular Forms in the world, created by 4 Chinese experts in order to popularize Tai Chi), & for the purposes of demonstration, in 1976, the Combined 48 Form was created by three Tai Chi experts headed by Professor Men Hui Feng. The Combined Forms were created based on combining and condensing classical Forms of the four major styles, namely Chen, Yang, Wu and Sun.

2.3.3 Adaptation to Vietnam

Tai Chi has been introduced into Vietnam since 1957 by Gu Liuxin (1908-1991), who carried out the command of former Chinese Prime Minister Chou En-Lai, arrived in Vietnam to introduce Tai Chi for Vietnamese president Ho Chi Minh. Since then, Tai Chi has been developing sharply in Vietnam (Wikipedia).

2.3.4 Effects of Tai Chi exercise

Tai Chi is a slow, graceful Chinese exercise that enhances relaxation skills, mental focus, and physical alignment while building leg strength, endurance, and stability (Yu & Johnson, 1999). It is also written as T'ai Chi Ch'uan" "Taiji", or "Taijiquan". It is an ideal for increasing stamina, flexibility and coordination. Tai Chi was originally developed by Chinese martial arts experts around the 13^{th} century A.D in order to advance their skills. It is a synthesis of martial arts and exercise and sitting meditation. Traditional Tai Chi forms incorporate highly complex movement patterns throughout the entire sequence which is based on blocks, kicks, and punches.

2.5.4.1 Cardiovascular and Cardio-respiratory functions

Tai Chi exercise can lead to significantly reduced lipid profiles, total and low-density lipoprotein cholesterol (Ko, Tsang, & Chan, 2006). Results in the shorter, 16-week study also showed improvements in insulin resistance related to decreased body fat in diabetic patients (Tsang et al., 2008). Drop in systole and diastole blood pressure have been detected after Tai Chi intervention in both short-term and long-term training regimes (Channer, Barrow, Barrow, Osborne, & Ives, 1996; K. M. Chen, Hsu, Chen, & Tseng, 2007; Taylor-Piliae & Haskell, 2007; Wolf et al., 1996). This improvement in blood pressure after a short intervention suggests that in healthy individuals, Tai Chi is a viable cardiovascular exercise regime. Short-term Tai Chi interventions were also effective in improving aerobic capacity (Mustian, Katula, & Zhao, 2006). Many studies have looked at improvement in cardio-respiratory measurements such as peak O_2, peak work rate, and VO_2 peak (Lan, Chen, Lai, & Wong, 1999; Lan, Lai, Chen, & Wong, 1998). Previous findings support Tai Chi as a measure to improve balance and blood pressure for middle-aged women (Thornton, Sykes, & Tang, 2004; Tsai et al., 2003). Tai Chi presents the ancient Chinese wisdom of an ideal conditioning exercise, not only for the healthy elderly but also for cardiac patients including those with chronic heart failure (Cheng, 2006).

2.5.4.2 Flexibility

It has been documented in several previous studies that Tai Chi has brought benefits to trunk and hamstring flexibility. Long-term Tai Chi practitioners have better scores in *sit and reach test* and total body rotation test (Hong, Li, & Robinson, 2000). It is also observed that Tai Chi training program could be significant in thoracolumbar flexibility (Lan et al., 1998; Lan, Lai, Wong, & Yu, 1996).

2.5.4.3 Musculoskeletal improvement

Tai Chi is a potent intervention that has been shown to improve flexibility, endurance, and upper-and lower body muscular strength (Audette et al., 2006; K. M. Chen, Li, et al., 2007; Lan et al., 1998; Lan et al., 1996; T. Tsang, Orr, Lam, Comino, & Singh, 2005). For example, Tai Chi practitioners have been found to have higher peak torque-to-body weight

ratios in concentric and eccentric isokinetic contractions of their knee extensors and flexor (Lan et al., 1998; Lan, Lai, Chen, & Wong, 2000; Tsang & Hui-Chan, 2005). Recent literature review has presented evidence that Tai Chi may have beneficial effects with respect to nonverbal fracture (Lee, Pittler, Shin, & Ernst, 2008). Tai Chi may be also an effective, safe, and practical intervention for maintaining better neuromuscular function and bone mineral density in postmenopausal women, increasing bone formation through increased calcium reuptake (Qin et al., 2005).

The physical benefits of Tai Chi have in fact been extensively investigated (Li et al., 2001). Tai Chi has been shown to increase strength, improve joint flexibility, and relieve muscular tension (Wolfson et al., 1996). In addition, Tai Chi is an exercise with moderate intensity, and is aerobic in nature. The exercise intensity of Tai Chi chuan is suitable for participants of different ages and gender to improve their functional capacity (Lan, Chen, & Lai, 2008). Cross-sectional studies have shown that long-term elderly Tai Chi practitioners have significantly stronger knee extensors than non-Tai Chi practitioners (Wu, 2002). Even after a few months of regular of Tai Chi, the elderly are shown to increase their knee extensor strength and endurance significantly more than those who do not practice it (Christou, Yang, & Rosengren, 2003; Lan et al., 1998; Lan et al., 2000). Thus, a long-term practice of these Tai Chi movements would evidently lead to the strengthening of these muscles. In another study, Wu (2008) utilized the volunteer subjects ages 61-84 (mean age 72.6 ± 8.7) years had been practicing Yang style Tai Chi regularly for the past 15 weeks. The result of this study demonstrated significantly longer duration and higher magnitude of ankle dorsiflexor and knee extensor Electro-myocardiography activities during the Tai Chi movements than during walking. Evidence to date indicates that Tai Chi preserves or even increases lower-extremity muscle strength. Tai Chi also appears to be safe and beneficial for patients with rheumatoid arthritis. In a randomized controlled trial, Song et al (2003) showed a 12-week Tai Chi program resulted in significant improvements in pain and stiffness in joints, balance, and abdominal strength, and fewer reported perceived difficulties in physical functioning, compared to those of control subjects.

The effects of Tai Chi practice on muscle strength and endurance in older people was also reported in a study of Xu et al (2006) that regular older Tai Chi practitioners and

joggers showed better scores than the sedentary controls on most muscle strength and endurance measures. Furthermore, in one cross-sectional study, Gyllensten et al (2010) concluded that comparing with healthy controls, Tai Chi practitioners had better stability limits, had better ability to jump off the floor ($p<0.05$) and to maintain a longer single-leg stance after landing ($p<0.05$) and better overall body awareness ($p<0.001$).

2.5.4.4 Psychological functions and wellness

Tai Chi as a mind-body technique also serves to integrate physiological improvements with psychological ones, including improved confidence, quality of life, and motivation. Significant improvements have been detected for quality of life dimensions such as general health perception, social functioning, vitality, and mental health or psychological well-being (Abbott, Hui, Hays, Li, & Pan, 2007; M. Irwin, Pike, & Oxman, 2004). The health related quality of life of people who practiced Tai Chi has also been found to improve (Kin, Toba, & Orimo, 2007). In another study, Tai Chi participants reported significant improvements in body care and health behavior due to improved motivation (Greenspan, Wolf, Kelley, & O'Grady, 2007; Song et al., 2007).

Significant psychological benefits were also observed, such as better perceived social support and mood state and superior relaxation among Tai Chi practitioners (Lee, Lee, & Woo, 2007; Taylor-Piliae et al., 2006). From a behavioral-immunological perspective, Tai Chi has been found to be associated with significantly decreased sympathetic nervous system activity (Motivala, Sollers, Thayer, & Irwin, 2006) and lower perceived mental stress measured by saliva cortisol (Esch, Duckstein, Welke, Stefano, & Braun, 2007). Psychological tensions may be alleviated by Tai Chi through production of the regulatory T cell mediators transforming growth factor beta and interleukin 10 under specific antigen stimulation (Robins et al., 2006; Yeh, Wang, Wayne, & Phillips, 2008). Tai Chi has also been associated with significant decreases in sadness, confusion, anger, tension, and fear and with increases in energy and happiness (Gemmell & Leathem, 2006), self-esteem (Mustian et al., 2004) and self-efficacy (Taylor-Piliae & Froelicher, 2004). Participant statements in these studies indicated that individuals experienced enhanced well-being and calmness as well as less reactivity, increased self-care and self-awareness, and a sense of interconnection with or interdependence of nature (Wall, 2005). Participants

also reported improved quality of sleep due to combined Tai Chi and mindfulness-based stress reduction (Chen et al., 2007). Knowledge about Tai Chi benefits that Tai Chi may bring combined with Tai Chi intervention as a part of educational programs or cognitive-behavioral approaches could be particular helpful for individuals intending to improve their mental capacities (Posadzki & Jacques, 2009).

In other researches (Li et al., 2001a; Li et al., 2002; Li et al. 2003) stated that Tai Chi enhanced older adults' multidimensional psychological well-being and health related to quality of life indicators. In a 6-month randomized controlled trial, healthy older adults were randomly assigned to either a control condition or Tai Chi. Results indicated that Tai Chi participants reported higher levels of health perceptions, life satisfaction, positive effects, and well-being, and lower of depression, negative effect, and psychological distress (Li et al., 2001a). Participants also showed a higher level of self-efficacy relevant to movement confidence (Li et al., 2001). Similar profiles have been reported by other researchers (Kutner, Barnhart, Wolf, McNeely, & Xu, 1997) in that Tai Chi practice resulted in improved well-being, increased alertness, relaxation, better mental outlook, achievement, and greater confidence.

2.5.4.5 Coronary artery diseases

Coronary heart disease (CHD) is the leading cause of death in the developed countries and many developing countries (Lan, Chen, Wong, & Lai, 2008). There are several reasons to recommend Tai Chi as an alternative exercise program for patients with CHD. First, Tai Chi does not need special facilities or expensive equipment, and it can be practiced anytime and anywhere. Second, Tai Chi is effective in enhancing aerobic capacity, muscular strength and improving cardiovascular risk factors. Third, Tai Chi is a low-cost, low-technology exercise, ant it can be easily implemented in the community (Lan et al, 2008). Patients recovering from coronary artery bypass surgery routinely receive cardiac rehabilitation services of which exercise is an integral component. However they can be expensive, inconvenient or not readily accessible, because of the need of special facilities or expensive equipment. In addition, Tai Chi is a low-intensity exercise, which especially suited for the unfit and elderly patients (Hart et al., 2004).

2.5.4.6 Hypertension

Tai Chi training shows beneficial effects for patients with high blood pressure. In Tai Chi training intervention studies, training program 6 to 12 weeks significantly decreased systole and diastole blood pressure at rest or after exercise (Channer et al., 1996; Tsai et al., 2003; Young, Appel, Jee, & Miller, 1999). Hypertensive patients showed the most favorable improvement. Tai Chi is a low-impact activity with self-paced and fluid movements, making it appropriate as a means to reduce blood pressure in people with hypertension. There are some intervention trials compared the effects of Tai Chi and aerobic exercise on blood pressure- a surrogate for hypertension. An earlier study by Channer (1996) showed that over 11 sessions of exercise, both Tai Chi and aerobic exercise were associated with reductions in systolic blood pressure; Tai Chi was also associated with reductions in diastolic blood pressure in a sample of patients recovering from acute myocardial infarction. In a different study by Young (Young et al, 1999), physical inactive older women with systolic blood pressure 130-159mmHg and diastolic blood pressure > 95mmHg were randomized to a 12-week moderate-intensity aerobic exercise program or a Tai Chi program of light activity. At the end of intervention, the Tai Chi group decreased 7.0mmHg of systolic and 2.4mmHg of diastolic blood pressure. The effect is greater for systolic than diastolic blood pressure which is dependent upon elasticity in the arterial wall (Thornton, 2008; Young et al., 1999).

2.5.4.7 Balance and prevention of falls

Falls have been identified as one of the major causes of morbidity and mortality in the elderly (Tinetti, 2003). From a practical point of view, older subjects may not have the time or wish to spend a long time to learn a fall prevention program. So, the questions arise as to how long will an elderly subject need to practice Tai Chi to achieve significant improvements in sensorimotor control of balance. A randomized controlled trial showed that 4 weeks of daily Tai Chi practice was sufficient to produce significant improvements in the sensorimotor control of balance performance in older subjects, as measured by significantly less body sway when standing under conditions requiring an increased reliance on the vestibular system ($p=0.0006$) and better directional control in the limits of

stability test (p=0.018) when compared with those of the control group receiving general education (Tsang & Hui-Chan, 2008). Because Tai Chi can be practiced by older adults anytime and anywhere, it is particularly suited to preventing or slowing down the development of balance disorders in this age group. In fact, Tai Chi practice has already been shown to be effective in helping to prevent falls among older adults (Li et al., 2005; Wolf et al., 1996).

Beneficial effects of Tai Chi exercise on prevention of falls and balance are also described within the literature. Tai Chi interventions have been shown to prevent a decline in functional balance and gait among older people (Gatts & Woolacott, 2006; Lin et al., 2006). Tai Chi has also been found to improve the mechanism by which forward momentum is generated and to improve coordination during gait initiation, suggesting improvements in postural control (Hass et al., 2004) and dynamic balance (Maciaszek, Osinski, Szeklicki, & Stemplewski, 2007). It also significantly enhanced balance responses by more effective use of mechanisms controlling stepping strategies of the swing leg and improved ability to tolerate unsteadiness. Tai Chi has also increased neuromuscular responses controlling the ankle joint, which also enhance balance responses (Gatts & Woollacott, 2006).

The movements of Tai Chi training have been shown to simulate proprioception and functional strong influence on balance control. The potential influence on balance control is supported by measurements (Mao, Li, & Hong, 2006). Tai Chi also appears to lead to improved physical status (Wolf, Barnhart, Ellison, & Coogler, 1997). Tsang & Hui-Chan (2006) compared the effects of vestibular stimulation on standing balance between older Tai Chi practitioners and sedentary controls. Subjects sat on a chair with their heads fixed at 30^0 of flexion, and experienced clockwise whole body rotation at 80^0/s for 60s with eyes closed. After rotation, subjects stood on a forced platform with eyes closed, and maintained their static balance. The Tai Chi group showed significantly smaller increases in total sway path, peak amplitude, and mean velocity of body sway in the anteriposterior direction than the control group. Wong & Lan (2008) concluded that Tai Chi exercise is effective in the organization of proprioceptive, visual and vestibular systems, which are important to maintain balance and prevent falls. In another study for proprioception behavior in old people, Li, Xu & Hong (2008) compared the flexibility of ankle joint

among Tai Chi practitioners and swimming/running group and sedentary counterpart. It is concluded that Tai Chi group showed a significantly smaller mean threshold for detection of passive motion in knee flexion compared with the control group. Wolf (1996) and colleagues conducted the randomized controlled trial comparing the efficacy of two methods of exercise of falls. Community living healthy adults were randomized to one of three groups: Tai Chi training, computerized balance training and an attention control. The result of a 15 week trial showed that Tai Chi participants experienced significant reduction in falls compared to the exercise control participants.

To evaluate the training effect of Tai Chi in postural control and backward fall prevention in the elderly, balance assessment and visually guided lower limb response time were analyzed in a cased-controlled study conducted in a community setting; Wong (2009) proved that Tai Chi may improve motor response and postural balance in the elderly, particularly in more challenging conditions. Postural responses to unexpected perturbation were better in the forward-backward and forward-sideways directions than sideways or backward-sideways directions, which may be clinical relevant. Furthermore, in other research, Li ((2005) utilized a randomized controlled trial involved sample of 256 physically inactive, community-dwelling adults aged 70-92, the results of this study showed that a three-time-per-week, 6-month Tai Chi program is effective in decreasing the number of falls, the risk for fall, and the fear of falling, and it improves functional balance and physical performance in physically inactive persons aged 70 years or older. The result of study of Li et al (2005) was consistent with those reported by Wolf et al (1996), which showed a significant reduction in fear of falling in Tai Chi compared with the control group study of Li (2001). The study of Fong (2006) on Tai Chi of sensorimotor and balance, showed that Tai Chi training of more than 1 year might have the benefit of faster hamstring and gastrocnemius reflex reaction and improved knee joint position sense. These changes may be associated with an improved dynamic standing balance (Fong & Ng, 2006). Study of the effects of Tai Chi on physiological function and fear of falling in the less robust elderly in 8 weeks, Zhang et al (2006) concluded that the intensive Tai Chi training program improved balance and flexibility and reduced fear of falling in the elderly with low balance ability. The results showed the marked effectiveness of Tai Chi on both physical performance and fall-related self-confidence among elderly persons with low

balance ability. It also indicated that the effectiveness of Tai Chi as an intervention helpful to prevent falling, especially among high-risk populations (Zhang et al, 2006). In one cross-sectional study, Tsang & Hui-Chan (2004) investigated the effects of long-term Tai Chi practice on balance control when healthy elderly Tai Chi practitioners stood under reduced or conflicting somatosensory, visual, and vestibular conditions, as compared with healthy elderly non-Tai Chi practitioners and young subjects, it is concluded that long-term Tai Chi practice improved balance control in the elderly population when there was an increased reliance on the visual and vestibular systems during stance.

2.5.4.8 Neurological, chronic diseases and pain

In a randomized controlled trial, Hackney & Earhart (2008) reported that participants with Parkinson's disease (PD) who participated in Tai Chi for twice weekly Tai Chi lessons demonstrated improvements in gait, balance, and functional mobility. The results of this study suggested that Tai Chi may be an effective and safe form of exercise for some individuals with mild to moderately severe PD. In another randomized controlled trial, assigned to 15-week intervention program o Tai Chi, assessing the health related quality of life (SF-36) and headache status, Abbott et al (2007) concluded that a 15-week intervention of Tai Chi practice was effective in reducing headache impact and also effective in improving perception of some aspects of physical and mental health. Furthermore, Irwin et al (2003) also utilized SF-36 scales to assess the behavioral intervention via Tai Chi exercise for older people who show impairments of health status and are at risk for shingles. It is also concluded that administration of Tai Chi for 15 weeks led to an increase in Varicella-Zoster Virus specific cell-mediated immunity. Gains in health functioning were found in participants who received Tai Chi and were most marked in those older adults who had the greatest impairment of health status.

To review the physiological and psychological effects of a 12-week Tai Chi program in patients with heart failure, Yeh et al (2008) reported that Tai Chi may enhance quality of life, exercise capacity, and sleep stability in patients with chronic heart failure. Moreover, the 8-week Tai Chi intervention provides evidence of Tai Chi's benefits among older women with type 2 diabetes. Particularly, the 8-week regular Tai Chi exercise showed decreased blood glucose effectively while maintaining normal insulin levels.

Increasing insulin sensitivity might be the primary mechanism which effectively improves the blood metabolism in type 2 diabetes (Wang, 2008). Tai chi may also be a beneficial adjunctive treatment that enhances quality of life and functional capacity in patients with chronic heart failure who are already receiving standard medical therapy (Yeh et al., 2004).

2.5.4.9 Bone function, osteoarthritis and rheumatoid arthritis

Regarding retarding bone loss in older women, Chan et al (2004) tested the hypothesis that Tai Chi may retard bone loss in early postmenopausal women. At the end of the trial, bone mineral density (BMD) measurements revealed a general bone loss in both Tai Chi and control subjects at all measured skeletal sites, but with a slower rate in the Tai Chi group. In another study of pain of older women with osteoarthritis (OA), Song et al (2003) reported that older women with osteoarthritis were able to safely perform Tai Chi exercise in 12 weeks, and this was effective in improving their arthritic symptoms, balance, and physical functioning.

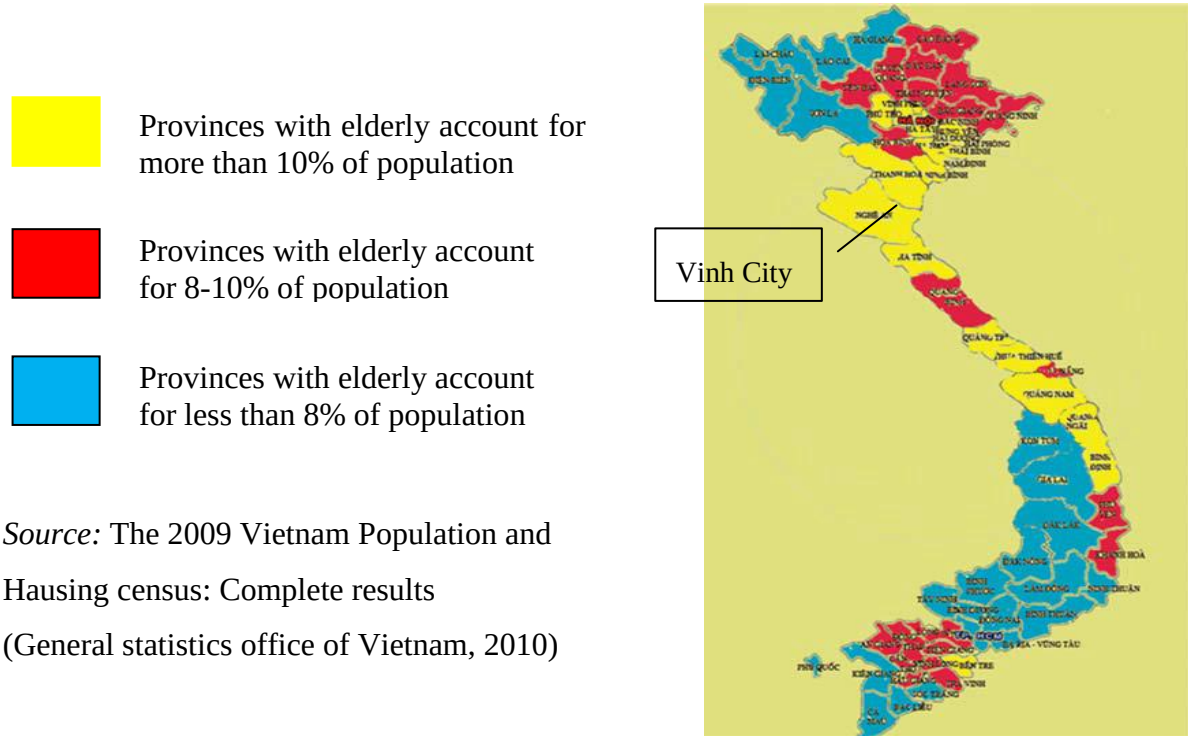
In study of (Chen et al., 2008) utilized longitudinal research with older subjects aged 60 or over who have osteoarthritis. Participants experienced significant improvements in physical functioning, role limitations, and social functioning on the dimensions of quality of life (SF-36, $p<.05$) and lean body mass was significantly decreased within the study period ($p<.05$). Chen also concluded that elderly people with osteoarthritis should be encouraged to exercise using Tai Chi for maintaining physical functions and improving quality of life. In a review of Tai Chi for rheumatoid arthritis, Yeh et al (2008) indicated that Tai Chi does not exacerbate symptoms of rheumatoid arthritis. Tai Chi has statistically significant benefits on lower extremity range of motion; in particular ankle range of motion, for people with rheumatoid arthritis.

2.4 Aging population in Vietnam

According to the United Nations (2004), the elderly population in Vietnam increased significantly from 7.5 percent of the total population in 2005 to about 26 percent in 2050. The aging process in Vietnam is taking more rapidly than official population projections (United Nations, 2004). Thank to *Doi moi* transformation (see. Babieri, 2006), it had significant impacts on all areas of society, particularly with the changes of economic

structure from agriculture-based to industrial production, and urbanization with strong flows of laborers from rural to urban areas. For provinces where the elderly account for more than 10 percent of the total population, one important factor is out-migration of the working age population. When compareing areas, data from the Vietnam (Household) Living Standards Surveys (General statistics office of Vietnam, 2010) collected over the past decade show that most of the elderly are still living in rural areas, even though urbanization has been pregressive in Vietnam. The percentage of elderly living in rural areas only slowly decreased from 78 percent in 1993 to 73 percent in 2008 (Chart 2.2)

Chart 2.2. Distribution of the elderly population by province (2009)

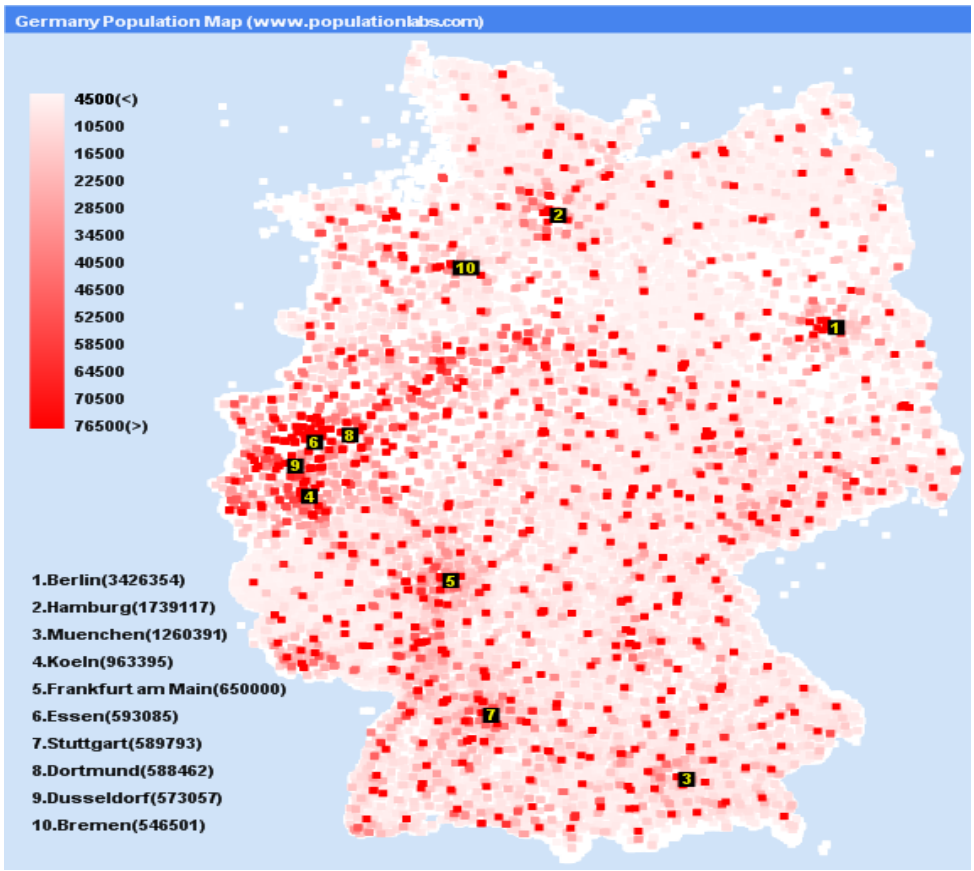


Source: The 2009 Vietnam Population and Hausing census: Complete results (General statistics office of Vietnam, 2010)

2.5 Aging population in Germany

Older German people' average life expectancy has increased as well. The average life expectancy has steadily been improving in the last decades which leads to life expectancy at birth (e_0) in Germany is 80 (women: 82.44; Men: 77.82) years (Statistisches Bundesamt, 2009a). According to estimates reported by Germany, German gained 3.2 years in life expectancy. With men showing a greater gain than women: 3.6 years and 2.9

years, respectively. "As the result of longevity and low fertility rates, the elderly population in Germany has increased dramatically over the years it is predicted to increase from 7 percent of the total population in the last century to over 10 percent by 2020" (recited from Dallinger, 2012). Germans are living longer. Over the past fifty years, life expectancy at birth in Germany has risen from 68 to 78, for a cumulative gain of ten years. Life expectancy at older ages has risen as well. In 1950, the typical 60 year old could expect to live to 76. Today's 60 year old can expect to live to 82. This increase in life expectancy has already added nearly one-third to the total cost of Germany's public pension system (Jackson, 2003). As the length of life increases, older people can respond with lifestyle changes that can increase healthy year of life. Correspondingly, health care systems need to shift towards more geriatric care, the prevention and management of chronic diseases and more formal long-term care. Since people are living longer, measures to improve health and prevent disease neen to focus on people of working age (WHO, 2004).



Population Map of Germany

(Source: http://www.populationlabs.com/Germany_Population.asp)

Chapter 3 Design and Methodology

3.1 Research design

3.1.1 Participants

The research was carried out with a randomized controlled trial. This research was conducted in community-dwelling in Vinh city, Vietnam. One hundred and two participants were recruited by interview (Email, telephone, and questionnaire). Inclusion criteria of both groups include the subjects being able to perform fully the SFT, finish the MMSE with score a greater than 24, have no experience in Tai Chi. Exclusion criteria includes subjects who have been in contact with serious disease such as: symptomatic coronary insufficiency, angina, arrhythmia, orthostatic hypotension, dementia problems.

Based on the previous findings (Li et al., 2001; Li et al., 2002) with the standardized mean difference of the group means, alpha level = 0.05, desired statistical power = 0.8, Effect size is set at medium (ES=0.5).

German sample is 159 people recruited by author Volker Cihle from 11 different cities of Germany: Bremen (Bremen); Schwandorf (Bayern); Altensteig, Friedrichshafen, Heilbronn, Heidelberg (Baden-Wuetemberg); Wolfsburg), Walfenbuettel, Braunschweig (Niedersachsen); Oschatz (Sachsen); Dessan (Sachsen-Anhalt).

3.1.2 Design

The subjects were divided randomly into two groups, Training group and Control group. The subjects were expected to consent or volunteer. Participants in Training group (forty eight subjects ranging in age from 60 years to 79 (69.02±5.16) were assigned 6-months Tai Chi training. Participants in the control group (forty eight subjects ranging in age from 60 years to 79 (68.72±4.94) were instructed to maintain their routine daily activities and not to begin any new exercise programs. The SFT were used in an empirical process to assess the physical fitness. Blood circulations (heart beat, systole blood pressure, diastole blood pressure) and some anthropometrical indices (BMI, WHR, weight, height) were checked. The SF-36 was used to assess the changes of physical and mental

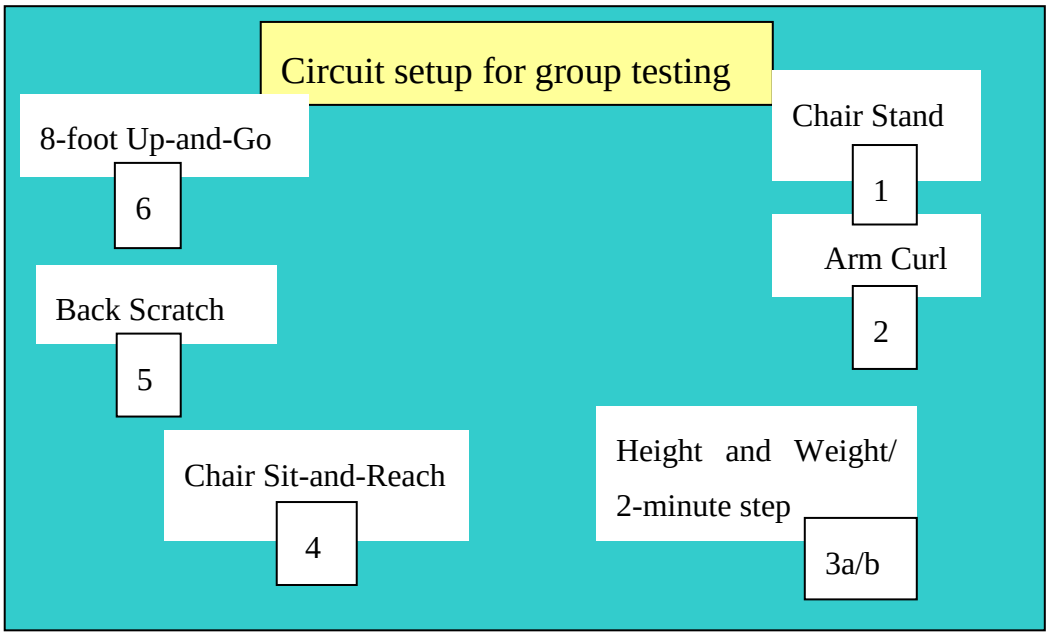
health. Trial making test (cognitive performance), Pittsburgh sleep quality index, the falls efficacy scale, and valuation of life were also tested in intervention periods.

3.2 Test protocol

Senior Fitness Test

The Senior Fitness Test was administered. This test protocol was designed to evaluate the physiological capability related to independently functioning: lower and upper body strength, aerobic endurance, lower and upper body flexibility and agility and dynamic balance. All the test items were validated and reliable with criterion measures (Rikli and Jones, 2001).

Chart 3.1. Testing order was taken from Rikli & Jones (2001).Manual SFT p.56.



According to Rikli and Jones (2001), it is important to whether the 6-minute test or the 2-minute step is used as the aerobic endurance measure. It depends on the space or the weather of the day testing. In this study we use the 2-minute step test. The test items should be scheduled in the following order to minimize fatigue: Chair stand test, arm curl test, 2-minute step test, chair sit-and-reach test, back scratch test and 8-foot up-and-go test.

Table 3.1 Description of SFT, adapted from Rikli & Jones 2001

Test Items	Area of assessment	Discription
30 second chair stand	Lower body strength	Participant sit in the middle of the chair with back straight, feet flat on the floor, arms crossed at the wrists and held against the chest. On the signal "go", pariticipant rises to a full stand and returns to fully seated position in 30 seconds.
Arm curl	Upper body strength	Participant sit in the middle of the chair with back straight, feet flat on the floor, the weight is held down at the side, perpencular to the floor, in dominant hand with handshare grip. Weight is curled up the returned to the fully extended down position in 30 second from the signal "go".
Back-scratch	Upper body flexibility	Participant stands and places his or her preferred hand over the same shoulder, palm down and fingers extended, reaching down the middle of the back as far as possible. Elbow pointed up. The other arm around the back of the waist with the palm up, reaching up the middle of the back as far as possible in an attempt to touch or overlap the extended middle fingers of both hands. Give minus (-) score if the middle fingers do not touch, a zero score if the middle fingers touch, and a plus (+) score if the middle fingers overlap.
Chair sit-and-reach	Lower body flexibility	Participant sits on the edge of the chair. One leg is bent with the foot flat on the flood. The other leg is extended as straight as possible in front of the hip. The heel is placed on the floor with the food flexed at apporoximately 90 degree. Arms outstretched, hands overlapping, and middle fingers even, the participant slowly bend forward at the hip joint reaching as far as possible or past the toe. Maximum reach must be heald for two seconds.
8-foot up-and-go	Agility and dynamic balance	Participant sit in the middle of the chair with back straight, feet flat on the floor, and on the thighs. The torso slightly leaning forward. On the signal "go" the participant gets up from the chair, walks as quicky as possible around either side of the cone and sits back down in the chair. The distance is 8 feet (2.44cm)
2-minute step test	Aerobic endurance	On the signal "go" the participant begins stepping in place as many times as possible in the 2-minute period. The knee must be raise in to the correct height.

Environment condition

According to guide for Senior Fitness Test (Rikli and Jones, 2001), the tests should not be administered if the temperature or humidity conditions are uncomfortable or appear unsafe for the participants. Depending on temperature, humidity tolerance, each individual should be tested with comfort level. Observing the sight and symptom of participants, if one tends to be in bad health condition during the tests, stop immediately.

Warm-up exercises and participants instructions

Before testing begins, participants should engage in five to eight minutes of warm-up and stretching activities.

The falls efficacy scale

The Falls Efficacy Scale (FES), an instrument to measure fear of falling, was designed to assess the degree of perceived efficacy (i.e., self-confidence) at avoiding falls during each of 10 relatively non-hazardous activities of daily living (M.E. Tinetti et al., 1990). On the scale from 1 to 10, with *1 being very confident and 10 not confident at all*, a total score of greater than 70 indicates that the person has a fear of falling. Participants complete a scale which consists of 10 item related to independent living confidence in accomplishing each activity without falling is assessed on a 10-point continuum. A high score is equivalent to low confidence (efficacy). The final FEF score equals the sum of the score of each the 10 possible scores range from 10-100 (Tinetti et al, 1990).

Trail Making Test (cognitive performance)

TMT is primarily a test of motor speed and visual attention. In TMT, part A, the subject's task is to quickly draw the lines on a page connecting 25 consecutive numbers. In part B, the subjects must draw the lines alternating between number and letter (Gaudino, Geisler, & Squires, 1995). Both parts of the Trail Making Test consist of 25 circles distributed over a sheet of paper. In part A, the circles are numbered 1-25, and the patient should draw lines to connect the numbers in ascending order. In part B, the circles include both numbers (1-12) and letters (A, B, C, D, E, F, G, H, I, J, K, L); as in part A, participant draws lines to connect the circles in an ascending pattern, but with the added task of alternating between the numbers and letters (i.e., 1-A-2-B-3-C, etc.). The participant should be instructed to connect the circles as quickly as possible, without lifting the pen or pencil from the paper. Time the participant as he or she connects the 'trail". If the

participant makes an error, point it out immediately and allow him or her to connect it. It is unnecessary to continue the test if the participant has not completed both parts after five minutes have elapsed (Corrigan & Hinleldey, 1987; Reitan, 1958).

Valuation of life (VOL) (Lawton et al., 2001)

VOL is a two-factor scale consisting of items measuring hope, futurity purpose, meaning, self-efficacy, and perseverance. Each item is rated on a 5-point scale from 1 = disagree very strongly to 5 = agree very strongly. Futurity is outlook that sees what might happen in the future as worth anticipating and planning for. Hope is the expectation that what occurs now and in the future will be positive. Self-efficacy is a judgment that one will behave competently in the future. Persistence is the conviction that one's effort to solve a problem is worthwhile and likely to succeed. Purpose presents espousal of goals that guide one's life. High score denotes high valuation.

Pittsburgh Sleep Quality Index (PSQI) (Buysee et al., 1989)

The Pittsburgh Sleep Quality Index is an effective instrument use to measure the quality and patterns of sleep of the older adults. It differentiates "poor" from "good" sleep by measuring seven areas: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction over the last month. The PSQI's simplicity and its ability to identify different groups of patients suggest several clinical and research applications in psychiatry and general medical settings. Most fundamentally, it may be used as a simple screening measure to identify cases and controls, or 'good" and "poor" sleepers.

Mini-Mental state examination (MMSE) (Folstein et al., 1975)

MMSE was originally designed to provide a brief, standardized assessment of mental status that would serve to differentiate between organic and functional disorder in psychiatric patients. The MMSE is a fully structured scale that consists of 30 points grouped into seven categories: orientation to place(state, country, town, hospital, and floor), orientation to time (year, season, month, day and date) registration (immediately repeating three words), attention and concentration (serially subtracting 7 beginning with 100, or alternatively, spelling the word "World" or "HUONG" instead, backward), recall (recalling the previously repeated three words), language (naming two items, repeating a

phrase, reading aloud and understanding a sentence, writing a sentence, and following a three- step command), and visual construction (copying and design).

Anthropometrical measurements:

Anthropometrical measurements: we will examine height, weight of participants and BMI will be calculated.

Procedure:

Shoes: For the sake of time, shoes can be left on during height and weight measurements.

Height: Tape a 60-inch tape (≈ 1.50 meters) measure vertically on the wall with the zero end positioned exactly 20 inches ((≈ 0.5 meters) up from the floor. Have the participant stand with the back of the head against the wall (the middle of the head is lined up with the tape measure) and the eyes looking straight ahead. Place the ruler (or similar object) on top of the participant's head, and while keeping it level, extent it straight back to the tape measure. The person's height is the score in inches indicated on the tape measure, plus 20 inches (the distance from the floor to the zero point on the tape measure)

Weight: Have the participant remove any heavy articles of clothing. Measure the person's weight and record it to the nearest pound (kg) (a pound ≈ 0.5kg).

Scoring: Record the person's height and weight on the scorecard. Body Mass Index (BMI) can be calculated by using the formula:

BMI = kg/m^2 (weight/height)

BMI = 19-26: Healthy range

> 30: Obese

≥ 27: Overweight, associated with increased risk for disease and loss of mobility

≤ 18: Underweight, could indicate loss of muscle mass and bone tissue

Hip girth: To measure the circumference of the hip area, as a measure of the underlying hip structure, musculature and adipose tissue. When combined with the measure of abdominal girth in the Waist-Hip Ratio (WHR), has been shown to be related to the risk of coronary heart disease (Welborn et al., 2003).

Procedure: The hip girth measurement is taken over minimal clothing, at the level of the greatest protrusion of the gluteal (buttock) muscles. The subject stands erect with their

weight evenly distributed on both feet and legs slightly parted, making sure not tense the gluteal muscles. When recording, you need to make sure the tape is not too tight or too loose, is lying flat and is horizontal. It may help to have the subject stand on a box to make the measurement easier.

Waist and abdominal girth: The purpose of determining waist girth is to gain a measure of the amount of abdominal fat (visceral fat), which has been linked to increased risk of coronary heart disease and diabetes (Pouliot et al., 1994; Welborn et al., 2003).

Procedure: The waist measurement is taken at the narrowest waist level, or if this is not apparent, at the midpoint between the lowest rib and the top of the hip bone (iliac crest). If you are unsure if this measurement was taken at the narrowest level, take several measurements at different levels and take the lowest measurement. Some procedures measure abdominal circumference at the level of the umbilicus (belly-button), such as. When recording, you need to make sure the tape is not too tight or too loose, is lying flat on the skin, and is horizontal.

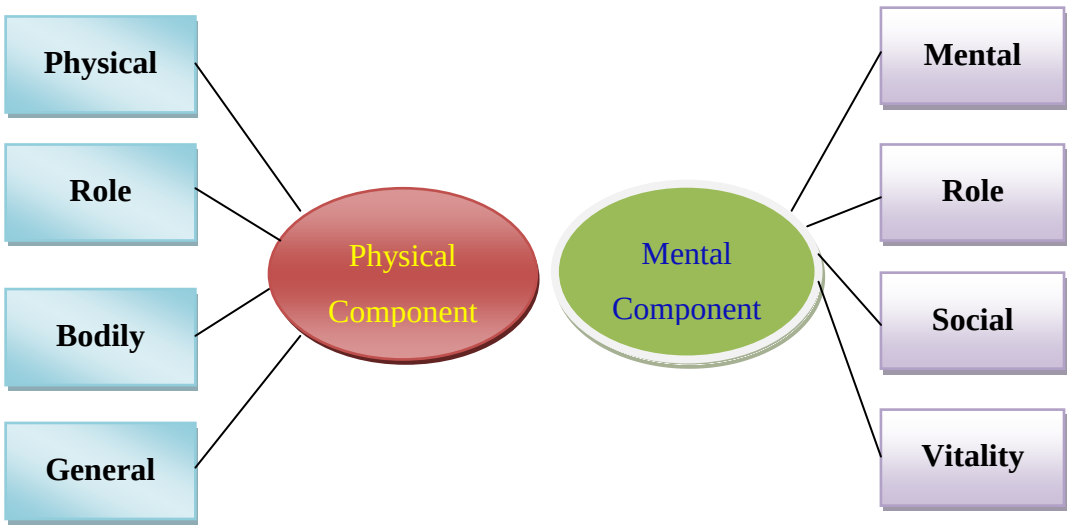
Waist to Hip ratio (WHR): The purpose of this test to determine the ratio of waist circumference to the hip circumference, as this has been shown to be related to the risk of coronary heart disease.

Waist to Hip Ratio (WHR) = Gw/Gh, where Gw = waist girth, Gh = hip girth

Blood pressure measurement protocol

Blood pressure was measured while subject is seated comfortably. The arm being used should be relaxed, uncovered, and supported at the level of the heart. Only the part of the arm where the blood pressure cuff is fastened needs to be at heart level, not the entire arm. Adjustable cuffed-side sphygmomanometer (German) was used for arm circumference 27 to 34 cm, 'adult' cuff: 16 x 30 cm. Subjects were measured at least two times within one test-period, before exercise and after at least one hour after exercise. Before having been measured, subjects had been given time approximately ten minutes to accommodate with the temperature of the testing room. Measurements were taken by colleagues who understand well method and procedures for blood pressure measurement, and physicians.

Chart 3.2.Physical and mental components



SF-36 Scales measure physical and mental components of health taken from Ware et al (1994)

Table 3.2: Structure of Short form-36

Summary measures	**Scales**	Items
Physical Health	Physical Function (PF)	Vigorous activities (3a)
		Moderate activities (3b)
		Lift, carry groceries (3c)
		Climb several flights (3d)
		Climb one flight (3e)
		Bend, kneel (3f)
		Walk mile (3g)
		Walk several blocks (3h)
		Walk one block (3i)
		Bath, dress (3j)
	Role Physical (RP)	Cut down time (4a)
		Accomplished less (4b)
		Limited in kind of work (4c)
		Had difficulty (4d)
	Bodily Pain (BP)	Pain magnitude (7)
		Pain interference (8)
	General Health (GH)	General rating (1)
		Sick easier (11a)
		As healthy (11b)
		Health getting worse (11c)
		Health excellent (11d)
Mental Health	Vitality (VT)	Full of life (9a)
		Energy (9e)
		Worn out (9g)
		Tired (9i)
	Social Functioning (SF)	Social excellent (6)
		Social time (10)
	Role Emotional (RE)	Cut down time (5a)
		Accomplished less (5b)
		Not careful (5c)
	Mental Health	Nervous (9b)
		Down in dumps (9c)
		Peaceful (9d)
		Blue/sad (9f)
		Happy (9h)

3.3 Instrumentation

- Folding chair (Vietnam)
- Stopwatches 1/10 second reading (Hanhart profile J.W. German)
- Hand weights: dumbbells: 5 Ibs (2,27kg) for women and 8 Ibs (3,63kg) for men (weight-changeable dumbbells, German)
- Scale (China)
- Masking tapes (Vietnam)
- Long tape measures (Butterfly, China)
- Cones (or similar markers)
- Small pencils
- Sphygmomanometer (German)
- Short form 36 (SF-36) (sheets) (see Appendix 2)
- Score card for Senior Fitness Test (see appendix 3)
- The Falls efficacy scale questionnaire (see appendix 4)
- Mini-Mental Examination Status questionnaire (see appendix 5)
- Pittsburgh Sleep Quality Index questionnaire (see appendix 6)
- Valuation of life questionnaire (see appendix 7)
- Trail making test questionnaire (see appendix 8)

3.4 Tai Chi program

3.4.1 Tai Chi group

Those people who took part in Tai Chi exercise were asked to present and practice Tai Chi in the group 2 times per week, each session lasts for 60 minutes (Li et al, 2001). The Tai Chi exercise selected is the 24 forms of Tai Chi (see appendix 1) which is commonly used in Vietnamese elderly dwelling population. In each session, there is a 15 minute-warming up and 15 minute-cooling down, session followed by a 30 minute-24-form Tai Chi. The Tai Chi instructors were recruited by investigators to conduct the class. The instructors have experience of teaching Tai Chi. There was a mid-term evaluation in Tai Chi class to observe the training process. Tai Chi classes were conducted at the Tai Chi club in (Truong Thi ward) which belongs to the Sport Center of Vinh city and under the administration of

the session of Information and Culture of the Committee of Vinh city. Participants were encouraged and allowed to wear flat-clothed shoes and clothes which are comfortable to move. High-heeled shoes or no shoes were not permitted. Participants in the Tai Chi group are expected to keep taking part in the follow-up period. However, they can quit or withdraw whenever they want to.

3.4.2 Control group

Participants in Control group were instructed to maintain their routine daily activities and not to begin any new exercise programs. They were examined for all tests after every three months like the Tai Chi group.

3.5 Validation and reliability of measurement

Senior fitness test: Based on the Senior Fitness Test kit (updated version) which included Senior Fitness Test Manual, Senior Fitness Software CD and Senior Fitness Test DVD. All of these materials are bought with 85 Euro (paid by Institute of Gerontology, Heidelberg).

SF-36: The questionnaire of SF-36 (Vietnamese version) was used with permission from Dr. Watkins et al (2002). A questionnaire was used to assess and self-report health status. The questionnaire was administered in Vietnamese by trained Vietnamese interviewers. Translation of the United States version of the SF-36 was performed by two independent translators using forward and backward translation methods (Watkins et al, 2002).

Pittburgh Sleep Quality Index (PSQI) translated version was taken from: http://viensuckhoetamthanquocgia.gov.vn/trac-nghiem-tam-ly/28-cac-trc-nghim/134-ch-bao-cht-lng-gic-ng-pittsburgh-psqi.html.

Mini-Mental State examination (MMSE) translated version was taken from: http://viensuckhoetamthanquocgia.gov.vn/trac-nghiem-tam-ly/28-cac-trc-nghim/135-thang-anh-gia-tam-thn-ti-thiu-mmse.html

Valuation of Life (VOL), the activities-specific balance confidence scale (ABC), Trail making test (TMT), and The Fall Efficacy Scale (FES) were translated into Vietnamese with independences of lectures of English in Vinh University.

3.6 Empirical processes

Table 3.3. Participants flow and schedule from screening to follow-up assessment

Time	Action	Results
Week 0	Telephone, Email, questionnaires screening Conducted by investigators	Receive participants' information statement Consent Complete telephone screening questionnaire to determine eligibility.
Week 1	Baseline assessment Randomization	Sign participants informed consent Complete demographic data Complete baseline questionnaires Complete physical test and the other tests (PSQI, VOL, TMT, SF-36, FES)
Week 12	Intervention	Tai Chi group: 2 x 60 min group sessions/week for 24 weeks Control group: not taking part in any new physical program but maintaining daily physical activity. Collect data at midpoint
Week 24	Endpoint assessment	Both groups finish intervention. Tai Chi group keep being assessed at follow-up point Collect data at endpoint
Week 32	Follow-up assessment	Collect data of Tai Chi group at follow-up (only for Tai Chi group)

3.7 Data collection and safety

After obtaining the screening of the samples, tests were carried out for each period of time: baseline, mid-point and endpoint. Participants were examined and tested by instructors, assistants and colleagues. For physical tests, participants were instructed to warm up for at least fifteen minutes. Risks of participation in testing and training are minimal. Participants were encouraged to report their physical problems or injuries to instructors. They might stop exercising if tired or having any problem with their current

physical or mental health during exercising and testing processes. Compensation was not implemented by investigators or instructor. Participators would not be penalized in any situation for deciding to remain or withdraw from the study, they were volunteers.

3.8 Statistical analysis

All statistical analyses were conducted using the statistical package for the social science(Statistical Package for Social Sciences, 2005). Descriptive statistics were used to summarize the following: age, gender, height, weight, BMI, and demographic charateristics. The statistical significance has been estimated at probability (p-value) equal or less than 0.05. Data are expressed as means ± standard deviation. The completely randomized design (Analysis of variance; ANOVA) was used to determine defferences of varibles and identified for included; *One-way ANOVA* is to compare all variables of subjects, expecially subjects'ages, anthropometry and parametes between subjects. The multiple comparision *Post-hoc* test used to determine the mean differences of data between groups of subjects. *Repeated measures* for compare the variables of repetitive sessions of this study within group subject. *Hierarchical regression analysis* was used to find out the relation between dependent and independent variables. The Independent t-test for compare mean differences between group subject in each stage. The *Bland-Altman* (Bland & Atman, 1986)was also used to compare within group subjects. Physical test results (for senior fitnest test) are stored in Senior fitness test software and the other test results are stored in SPSS verson 16.

In summary, this chapter described the method used in a randomized controlled trial of community dwelling older people. Participants were randomly assigned to either group called Tai Chi, with which they were with Tai Chi exercise (Tai Chi group), or group called Control, with which participants remained daily routine exercise and took part in non-new exercise program.

Chapter 4 Results

4.1 Characteristics of the sampling groups

The descriptive characteristics of the samples in both Tai Chi and the Control groups were shown in Table 4.1, the range of age (year), the average age value (year), the range of body mass index (kg/m^2), the range of waist hip ratio (cm), marital status, and the range of education (year).

Table 4.1.Characteristics of sampling groups at baseline

Characteristics		**Mean ± SD (min-max)**	**Number** (percentage)
Age (year)		68.97 ± 5.11 (60-79)	
BMI (kg/m^2)		24.28± 1.10(21.30-27.56)	
WHR (cm)		0.94 ± 0.05 (0.82-1.27)	
Sex	Male		48 (50)
	Female		48 (50)
Marital status	Living with other person		24 (25)
	Married		53 (55.2)
	Widowed		13 (13.5)
	Single		1 (1.0)
	Not say (sure)		5 (5.2)
Education (yrs)	5-9		24 (25)
	10-12		45 (49.6)
	>12		27 (28.1)

	Tai Chi group		Control group	
	N		N	
Number of participants	48		48	
Male	24		24	
Female	24		24	
	Mean	SD	Mean	SD
Age	69.23	5.30	68.73	4.95
Height (m)	1.58	0.06	1.59	0.06
Weight (kg)	60.76	4.78	62.42	5.82
BMI (kg/m^2)	24.14	1.38	24.42	0.71
WHR (cm)	0.94	0.06	0.95	0.03

The average age of the participants is 68.98 with SD 5.11, their body mass index is 24.28; waist hip ratio is 0.94cm. Forty eight participants are male, the same number are

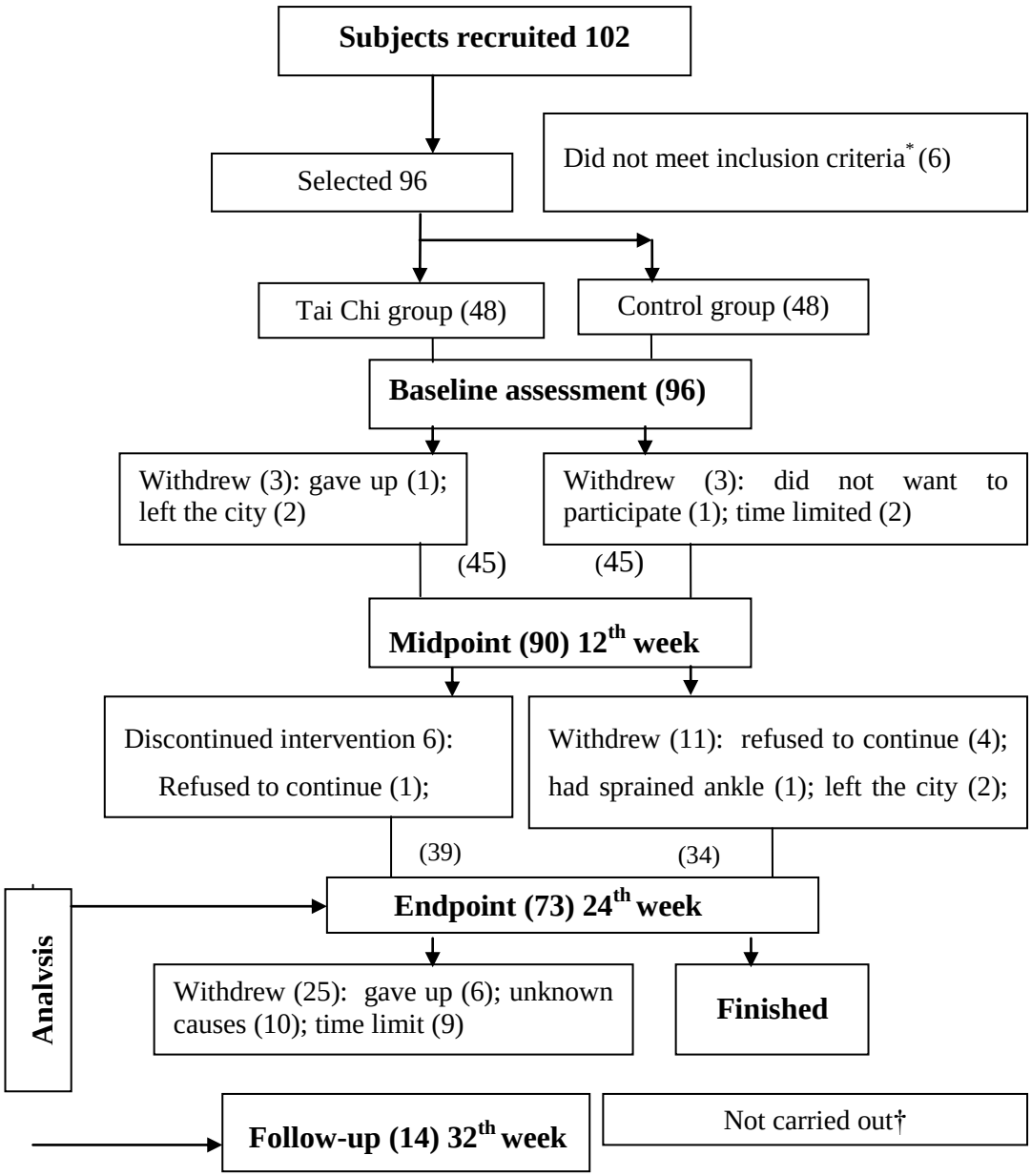
female. The marital status is presented in numbers and percentages, Living with another person is 24 (25%), Married is 53 (55.2%), Widowed is 13 (13.5%), Single is 1 (1.0) and Not say is 5 (5.2). Education is also presented in number and percentage, there are 25 (25%) in range of 5-9 years, 45 (49.6%) in range of 10-12 years and 27 (28.1%) over 12 years.

The number of participants in Tai Chi and the Control group at baseline are equal, and the ratio of male and female in both groups were also randomly equally distributed. The average age of the Tai Chi group is 69.23 (year) and 68.73 (year) in the Control group. In Tai Chi group, average of height (m) is 1.58, weight (kg) is 60.76, BMI (kg/m^2) is 24.14, and WHR (cm) is 0.94. In Control group, average height (m) is 1.58, weight (kg) is 62.42, BMI (kg/m^2) is 24.42, and WHR (cm) is 0.95.

During the period of intervention, at the second phase (midpoint), three subjects of the Tai Chi group have dropped out because one did not want to take part in and two left the city. Three subjects of the Control group have dropped out because one did not want to participate in and two left the city. At the third phase (endpoint), six subjects of the Tai Chi group have dropped out, one of them refused to continue and two left the city and three had time limits. Eleven subjects of the Control group withdrew, four refused to continue, one had sprained ankle, two left the city, five had unknown causes. At the final phase (follow-up), only fourteen subjects of Tai Chi group took part in the intervention. Others did not want to and unknown reasons or time limit.

Participants' attendance and attrition

Chart 4.1. Recruitment and drop out of samples



** According to protocol*

† Participants quit because of limitation of time, leaving city and unknown causes. The rest did not want to continue for follow-up.

4.2 Current situation of exercise training of older people in Vinh City

Some features of research setting

Vinh city: Area: 105 km^2; Population: 314.261 inhabitants

Average temperature: 24 °C, max temperature is 42.1°C and min temperature is 4 °C. Humidity is 85-90%. There are 16 wards, 9 communes (data until 05.09.2008)

Table 4.2. Distribution of Gender and sports

N0	Sport games	Gender					
		Both		Men		Women	
		Number	%	Number	%	Time	%
1	**Tai Chi**	**2053**	**19.47**	**901**	**43.89**	**1152**	**66.11**
2	Meditation	163	1.55	53	32.52	110	67.48
3	Ping pong	32	0.30	32	100.00	0	0
4	Badminton	79	0.75	43	54.43	36	45.57
5	Acupuncture spots	102	0.97	31	30.39	71	69.61
6	Chinese chess	44	0.42	44	100.00	0	0
7	Cycling	71	0.67	71	100.00	0	0
8	GiGong	17	0.16	12	70.59	5	29.41
9	Yoga	28	0.26	11	39.28	17	60.72
10	Jogging	7202	68.30	2467	35.16	4.735	64.84
11	Morning exercise	753	7,14	328	43,56	425	56,44
	Sum	**10544**	**100**	**3.993**	**37.87**	**6551**	**62.13**

It can be observed from table 4.2, a number of people who are engaging in Tai Chi in Vinh city are the second place after Jogging. This means that a majority of older adults want to participate in Tai Chi (Hoàng, 2009).

The test-retest reliability of various measurements

Test-retest reliability of the items in physical function, perceived health, valuation of life, sleep quality, cognitive performance, fall efficacy, and balance.

Table 4.3. Results of test-retest between variables of TC group by analysis-scale-reliability

Items measurement		Cronhbach's alpha	F (1, 44)	P
SFT	Chair-stand	.906	135	<0.001
	Arm-curl	.862	87.56	<0.001
	Back-scratch	.933	190.64	<0.001
	Chair sit-reach	.934	113.14	<0.001
	8-foot up-go	.930	115.5	<0.001
	2-mitute step	.971	50.619	<0.001
SF-36	PCS	.872	93.72	<0.001
	MCS	.924	82.6	<0.001
	TMT-A	.943	185.79	<0.001
	TMT-B	.925	449.28	<0.001
	VOL	.883	185.79	<0.001
	PSQI	.784	54.142	<0.001
	FES	.957	887.04	<0.001

SFT = Senior Fitness Test; SF-36 = Short Form-36; ABC = the Activities-specific Balance Confident scale; PSQI = Pittsburgh sleep quality index; VOL = Valuation of life; TMT = Trail making test; FES = the Falls efficacy scale.

The results of Table 4.3 showed that the reliability of the test-retest of independent variables was in significant correlation with Cronbach'Alpha for Chair-stand ($r = .906$; $p < .001$), in for Arm-curl ($r = .862$; $p < .001$), in Back-scratch ($r = .933$; $p < .001$), Chair-sit-reach ($r = .934$; $p < .001$), 8-foot up and go ($r = .930$; $p < .0001$), 2-minute step ($r = .971$; $p < .001$), PCS ($r = .872$; $p < .001$), MCS ($r = .924$; $p < .001$), TMT-A ($r = .943$; $p < .001$), TMT-B ($r = .925$; $p < .001$), VOL ($r = .883$; $p < .001$), FES ($r = .957$; $p < .001$) and PSQI ($r = .784$; $p < .001$), respectively. All test measurements are reliable for the evaluation of Tai Chi exercise.

4.3 Comparison of results between the Tai Chi and the Control group at the baseline

In this section, we compared the mean differences between Tai Chi and Control groups at the baseline for all dependent variables.

4.3.1 Comparison of blood pressure, BMI, and WHR at baseline

Table 4.4. One-way Anova for BMI, WHR and blood pressure between TC & CT group at baseline

Dependent variables	Tai Chi (n=48)	Control (n=48)	Sig.*
	Mean ± SD	Mean ± SD	
BMI (kg/m^2)	24.14 ± 1.38	24.42 ± .71	.213
WHR (cm)	.93 (.064)	.95 ± .033	.202
Systole(mmHg)	145.42 ± 10.21	147.40 ± 8.32	.301
Diastole(mmHg)	81.48 ± 6.23	82.19 ± 5.18	.547
Pulse (bpm)	84.48 ± 6.23	83.08 ± 4.46	.211

* *Determined by ANOVA; BMI=Body Mass Index; WHR=Waist Hip Ratio*

The results in table 4.4 show that there is no significant difference between two groups of intervention. It means that at the baseline, the results of BMI, WHR, and blood pressure of both groups are relatively equal. It can be observed in table 5 one-way Anova for BMI [F(1, 94) = 1.580, p > .05]; WHW [F(1,94) = 1.652, p > .05]; Systole [F(1,94) = 1.083, p > .05]; Diastole [F(1,94) = .366, p > .05]; Pulse [F(1,94) = 1.587, p > .05], respectively.

4.3.2 Comparison of results of physical component measurement between Tai Chi group and Control group at baseline

Table 4.5. One-way Anova for physical fitness tests between TC & CT group at baseline

Dependent variables	Tai Chi (n=48)	Control (n=48)	Sig.*
	Mean ± SD	Mean ± SD	
Chair stand (stands)	16.31 ± 2.74	16.33 ± 2.56	.969
Arm curl (times)	16.92 (2.54)	16.62 ± 2.39	.564
2 minute step(steps)	88.12 ± 8.53	85.75 ± 6.96	.139
Chair sit reach (cm)	-1.10 ± 5.68	-1.25 ± 5.73	.901
Back scratch (cm)	-2.23 ± 4.25	-1.69 ± 4.45	.544
8foot up and go (second)	6.98 ± .85	7.16 ± .67	.231

* *Determined by ANOVA*

There is no significant difference between two groups of intervention for senior fitness test (table 4.5). Statistical results of one-way Anova showed Chair stand test [F(1, 94) = .001; p > .05]; Arm curl [F(1, 94) = .335; p > .05]; 2minute step [F(1, 94) = 2.232; p

> .05]; Chair sit and reach [F(1, 94) = .016; p > .05]; Back scratch [F(1, 94) = .371; p > .05]; 8foot up and go [F(1, 94) = 1.452; p > .05], respectively.

4.3.3 Subjectively perceived health between Tai Chi and the Control groups at the baseline

There is no significant difference between the two groups of intervention for subjectively perceived health (table 4.6). Statistical results of one-way Anova showed Physical function [F(1, 94) = .578; p > .05]; Role physical [F(1, 94) = .624; p > .05]; Body pain [F(1, 94) = .867; p > .05]; General health [F(1, 94) = .252; p > .05]; Vitality [F(1, 94) = .006; p > .05]; Social functioning [F(1, 94) = .105; p > .05]; Role Emotional [F(1, 94) = 1.238; p > .05]; Mental health [F(1, 94) = .021; p > .05]; Physical component summary F(1, 94) = .555; p > .05; Mental component summary F(1, 94) = .404; p > .05; Short form 36 [F(1, 94) = .595; p > .05; Valuation of life [F(1, 94) = .415; p > .05], respectively.

Table 4.6. One-way Anova for subjectively perceived health between TC & CT group at baseline

Dependent variables	Tai Chi (n=48)	Control (n=48)	Sig.*
	Mean ± SD	Mean ± SD	
PF	54.79 ± 33.51	49.58 ± 33.62	.449
RP	43.75 ± 42.37	36.98 ± 41.75	.431
BP	58.85 ± 20.08	54.96 ± 20.90	.354
GH	44.42 ± 17.84	42.52 ± 19.12	.617
VT	58.02 ± 12.66	58.23 ± 13.74	.939
SF	49.60 ± 17.83	48.33 ± 20.51	.747
RE	47.23 ± 41.87	37.50 ± 43.85	.269
MH	61.75 ± 13.45	61.33 ± 14.48	.884
PCS (scale)	51.81 ± 23.28	48.23 ± 23.86	.458
MCS (scale)	52.19 ± 18.77	49.65 ± 20.34	.526
SF36 total (scale)	52.31 ± 22.42	48.69 ± 23.40	.442
VOL	38.39 ± 7.21	39.18 ± 4.50	.521

*

Determined by ANOVA; PF=Physical Function; RP=Role Physical; BP=Bodily Pain; GH=General Health; VT=Vitality; SF=Social Functioning; RE=Role Emotional; MH=Mental Health; PCS=Physical Component Summary; MCS=Mental Component Summary; SF36=Short Form 36; VOL=Valuation of Life.

4.3.4 Comparison of sleep quality between Tai Chi and Control group at baseline

Results from table 4.7 shows that there are no significant differences between Tai Chi and Control groups in sleep quality at baseline. Statistical results of Anova showe subscales of sleep quality: sleep duration [F(1, 94) = 1.962; p > .05]; sleep disturbance [F(1, 94) = .243; p > .05]; Q2 and Q5 new F(1, 94) = .081; p > .05; sleep latency [F(1, 94) = .152; p > .05]; sleep dysfunction [F(1, 94) = .084; p > .05]; sleep efficiency [F1, 94) = 1.850; p > .05]; overall sleep quality [F(1, 94) = .009; p > .05]; sleep medicine [F(1, 94) = .024; p > .05]; Pittsburgh sleep quality index total [F(1, 94) = 1.985; p > .05], and the Falls efficacy scale [F(1, 94) = 3.453; p > .05], respectively.

Table 4.7. One-way Anova for sleep quality between TC & CT group at the baseline

Dependent variables	Tai Chi (n=48)	Control (n=48)	Sig.*
	Mean ± SD	Mean ± SD	
sleep duration	.50 ± .79	.29 ± .65	.165
sleep disturbance	1.19 ± .60	1.25 ± .63	.623
Q2 and Q5a #	2.67 ± 1.35	2.58 ± 1.49	.776
sleep latency	1.67 ± .75	1.60 ± .81	.698
sleep dysfunction	1.65 ± 1.08	1.58 ± 1.02	.772
sleep efficiency	1.96 ± .79	1.75 ± .70	.177
overall sleep quality	1.60 ± 1.06	1.58 ± 1.02	.923
sleep medicine	.69 ± .65	.71 ± .65	.876
PSQI_Buysse (total)	9.38 ± 4.99	8.06 ± 4.09	.162
FES	54.71 ± 8.37	51.56 ± 8.21	.066

* *Determined by ANOVA;* # Q2 and Q5a refers to time to get into asleep and cannot get to sleep in 30 minutes; FES = the Falls Efficacy Scale

4.3.5 Comparison of cognitive performance between the Tai Chi and the Control groups at the baseline

Table 4.8.One-way Anova for cognitive performance between TC & CT groups at baseline

Dependent variables	Tai Chi (n=48)	Control (n=48)	Sig.*
	Mean ± SD	Mean ± SD	
Part A (number)	45.40 ± 6.78	45.04 ± 5.33	.777
Part B (number-letter)	117.06 ± 6.74	119.25 ± 7.82	.146

**Determined by ANOVA*

There are no significant differences between the two groups of intervention for cognitive performance (table 4.8). Statistical results from one-way Anova indicates part A [$F(1, 94) = .081$, $p > .05$]; Part B [$F(1, 94) = 2.252$, $p > .05$], respectively.

4.4 Comparison of results between Tai Chi and Control groups at Midpoint

4.4.1 Comparison of blood pressure, BMI, and WHR at midpoint

Table 4.9. One-way Anova for BMI, WHR, blood pddressure between TC & CT groups at midpoint

Dependent variables	Tai Chi (n=45)	Control (n=45)	Sig.*
	Mean ± SD	Mean ± SD	
BMI (kg/m^2)	23.55 ± 1.36	24.48 ± 1.00	.000
WHR (cm)	.92 ± .06	.95 ± .02	.017
Systole(mmHg)	138.78 ± 6.42	147.16 ± 7.65	.000
Diastole(mmHg)	83.87 ± 5.04	82.33 ± 4.64	.137
Pulse (bpm)	81.47 ± 3.92	82.38 ± 4.11	.286

** Determined by ANOVA; BMI=Body Mass Index; WHR=Waist Hip Ratio*

According to the statistical results of the table 4.9, it can be concluded that there are significant differences between the Tai Chi and the Control groups at the midpoint for BMI [$F(1, 88) = 13.691$, $p < .05$]; Systole [$F(1, 88) = 31.630$, $p < .05$]. However, It can also be observed from table 10 that there are no significant differences between the two groups for WHR [$F(1, 88) = 5.889$, $p > .05$]; Diastole [$F(1, 88) = 2.250$, $p > .05$]; Pulse [$F(1, 88) = 1.154$, $p > .05$], respectively.

4.4.2 Comparison of results of physical component measurement between the Tai Chi group and the Control groups at the Midpoint

All dependent variables of one-way Anova show significant differences between the two groups of intervention in senior fitness test. Participants in the Tai Chi group show better performance in physical fitness tests. It can be observed from table 4.10, the results show statistically for Chair stand test [$F(1, 88) = 26.366$, $p < .05$]; Arm curl test [$F(1, 88) = 29.763$, $p < .05$]; 2minutestep test [$F(1, 88) = 14.786$, $p < .05$]; Chair sit and reach test [$F(1, 88) = 15.484$, $p < .05$]; Back scratch test [$F(1, 88) = 17.340$, $p < .05$]; 8foot up and go test [$F(1, 88) = 37.232$, $p < .05$], respectively.

Table 4.10.One-way Anova for physical fitness test variables between TC & CT groups at midpoint

Dependent variables	Tai Chi (n=45)	Control (n=45)	Sig.*
	Mean ± SD	Mean ± SD	
Chair stand (stands)	18.82 ± 2.46	16.18 ± 2.42	.000
Arm curl (times)	19.38 ± 2.64	16.58 ± 2.21	.000
2 minute step(steps)	90.71 ± 7.38	85.09 ± 6.45	.000
Chair sit reach (cm)	2.84 ± 3.66	-.87 ± 5.15	.000
Back scratch (cm)	1.84 ± 3.56	-1.60 ± 2.25	.000
8foot up and go (second)	6.30 ± .77	7.21 ± .64	.000

* *Determined by ANOVA*

4.4.3 Subjectively perceived health between TC and CT groups at Midpoint

All dependent variables of one-way Anova show significant differences between the two groups of intervention in subjectively perceived health. Participants in the Tai Chi group report better score than the Control group for all subscales of test. It can be observed from table 4.11, the results of subscales show statistical differences in Physical function [$F(1, 88) = 28.383$, $p < .05$]; Role physical [$F(1, 88) = 43.656$, $p < .05$]; Bodily pain [$F(1, 88) = 5.756$, $p < .05$]; General health [$F(1, 88) = 21.222$, $p < .05$]; Vitality [$F(1, 88) = 11.696$, $p < .05$]; Social functioning [$F(1, 88) = 6.708$, $p < .05$]; Role emotional [$F(1, 88) = 21.476$, $p < .05$]; Mental health [$F(1, 88) = 9.312$, $p < .05$]; Physical component summary [$F(1, 88) = 31.731$, $p < .05$]; Mental component summary [$F(1, 88) = 20.449$, $p < .05$; Short form 36 total [$F(1, 88) = 27.935$, $p < .05$] and Valuation of life [$F(1, 88) = 43.738$, $p < .05$], respectively.

Table 4.11. One-way Anova for subjectively perceived health between TC & CT groups at midpoint

Dependent variables	Tai Chi (n=45)	Control (n=45)	Sig.*
	Mean ± SD	Mean ± SD	
PF	80.89 ± 19.86	49.44 ± 34.24	.000
RP	84.44 ± 25.16	37.22 ± 40.08	.000
BP	64.93 ± 14.08	55.78 ± 21.37	.019
GH	59.07 ± 11.70	44.58 ± 17.55	.000
VT	67.33 ± 8.56	59.67 ± 12.35	.001
SF	58.47 ± 12.45	49.04 ± 20.85	.011
RE	69.58 ± 37.56	31.11 ± 41.10	.000
MH	69.24 ± 9.37	62.04 ± 12.75	.003
PCS (scale)	71.29 ± 12.70	49.13 ± 23.12	.000
MCS (scale)	64.71 ± 12.77	49.31 ± 18.94	.000
SF36 total (scale)	69.29 ± 13.24	48.56 ± 22.73	.000
VOL	45.24 ± 4.76	39.93 ± 4.27	.000

* *Determined by ANOVA; PF=Physical Function; RP=Role Physical; BP=Bodily Pain; GH=General Health; VT=Vitality; SF=Social Functioning; RE=Role Emotional; MH=Mental Health; PCS=Physical Component Summary; MCS=Mental Component Summary; SF36=Short Form 36; VOL=Valuation of Life*

4.4.4 Comparison of sleep quality between the Tai Chi and the Control groups at the Midpoint

Results from table 4.12 shows that there are significant differences between the Tai Chi and the Control groups in sleep quality at midpoint except Q2 and Q5a [$F(1, 88) = 1.208$, $p > .05$]. Participants in the Tai Chi group report better improvement in sleep quality. The statistical results of Anova showe sleep duration [$F(1, 88) = 125.186$; $p < .05$]; sleep disturbance [$F(1, 88) = 57.57$; $p < .05$]; sleep latency [$F(1, 88) = 9.9$; $p < .05$]; sleep dysfunction [$F(1, 88) = 8.722$; $p < .05$]; sleep efficiency [$F(1, 88) = 7.727$; $p < .05$]; overall sleep quality [$F (1, 88) = 51.558$; $p < .05$]; sleep medicine [$F(1, 88) = 158.968$; $p < .05$]; Pittsburgh sleep quality index total [$F(1, 88) = 9.371$; $p < .05$], and the Falls efficacy scale [$F(1, 88) = 50.852$; $p < .05$], respectively.

Table 4.12. One-way Anova for sleep quality and balance between TC & CT groups at midpoint

Dependent variables	Tai Chi (n=45)	Control (n=45)	Sig.*
	Mean ± SD	Mean ± SD	
sleep duration	.07 ± .25	1.09 ± .55	.000
sleep disturbance	.84 ± .42	2.73 ± 1.61	.000
Q2 and Q5a #	1.42 ± .89	1.62 ± .83	.275
sleep latency	1.04 ± .47	1.58 ± 1.03	.002
sleep dysfunction	1.09 ± .82	1.53 ± .58	.004
sleep efficiency	1.04 ± .76	1.58 ± 1.03	.007
overall sleep quality	1.09 ± .82	.13 ± .34	.000
sleep medicine	.29 ± .54	7.62 ± 3.86	.000
PSQI_Buysse (total)	5.47 ± 2.17	7.62 ± 3.86	.003
FES	41.69 ± 6.78	52.69 ± 7.81	.000

* *Determined by ANOVA; FES = the Falls Efficacy Scale.*
# *Q2 and Q5a refer to time to get into asleep and cannot get to sleep in 30 minutes*

4.4.5 Comparison of motor speed and visual attention between the Tai Chi and the Control groups at the Midpoint

Table 4.13. One-way Anova for cognitive performance between TC & CT groups at midpoint

Dependent variables	Tai Chi (n=45)	Control (n=45)	Sig.*
	Mean ± SD	Mean ± SD	
Part A (number)	38.00 ± 5.49	45.02 ± 5.12	.000
Part B (number-letter)	106.38 ± 6.42	119.29 ± 7.64	.000

**.Determined by ANOVA*

There are significant differences between the two groups at midpoint for cognitive performance (table 4.13). Participants in the Tai Chi group show better performance in cognitive tests than that in the Control group. Statistical results of one-way Anova showed significant changes in Part A [$F(1, 88) = 39.354$, $p < .05$]; Part B [$F(1, 88) = 75.29$, $p < .05$], respectively.

Conclusion of this section: there were significant differences in all variables of tests between the Tai Chi and the Control groups at the midpoint

4.5 Comparison of results between the Tai Chi and the Control groups the endpoint

4.5.1 Comparison of blood pressure, Body Mass Index, and Waist Hip Ratio at Endpoint

Table 4.14. One-way Anova for BMI, WHR and blood pressure between TC and CT groups at endpoint

Dependent variables	Tai Chi (n=39)	Control (n=34)	Sig.*
	Mean ± SD	Mean ± SD	
BMI (kg/m^2)	23.22 ± 1.24	24.45 ± .76	.000
WHR (cm)	.91 ± .05	.95 ± .02	.001
Systole(mmHg)	134.51 ± 4.96	146.56 ± 6.54	.000
Diastole(mmHg)	80.95 ± 3.63	82.41 ± 3.84	.099
Pulse (bpm)	76.72 ± 3.23	82.06 ± 3.20	.000

* *Determined by ANOVA; BMI=Body Mass Index; WHR=Waist Hip Ratio*

There are remarkable changes between the Tai Chi and the Control groups at the endpoint for BMI, WHR and blood pressure (table 4.14). Participants in Tai Chi group keep showing better results than those in the Control group except diastole blood pressure. Statistical one-way Anova shows BMI [$F(1, 71) = 24.696$, $p < .05$]; Systole [$F(1, 71) = 13.116$, $p < .05$]; WHR [$F(1, 71) = 79.692$, $p < .05$]; Diastole [$F(1, 71) = 2.788$, $p < .05$]; Pulse [$F(1, 71) = 49.998$, $p < .05$], respectively.

4.5.2 Comparison of results of physical component measurement between the Tai Chi group and the Control group at the Endpoint

Table 4.15. One-way Anova for SFT variables between TC & CT groups at endpoint

Dependent variables	Tai Chi (n=39)	Control (n=34)	Sig.*
	Mean ± SD	Mean ± SD	
Chair stand (stands)	20.26 ± 2.39	16.00 ± 2.11	.000
Arm curl (times)	20.69 ± 2.46	16.41 ± 2.13	.000
2 minute step (steps)	91.62 ± 6.28	84.50 ± 5.59	.000
Chair sit reach (cm)	3.67 ± 3.23	-.65 ± 4.66	.000
Back scratch (cm)	3.10 ± 2.68	-1.74 ± 3.80	.000
8foot up and go (second)	6.11 ± .71	7.22 ± .62	.000

* *Determined by ANOVA*

All dependent variables of one-way Anova show significant differences between the two groups of intervention in senior fitness test at endpoint. The Tai Chi group keeps showing better performance in physical fitness test than that in the Control group. It can be observed from table 4.15, the results show statistically changes for Chair stand test [$F(1, 71) = 63.937$, $p < .05$]; Arm curl test [$F(1, 71) = 62.097$, $p < .05$]; 2minutestep test [$F(1, 71) = 25.77$, $p < .05$]; Chair sit and reach test [$F(1, 71) = 21.496$, $p < .05$]; Back scratch test [$F(1, 71) = 40.235$, $p < .05$]; 8foot up and go test [$F(1, 71) = 49.628$, $p < .05$], respectively

4.5.3 Subjectively perceived health between the Tai Chi and the Control groups at the endpoint (results from SF-36 and Valuation of life)

The one-way Anova shows significant differences between the two groups of intervention in subjectively perceived health. Participants in the Tai Chi group keep reporting better scores than those in the Control group. It can be observed from table 4.16, the results of subscales show statistically for Physical function [$F(1, 71) = 62.106$, $p < .05$]; Role physical [$F(1, 71) = 56.094$, $p < .05$]; Bodily pain [$F(1, 71) = 29.979$, $p < .05$]; General health [$F(1, 81) = 21.222$, $p < .05$]; Vitality [$F(1, 71) = 11.696$, $p < .05$]; Social functioning [$F(1, 71) = 47.458$, $p < .05$]; Role emotional [$F(1, 71) = 49.056$, $p < .05$]; Mental health [$F(1, 71) = 35.289$, $p < .05$]; Physical component summary [$F(1, 71) =$

64.971, p < .05]; Mental component summary [F(1, 71) = 61.214, p < .05; Short form 36 total [F(1, 71) = 62.250, p < .05] and Valuation of life [F(1, 71) = 336.561, p < .05], respectively.

Table 4.16. One-way Anova for subjectively perceived health between TC & CT groups at endpoint

Dependent variables	Tai Chi (n=39)	Control (n=34)	Sig.*
	Mean ± SD	Mean (SD)	
PF	93.21 ± 9.49	46.18 ± 35.88	.000
RP	91.67 ± 16.55	35.29 ± 43.57	.000
BP	74.72 ± 6.92	54.29 ± 22.10	.000
GH	69.90 ± 7.36	43.62 ± 19.67	.000
VT	72.95 ± 5.58	58.38 ± 10.27	.000
SF	73.46 ± 5.79	48.74 ± 21.55	.000
RE	91.51 ± 16.53	36.29 ± 45.98	.000
MH	74.05 ± 6.00	60.59 ± 12.61	.000
PCS (scale)	80.31 ± 6.85	47.32 ± 24.50	.000
MCS (scale)	76.36 ± 5.76	49.53 ± 20.52	.000
SF36 total (scale)	80.18 ± 6.56	47.97 ± 24.52	.000
VOL	52.20 ± 2.15	37.64 ± 4.38	.000

* *Determined by ANOVA; PF=Physical Function; RP=Role Physical; BP=Bodily Pain; GH=General Health; VT=Vitality; SF=Social Functioning; RE=Role Emotional; MH=Mental Health; PCS=Physical Component Summary; MCS=Mental Component Summary; SF36=Short Form 36; VOL=Valuation of Life*

4.5.4 Comparison of sleep quality between the Tai Chi and the Control groups at the Endpoint

There are significant differences between the Tai Chi and the Control groups in sleep quality at the endpoint (table 4.17). Participants in the Tai Chi group keep reporting a greater improvement in sleep quality than participants in the Control group. Statistical results of Anova shows sleep duration [F(1, 71) = 18.33; p < .05]; sleep disturbance [F(1, 71) = 57.57; p < .05]; Q2 and Q5a [F(1, 71) = 56.91, p > .05]; sleep latency [F(1, 71) = 35.29; p < .05]; sleep dysfunction [F(1, 71) = 44.75; p < .05]; sleep efficiency [F(1, 71) = 15.72; p < .05]; overall sleep quality [F (1, 71) = 46.27; p < .05]; sleep medicine [F(1, 71)

= 7.99; p < .05]; Pittsburgh sleep quality index total [F(1, 71) = 43.69; p < .05], and the Falls efficacy scale [F(1, 71) = 96.90; p < .05], respectively.

Table 4.17. One-way Anova for sleep quality and balance between TC& CT group at endpoint

Dependent variables	Tai Chi (n=39)	Control (n=34)	Sig.*
	Mean ± SD	Mean ± SD	
sleep duration	.05 ± .223	.47 ± .563	.000
sleep disturbance	.74 ± .442	1.00 ± .492	.022
Q2 and Q5a #	.95 ± 456	2.85 ± 1.50	.000
sleep latency	.87 ± .339	1.71 ± .799	.000
sleep dysfunction	.49 ± .506	1.71 ± 1.00	.000
sleep efficiency	.92 ± .739	1.56 ± .613	.000
overall sleep quality	.46 ± 505	1.68 ± .976	.000
sleep medicine	.03 ± .160	.24 ± .431	.006
PSQI_Buysse (total)	3.59 ± 1.56	7.97 ± 3.78	.000
FES	35.20 ± 5.89	51.35 ± 8.06	.000

* Determined by ANOVA; FES = the Falls Efficacy Scale
# Q2 and Q5a refer to time to get into asleep and cannot get to sleep in 30 minutes

4.5.5 Comparison of motor speed and visual attention between the Tai Chi and the Control groups at the endpoint

Table 4.18. One-way Anova for cognitive performance between TC & CT groups at endpoint

Dependent variables	Tai Chi (n=39)	Control (n=34)	Sig.*
	Mean (SD)	Mean (SD)	
Part A (number)	35.05 ± 4.31	44.24 ± 4.54	.000
Part B (number-letter)	102.05 ± 5.01	118.32 ± 6.36	.000

* *Determined by ANOVA*

There are significant differences between the two groups at endpoint for cognitive performance (table 4.18). The Tai Chi group reports higher score than the Control group.

Statistical results of one-way Anova shows significant changes in Part A [F(1, 71) = 78.37, p < .05]; Part B [F(1, 71) = 175.90, p < .05], respectively.

4.6 Comparison of results at three periods of test between the Tai Chi and the Control groups

4.6.1 Comparison of body mass index, waist hip ratio and blood pressure of within-subjected effect

Table 4.19 indicates that the result of main effects of testtime for BMI is significant, F(1.86, 142) = 20.27, p < 0.001, the result of testtime*group of BMI is also significant, F (1.86, 142) = 24.11, p < 0.001. The result of main effects of testtime for WHR is significant, F (1.79, 142) = 14.58, p < 0.001, the result of testtime*group WHR is also significant, F (1.79, 142) = 3.24, p < 0.001. The result of main effects of testtime for systole is significant, F (1.32, 142) = 65.42, p < 0.001, the result of testtime*group systole is also significant, F (1.32, 142) = 38.23, p < 0.001. The result of main effects of testtime for diastole is significant, F (1.50, 142) = 6.30, p < 0.05, the result of testtime*group diastole is also significant, F (1.50, 142) = 6.37, p < 0.05. The result of main effects of testtime for pulse is significant, F (1.37, 142) = 59.18, p < 0.001, the result of testtime*group pulse is also significant, F (1.37, 142) = 33.49, p < 0.001, respectively.

Table 4.19. General linear model-repeated measures of variables (BMI, WHR and BP)

Measurement	SS	MS	df	F	Sig.	(η)
BMI (kg/m^2)	6.64	3.55	1.86, 142	20.27§	.000	.222
	7.90	4.23		24.11§§	.000	.253
WHR (cm)	.009	.005	1.79, 142	14.58§	.000	.170
	.002	.001		3.23§§	.000	.044
Systole(mmHg)	1346.92	1014.40	1.32, 142	65.42§	.000	.478
	790.64	595.46		38.23§§	.000	.350
Diastole(mmHg)	80.51	53.46	1.50, 142	6.30§	.006	.082
	81.38	54.04		6.37§§	.005	.082
Pulse (bpm)	792.63	577.17	1.37, 142	59.18§	.000	.455
	448.58	326.64		33.49§§	.000	.331

*§.Testtime; §§.Testtime*group; η = Eta squared. BMI = Body Mass Index; WHR = Waist Hip Ratio; BP = Blood Pressure.*

Figure 4.1. The mean of BMI, WHR and BP at three consecutive tests

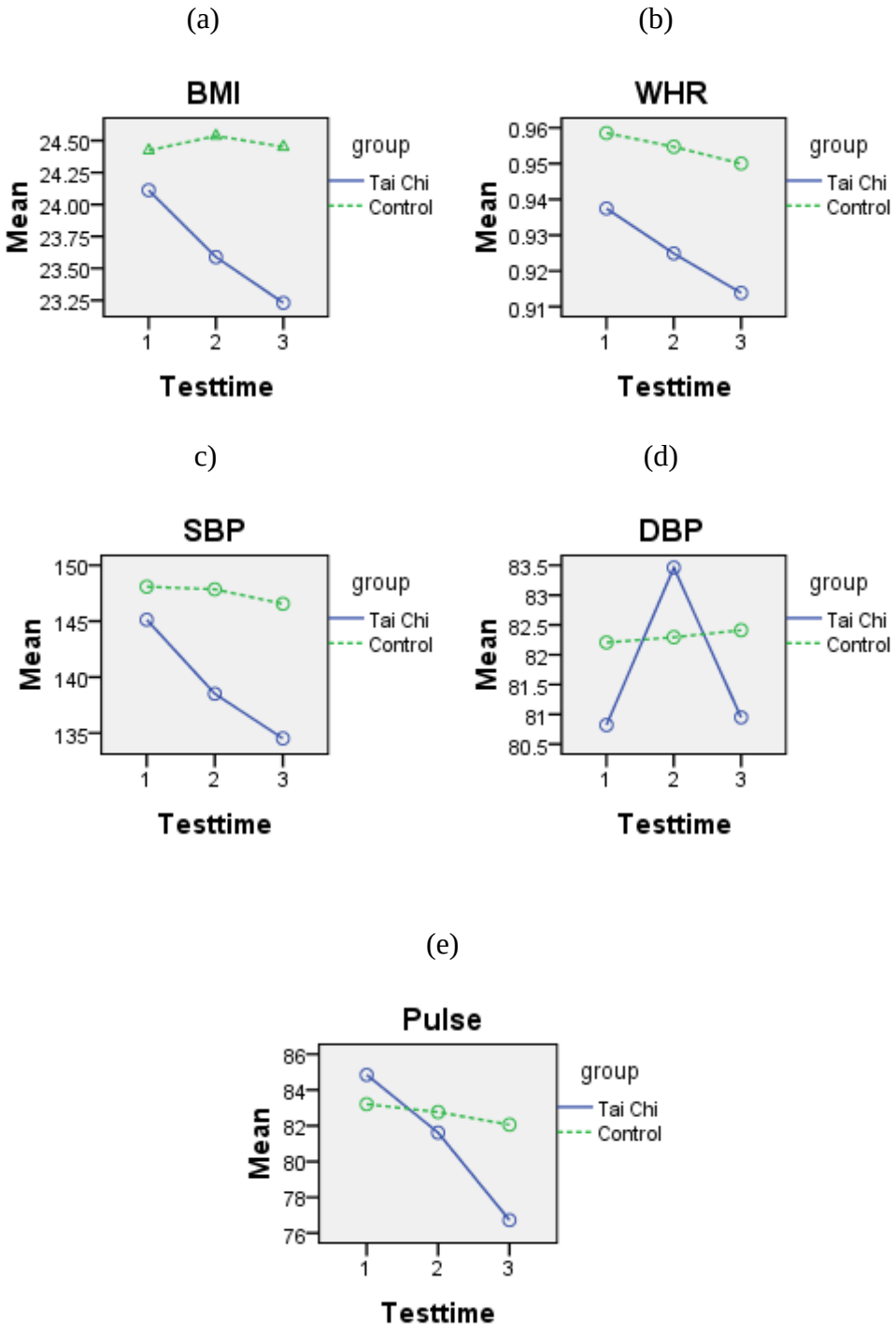


Figure 4.1 illustrates the means of BMI (a), WHR (b), SBP (c), DBP (d) and Pulse (e) between the Tai Chi and the Control groups over the times of tests. The Tai Chi group showed significantly better results than its counterpart of the Control group

4.6.2 Comparison of physical measurement of within-subjected effect

Table 4.20 indicates that the results of main effect of testtime for chair stand is significant, F (1.35, 142) = 120.86, p < 0.001, the result of testtime*group of chair stand is also significant, F (1.35, 142) = 157.65, p < 0.001. The result of main effects of testtime for arm curl is significant, F (1.47, 142) = 70.56, p < 0.001, the result of testtime*group arm curl is also significant, F (1.47, 142) = 82.15, p < 0.001. The result of main effects of testtime for 2-minute step is significant, F (1.31, 142) = 8.89, p < 0.001, the result of testtime*group for 2-minute step is also significant, F (1.31, 142) = 19.46, p < 0.001. The result of main effects of testtime for chair sit-reach is significant, F (1.44, 142) = 62.36, p < 0.001, the result of testtime*group for chair sit-reach is also significant, F (1.44, 142) = 44.74, p < 0.001. The result of main effects of testtime for back scratch is significant, F (1.69, 142) = 73.50, p < 0.001, the result of testtime*group for back scratch is also significant, F (1.69, 142) = 53.16, p < 0.001. The result of main effects of testtime for 8foot up-go is significant, F (1.39, 142) = 63.08, p < 0.001, the result of testtime*group for 8foot up-go is significant, F (1.39, 142) = 81.31, p < 0.001, respectively.

Table 4.20.General linear model-repeated measures of variables (SFT)

Measurement	SS	MS	df	F	Sig.	(η)
Chair stand (stands)	143.58	105.70	1.35, 142	120.86§	.000	.630
	187.28	137.88		157.65§§	.000	.689
Arm curl (times)	116.74	78.95	1.47, 142	70.56§	.000	.498
	135.92	91.92		82.15§§	.000	.536
2-minute step (steps)	103.13	78.30	1.31, 142	8.89§	.000	.111
	225.56	171.24		19.46§§	.000	.215
Chair sit reach (cm)	233.18	161.10	1.44, 142	62.36§	.000	.468
	167.30	115.58		44.74§§	.000	.387
Back scratch (cm)	340.80	201.06	1.69, 142	72.50§	.000	.505
	249.91	194.02		53.16§§	.000	.505
8foot up and go (s)	5.66	4.06	1.39, 142	63.08§	.000	.470
	7.29	5.23		81.31§§	.000	.534

*§.Testtime; §§.Testtime*group; η = Eta squared.*

Figure 4.2. The mean of senior fitness test variables at three consecutive tests (SFT)

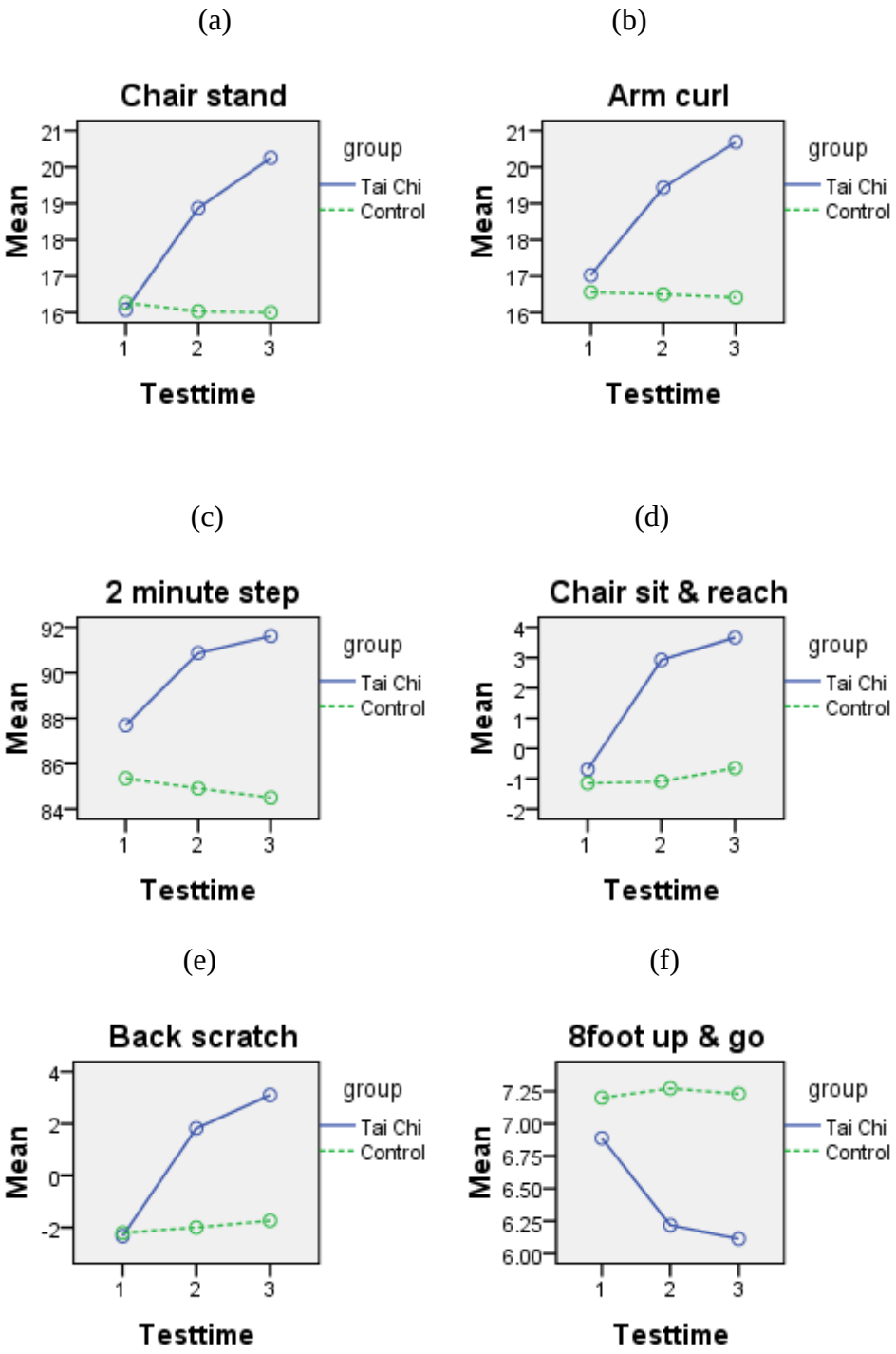


Figure 4.2 illustrates the means of Chair stand (a),Arm curl (b), 2 minute step (c), Chair sit and reach (d), Back scratch (e) and 8foot up and go (f) between the Tai Chi and the Control groups over the times of tests. The Tai Chi group showed significantly better results than its counterpart of the Control group

4.6.3 Comparison of subjectively perceived health of within-subjected effect

Table 4.21. General linear model-repeated measures of variables (SF-36 and VOL)

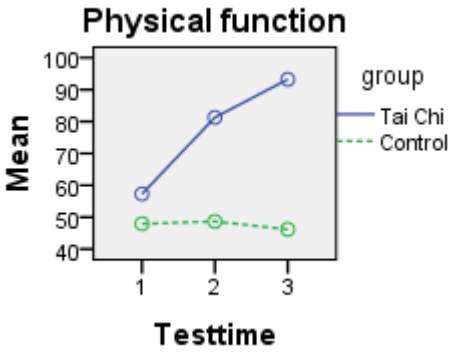
Measurement	SS	MS	df	F	Sig.	(η)
PF	11288.58	5644.29	1.31, 142	37.42§	.000	.345
	13117.81	8889.01		43.49§§	.000	.380
RP	19933.81	14134.56	1.41, 142	31.15§	.000	.304
	20812.80	14757.83		32.53§§	.000	.314
BP	1759.46	1164.61	1.51, 142	14.39§	.000	.169
	1743.46	1154.02		14.26§§	.000	.167
GH	6470.69	4353.65	1.48, 142	54.82§	.000	.436
	4436.59	2985.05		37.59§§	.000	.346
VT	1968.07	1458.08	1.35, 142	27.94§	.000	.282
	1500.95	1112.01		21.31§§	.000	.231
SF	5519.41	3387.24	1.62, 142	43.98§	.000	.383
	4776.03	2931.03		38.05§§	.000	.349
RE	13107.48	7936.94	1.65, 142	16.76§	.000	.191
	14832.30	8981.37		18.96§§	.000	.211
MH	1124.17	795.52	1.41, 142	19.44§	.000	.215
	947.08	670.20		16.38§§	.000	.187
PCS (scale)	6737.99	5671.94	1.18, 142	47.81§	.000	.402
	6287.45	5292.68		44.61§§	.000	.386
MCS (scale)	4702.02	2351.01	1.30, 142	41.28§	.000	.368
	4163.50	3182.53		36.55§§	.000	.340
SF36 total (scale)	6053.81	5139.77	1.17, 142	45.60§	.000	.391
	5838.30	4956.80		43.97§§	.000	.382
VOL	1622.63	899.25	1.80, 142	104.04§	.000	.594
	2123.87	1182.02		136.76§§	.000	.658

*§.Testtime; §§.Testtime*group; η = Eta squared; PF=Physical Function; RP=Role Physical; BP=Bodily Pain; GH=General Health; VT=Vitality; SF=Social Functioning; RE=Role Emotional; MH=Mental Health; PCS=Physical Component Summary; MCS=Mental Component Summary; SF36=Short Form 36; VOL=Valuation of Life*

Table 4.21 indicates that the result of main effects of testtime for physical function is significant, F (1.31, 142) = 37.42, p < 0.001, the result of testtime*group of physical function is also significant, F (1.31, 142) = 43.49, p < 0.001. The result of main effects of testtime for role physical is significant, F (1.41, 142) = 31.15, p < 0.001, the result of testtime*group of role physical is also significant, F (1.41, 142) = 32.53, p < 0.001. The result of main effects of testtime for bodily pain is significant, F (1.51, 142) = 14.39, p < 0.001, the result of testtime*group of bodily pain is also significant, F (1.51, 142) = 14.26, p < 0.001. The result of main effects of testtime for general health is significant, F (1.48, 142) = 54.82, p < 0.001, the result of testtime*group of general health is also significant, F (1.48, 142) = 37.59, p < 0.001. The result of main effects of testtime for vitality is significant, F (1.35, 142) = 27.94, p < 0.001, the result of testtime*group of vitality is also significant, F (1.35, 142) = 21.31, p < 0.001. The result of main effects of testtime for social functioning is significant, F (1.62, 142) = 43.98, p < 0.001, the result of testtime*group of social functioning is also significant, F (1.64, 142) = 38.05, p < 0.001. The result of main effects of testtime for role emotional is significant, F (1.65, 142) = 16.76, p < 0.001, the result of testtime*group of role emotional is also significant, F (1.65, 142) = 18.96, p < 0.001. The result of main effects of testtime for mental health is significant, F (1.41, 142) = 16. 41, p < 0.001, the result of testtime*group of mental health is also significant, F (1.41, 142) = 19.38, p < 0.001. The result of main effects of testtime for physical component summary is significant, F () = 47.81, p < 0.001, the result of testtime*group of physical component summary is also significant, F (1.18, 142) = 44.61, p < 0.001. The result of main effects of testtime for mental component summary is significant, F (1.30, 142) = 41.28, p < 0.001, the result of testtime*group of mental component summary is also significant, F (1.30, 1.42) = 36.55, p < 0.001. The result of main effects of testtime for short form 36 is significant, F (1.17, 142) = 45.60, p < 0.001, the result of testtime*group of short form 36 is also significant, F (1.17, 142) = 43.97, p < 0.001. The result of main effects of testtime for valuation of life is significant, F (1.80, 142) = 104.04, p < 0.001, the result of testtime*group of valuation of life is also significant, F (1.80, 142) = 136.76, p < 0.001.

Figure 4.3. Mean of subjectively perceived health and valuation of life at three consecutive tests (SF-36 and VOL)

(a)



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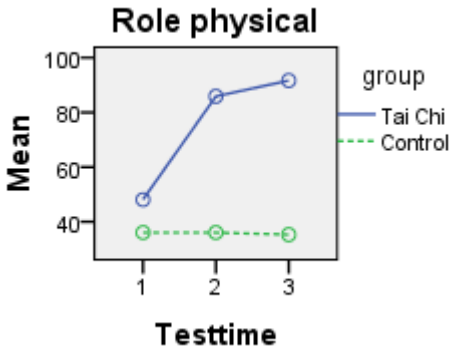

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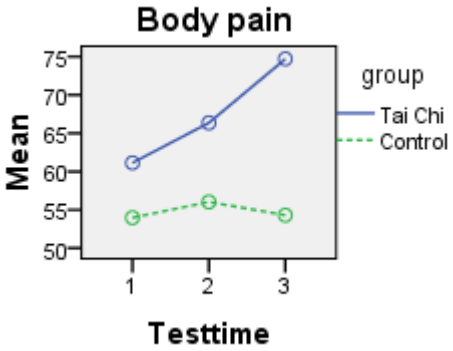

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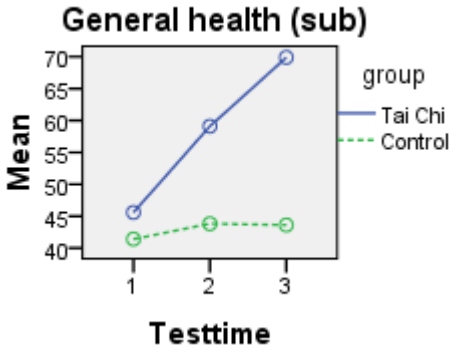
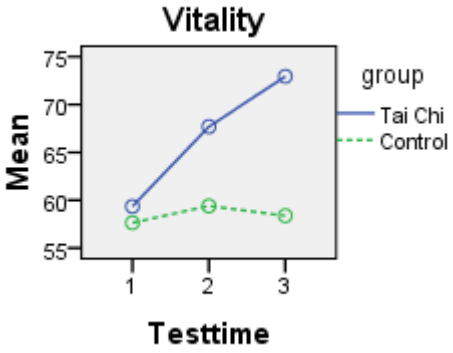
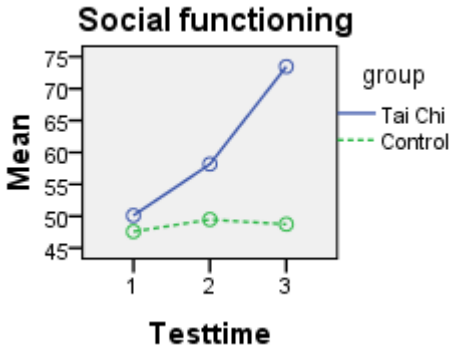


(e)



(f)



(g)

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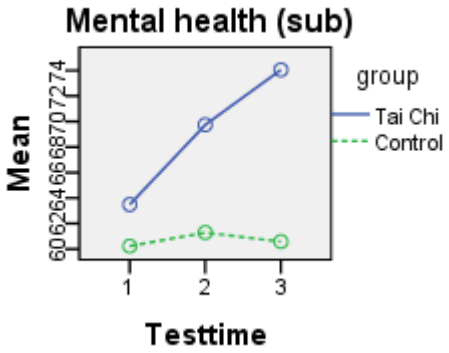
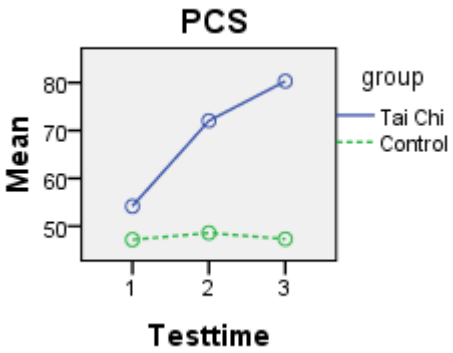
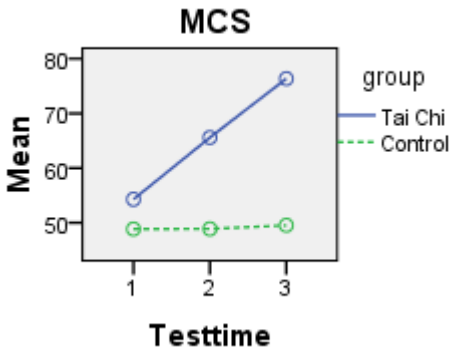


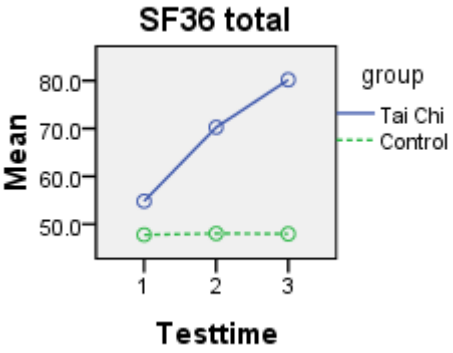
(i)



(j)



(k)



(l)

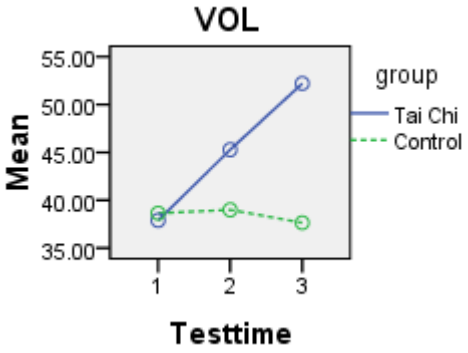


Figure 4.3 illustrates the means of Physical function (a), Role physical (b), Body pain (c), General health (d), Vitality (e), Social functioning (f), Role emotion (j), Mental health (h) Physical component summary (i), Mental component summary (j), Short form – 36 (k) and Valuation of life (l) between the Tai Chi and the Control groups over the times of tests. The Tai Chi group showed significantly better results than its counterpart of the Control group

4.6.4 Comparison of sleep quality of within-subjected effect

Table 4.22. General linear model-repeated measures of variables (PSQI and FES)

Measurement	SS	MS	Df	F	Sig.	(η)
sleep duration	5.05	3.43	1.47, 142	9.18[§]	.001	.114
	13.82	9.38		25.11[§§]	.000	2.61
sleep disturbance	33.39	21.37	1.56, 142	52.12[§]	.000	.423
	37.19	23.80		58.05[§§]	.000	.450
Q2 and Q5a [#]	46.77	25.91	1.80, 142	57.81[§]	.000	.449
	34.16	18.93		42.23[§§]	.000	.373
sleep latency	5.50	2.75	2, 142	18.41[§]	.000	.206
	5.17	2.58		17.31[§§]	.000	.196
sleep dysfunction	10.78	5.39	2, 142	24.40[§]	.000	.256
	9.37	4.87		22.04[§§]	.000	.237
sleep efficiency	15.97	7.98	2, 142	17.18[§]	.000	.195
	5.31	2.65		5.71[§§]	.004	.074
overall sleep	38.11	19.05	2, 142	78.05[§]	.000	.524
quality	38.71	19.35		79.29[§§]	.000	.528
sleep medicine	684.30	610.96	1.12, 142	139.45[§]	.000	.663
	700.96	625.84		142.85[§§]	.000	.668
PSQI_Buysse	357.12	246.27	1.45, 142	49.50[§]	.000	.411
(total)	187.38	129.22		25.97[§§]	.000	.268
FES	3647.75	1823.87	2, 142	310.63[§]	.000	.594
	3865.56	2329.40		329.18[§§]	.000	.658

*[§].Testtime; [§§].Testtime*group; η = Eta squared. PSQI Buysse = Pittsburgh Sleep Quality Index calculated by Dr. Buysee; FES = the Falls Efficacy Scale.*

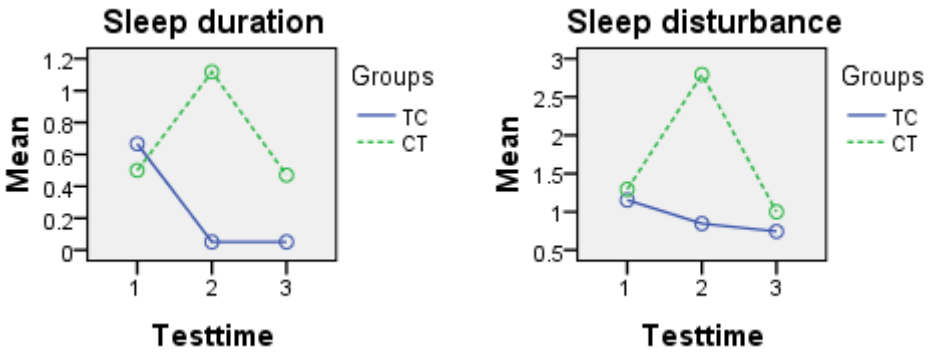
[#] Q2 and Q5a refer to time to get into asleep and cannot get to sleep in 30 minutes

Table 4.22 indicates that the result of main effects of testtime for sleep duration is significant, $F(1.47, 142) = 9.18$, $p < 0.05$, the result of testtime*group for sleep duration is also significant, $F(1.47, 142) = 25.11$, $p < 0.001$. The result of main effects of testtime for sleep disturbance is significant, $F(1.56, 142) = 52.12$, $p < 0.001$, the result of testtime*group for sleep disturbance is also significant, $F(1.56, 142) = 58.05$, $p < 0.001$. The result of main effects of testtime for Q2 and Q5a is significant, $F(1.80, 142) = 57.81$,

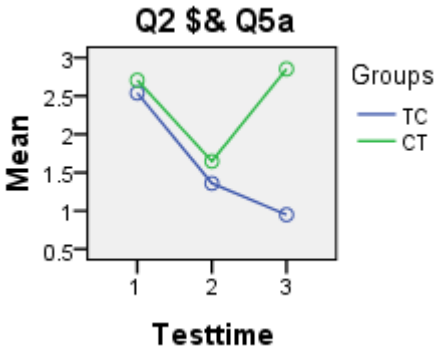
$p < 0.001$, the result of testtime*group for Q2 and Q5a is also significant, $F(1.80, 142) = 42.23$, $p < 0.001$. The result of main effects of testtime for sleep latency is significant, $F(2, 142) = 18.41$, $p < 0.001$, the result of testtime*group for sleep latency is also significant, $F(2, 142) = 17.31$, $p < 0.001$. The result of main effects of testtime for sleep dysfunction is significant, $F(2, 142) = 24.40$, $p < 0.001$, the result of testtime*group for sleep dysfunction is also significant, $F(2, 142) = 22.04$, $p < 0.001$. The result of main effects of testtime for sleep efficiency is significant, $F(2, 142) = 17.18$, $p < 0.001$, the result of testtime*group for sleep efficiency is also significant, $F(2, 142) = 5.71$, $p < 0.05$. The result of main effects of testtime for overall sleep quality is significant, $F(2, 142) = 78.05$, $p < 0.001$, the result of testtime*group for overall sleep quality is also significant, $F(2, 142) = 79.29$, $p < 0.001$. The result of main effects of testtime for sleep medicine is significant, $F(1.12, 142) = 139.45$, $p < 0.001$, the result of testtime*group for sleep medicine is also significant, $F(1.12, 142) = 142.85$, $p < 0.001$. The result of main effects of testtime for Pittsburgh sleep quality index is significant, $F(1.45, 142) = 49.50$, $p < 0.001$, the result of testtime*group for Pittsburgh sleep quality index is also significant, $F(1.45, 142) = 25.97$, $p < 0.001$. The result of main effects of testtime for the Falls efficacy scale is significant, $F(2, 142) = 310.63$, $p < 0.001$, the result of testtime*group for the Falls efficacy scale is also significant, $F(2, 142) = 329.18$, $p < 0.001$, respectively.

Figure 4.4. Mean of sleep quality at three consecutive tests

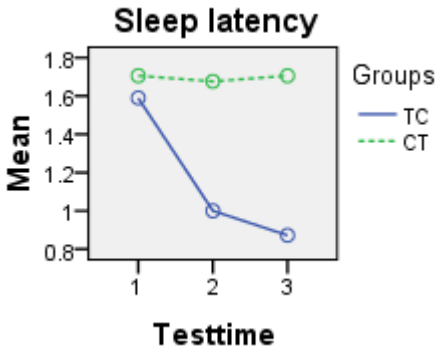
(a) (b)



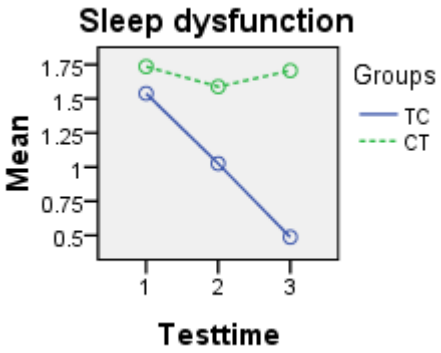
(c)


Q2 $& Q5a
Mean
Testtime
Groups
TC
CT

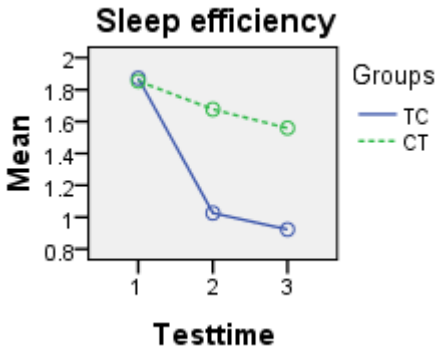
(d)


Sleep latency
Mean
Testtime
Groups
TC
CT

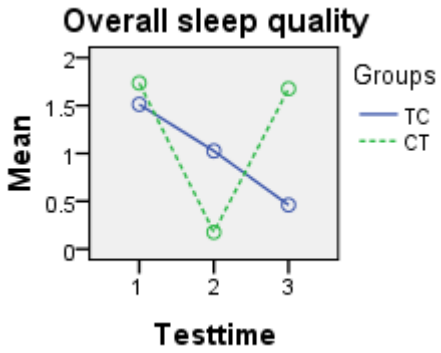
(e)


Sleep dysfunction
Mean
Testtime
Groups
TC
CT

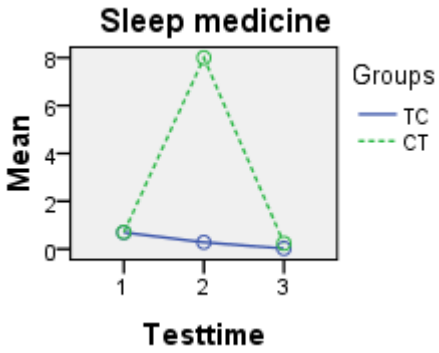
(f)


Sleep efficiency
Mean
Testtime
Groups
TC
CT

(g)


Overall sleep quality
Mean
Testtime
Groups
TC
CT

(h)


Sleep medicine
Mean
Testtime
Groups
TC
CT

(i) (j)

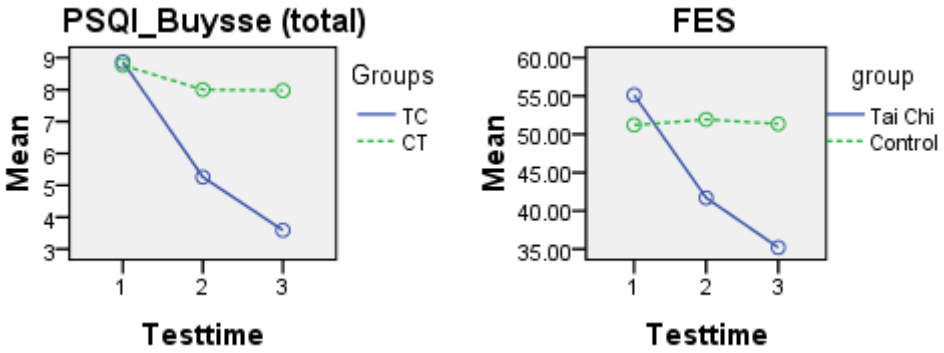


Figure 4.4 illustrates the means of Sleep duration (a),Sleep disturbance (b), Q2 & Q5 (c), Sleep latency (d), Sleep dysfunction (e),Sleep efficiency (f), Overall sleep quality(j), Sleep medicine (h), PSQI-Buysse (i), and the Falls Efficacy Scale (j) between the Tai Chi and the Control groups over the times of tests. The Tai Chi group showed significantly better results than its counterpart of the Control group

4.6.5 Comparison of Cognitive performance of within-subjected effect

Table 4.23.General linear model-repeated measures of variables (TMT)

Measurement	SS	MS	Df	F	Sig.	(η)
Part A	1081.84	746.37	1.44, 142	208.87§	.000	.746
	889.51	613.48		171.74§§	.000	.708
Part B	2287.57	1686.37	1.35, 142	435.65§	.000	.860
	2172.44	1601.50		413.73§§	.000	.854

*§.Testtime; §§.Testtime*group; η = Eta squared.*

Table 4.23 indicates that the result of main effects of testtime for Trail making test part A is significant, F (1.44, 142) = 208.87, p < 0.05, the result of testtime*group for Trail making test part A is also significant, F (1.44, 142) = 171.74, p < 0.001. The result of main effects of testtime for Trail making test part B is significant, F (1.35, 142) = 435.65, p < 0.001, the result of testtime*group for Trail making test part B is also significant, F (1.35, 142) = 413.73, p < 0.001, respectively.

Figure 4.5. Mean of cognitive performance at three consecutive tests (TMT)

(a) (b)

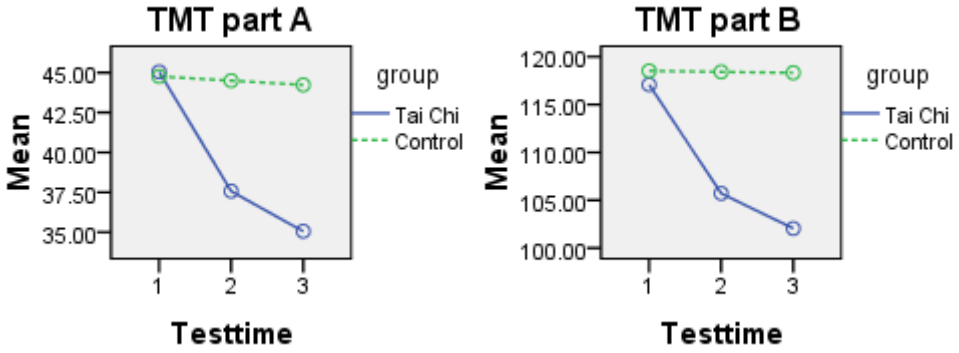


Figure 4.5 illustrates the means of Trail Making Test A (a), Trail Making Test B (b) between the Tai Chi and the Control groups over the times of tests. The Tai Chi group showed significantly better results than its counterpart of the Control group

4.7 Identification of multi factorial interaction among dependent and independent variables

In this part, it shows hierarchical regression analyses for all selected variables. All the tables show the predictive value of selected variables. The overall predictors, which were chosen for regression analyses, were education, sex, age and country. The variable-coding of each predictor is given in the tables' footnotes. Unstandardized regression coefficients (B) show the value of each predictor for each dependent variable, while R^2 and adjusted R^2 give the amount of explained variance in different steps of the hierarchical regression analyses.

Table 4.24. The hierarchical regression models: Body mass index (BMI)

	Unstandardized coefficients: regression coefficient B			
Predictors	Step 1	Step 2	Step 3	Step 4
Education[a]	-.130	-.100	-.100	-.040
Sex[b]		.202	.202	.212
Age[c]			-.002	-428
Group[d]				.773***
R^2	.006	.013	.013	.114***
R^2 change	.006	.006	.000	.101***
Adjusted R^2	.002	.005	.001	.100***

*[a]0 = < 5 years, 1 = 5 to 9 years, 2 = 10 to 12 years, 3 = > 12 years; [b]0 = male, 1 = female; [c]60 to 79 years; [d]0 = Tai Chi, 1 = Control; *p < 0.05, **p < 0.01, ***p < 0.001; (Education df=1.257; Sex df=1.256; Age df=1.255; Group df=1.254)*

Regarding body mass index, regression analyses show that only group is the prominent predictor (table 4.24). Step 4 introduces group as a predictor, which shows that the Tai Chi group has a significantly better level in body mass index than the Control group (B = .77; p < .001; adjusted R^2 = .10) which account for 10% of variance in body mass index.

There is no connection between the dependent variable and predictors except the *group* for waist hip ratio (table 4.45). Step 4 shows that group proved as the strongest

predictor for waist hip ratio (B = .026; p < .001; R change = .070; adjusted R^2 = .093) explaining 9.3% of variance between the two groups in waist hip ratio.

Table 4.25.The hierarchical regression models: Waist hip ratio (WHR)

	Unstandardized coefficients: regression coefficient B			
Predictors	Step 1	Step 2	Step 3	Step 4
Education[a]	.008	.008	.008	.01
Sex[b]		.000	.001	.002
Age[c]			.002	.002*
Group[d]				.026***
R^2	.013	.013	.037	.107***
R^2 *change*	.013	.000	.023	.070***
Adjusted R^2	.010	.006	.026	.093***

[a]0 = < 5 years, 1 = 5 to 9 years, 2 = 10 to 12 years, 3 = > 12 years; [b]0 = male, 1 = female; [c]60 to 79 years; [d]0 = Tai Chi, 1 = Control; *p < 0.05, **p < 0.01, ***p < 0.001; *(Education df=1.257; Sex df=1.256; Age df=1.255; Group df=1.254)*

Table 4.26. The hierarchical regression models: Systole blood pressure (SBP)

	Unstandardized coefficients: regression coefficient B			
Predictors	Step 1	Step 2	Step 3	Step 4
Education[a]	.084	.065	.032	.861
Sex[b]		-.174	.001	.138
Age[c]			.285*	.308**
Group[d]				7.38***
R^2	.000	.000	.026	.192***
R^2 *change*	.000	.000	.026	.166***
Adjusted R^2	-.004	-.008	.014	.197***

*[a]0 = < 5 years, 1 = 5 to 9 years, 2 = 10 to 12 years, 3 = > 12 years; [b]0 = male, 1 = female; [c]60 to 79 years; [d]0 = Tai Chi, 1 = Control; *p < 0.05, **p < 0.01, ***p < 0.001; (Education df=1.257; Sex df=1.256; Age df=1.255; Group df=1.254)*

Education and sex are not predictors and show no connection in this sector (table 4.26). While *age* and *group* are predictors, step 3 introduce *age* as a predictor, which

shows that younger participants have better results than older ones for systole blood pressure (B = .29; p < .05; adjusted R^2 = .014) which account for 1.4% of variance in systole blood pressure. Step 4 is added in which *group* proved as a strongest predictor for systole blood pressure between the Tai Chi and the Control groups (B = 7.40; p < .001; R^2 = .17; adjusted R^2 = .197) which explaining for 19.7 % of variance in systole blood pressure for *group*.

Table 4.27. The hierarchical regression models: Diastole blood pressure (DBP)

	Unstandardized coefficients: regression coefficient B			
Predictors	Step 1	Step 2	Step 3	Step 4
Education[a]	.289	.115	.096	.118
Sex[b]		-1.59*	-1.49*	-1.49*
Age[c]			.159	.159
Group[d]				.146
R^2	.002	.027	.053**	.054
R^2 *change*	.002	.025	.026**	.001
Adjusted R^2	-.002	.019	.042**	.039

*[a]0 = < 5 years, 1 = 5 to 9 years, 2 = 10 to 12 years, 3 = > 12 years; [b]0 = male, 1 = female; [c]60 to 79 years; [d]0 = Tai Chi, 1 = Control; *p < 0.05, **p < 0.01, ***p < 0.001; (Education df=1.257; Sex df=1.256; Age df=1.255; Group df=1.254)*

Regarding diastole blood pressure, regression analyses show that only *sex* is a predictor, while *education*, *age* and *group* are not predictors in this sector (table 4.27). Step 2 gives significant results for sex (B = -1.59; p < .05) explaining 1.9% of variance in diastole blood pressure. That means diastole blood pressure of men is higher than that of women.

Table 4.28. The hierarchical regression models: Pulse

	Unstandardized coefficients: regression coefficient B			
Predictors	Step 1	Step 2	Step 3	Step 4
Education[a]	-.570	-.504	-.520	-.399
Sex[b]		.610	.696	.722
Age[c]			.141*	.145*
Group[d]				1.374*
R^2	.007	.011	.030*	.050*
R^2 *change*	.007	.004	.020*	.019*
Adjusted R^2	.003	.003	.020*	.035*

*[a]0 = < 5 years, 1 = 5 to 9 years, 2 = 10 to 12 years, 3 = > 12 years; [b]0 = male, 1 = female; [c]60 to 79 years; [d]0 = Tai Chi, 1 = Control; *p < 0.05, **p < 0.01, ***p < 0.001; (Education df=1.257; Sex df=1.256; Age df=1.255; Group df=1.254)*

There is no connection between *education* and *sex* and dependent variable (pulse) in this sector (table 4.28). While *age* and *group* are predictors, step 3 introduces *age* as a predictor, which shows that younger participants have better results than older ones for pulse (B = .41; p < .05; adjusted R^2 = .02) which account for 2% of variance in pulse. Step 4 is added in which *group* proved as a strongest predictor for pulse between Tai Chi and Control groups (B = 1.37; p < .05; R^2 = .05; adjusted R^2 = .035) which explains 3.5% of variance in pulse for *group.*

Table 4.29. The hierarchical regression models: Lower strength

	Unstandardized coefficients: regression coefficient B			
Predictors	Step 1	Step 2	Step 3	Step 4
Education[a]	.286	.003	.014	.-176
Sex[b]		-2.58***	-2.66***	-2.69***
Age[c]			-.104**	-.111***
Group[d]				-2.35***
R^2	.005	.191***	.222**	.378***
R^2 *change*	.005	.186***	.031**	.156***
Adjusted R^2	.001	.185***	.213**	.369***

*[a]0 = < 5 years, 1 = 5 to 9 years, 2 = 10 to 12 years, 3 = > 12 years; [b]0 = male, 1 = female; [c]60 to 79 years; [d]0 = Tai Chi, 1 = Control; *p < 0.05, **p < 0.01, ***p < 0.001; (Education df=1.257; Sex df=1.256; Age df=1.255; Group df=1.254)*

Education is not a predictor for dependent variable (lower strength and upper strength) in this sector (table 4.29 and table 4.30). While *sex, age* and *group* are predictors, step 2 introduces *sex* as a predictor, which shows that men participants have better results than women for lower strength (B = -2.58; $p < .001$; adjusted $R^2 = .185$) which accounts for 18.5% of the variance in lower strength. And for upper strength (B = -1.04; $p < .01$; adjusted $R^2 = .03$) which account for 3% of the variance in upper strength. Step 3 introduces *age* as a predictor, which shows that younger participants have a better level than older ones in lower strength (B = -.1; $p < .01$; adjusted $R^2 = .213$) account for 21.3% of the variance for lower strength and in upper strength younger participants also have a better level than older ones (B = -.16; $p < .001$; adjusted $R^2 = .109$) account for 10.9% of the variance for upper strength. Step 4 is added in which *group* proved as a predictor for lower strength between Tai Chi and Control groups (B = -2.35; $p < .001$; $R^2 = .156$; adjusted $R^2 = .369$) which explains 36.9% of variance in lower strength for *group* and for upper strength between the Tai Chi and the Control groups (B = -2.37; $p < .001$; $R^2 = .167$; adjusted $R^2 = .276$) which explaining for 27.6% of variance in lower strength for *group*.

Table 4.30. The hierarchical regression models: Upper strength

	Unstandardized coefficients: regression coefficient B			
Predictors	Step 1	Step 2	Step 3	Step 4
Education[a]	.303	.189	.208	.000
Sex[b]		-1.04**	-1.14**	-1.18***
Age[c]			-.163***	-.171***
Group[d]				-2.37***
R^2	.006	.038**	.120***	.287***
R^2 change	.006	.032**	.082***	.167***
Adjusted R^2	.002	.030**	.109***	.276***

*[a]0 = < 5 years, 1 = 5 to 9 years, 2 = 10 to 12 years, 3 = > 12 years; [b]0 = male, 1 = female; [c]60 to 79 years; [d]0 = Tai Chi, 1 = Control; *p < 0.05, **p < 0.01, ***p < 0.001; (Education df=1.257; Sex df=1.256; Age df=1.255; Group df=1.254)*

Table 4.31. Hierarchical regression models: Lower flexibility

	Unstandardized coefficients: regression coefficient B			
Predictors	Step 1	Step 2	Step 3	Step 4
Education[a]	-1.48**	-1.15**	-1.09**	-1.36***
Sex[b]		3.03***	2.76***	2.70***
Age[c]			-.437***	-.446***
Group[d]				-3.02***
R^2	.043**	.126***	.307***	.390***
R^2 change	.043**	.083***	.180***	.083***
Adjusted R^2	.040**	.119***	.299***	.381***

*[a]0 = < 5 years, 1 = 5 to 9 years, 2 = 10 to 12 years, 3 = > 12 years; [b]0 = male, 1 = female; [c]60 to 79 years; [d]0 = Tai Chi, 1 = Control; *p < 0.05, **p < 0.01, ***p < 0.001; (Education df=1.257; Sex df=1.256; Age df=1.255; Group df=1.254)*

The lower flexibility regression models show that *education*, *sex*, *age* and *group* are all predictors for dependent variable (lower flexibility) (table 4.31). Step 2 introduces *sex* as a predictor, which shows that men participants have better levels than women for lower flexibility (B = 3.03; p < .001; adjusted R^2 = .119) which account for 11.9 % of the variance in lower flexibility. Step 3 introduces *age* as a predictor, which shows that younger participants have a better a level than older ones in lower flexibility (B = -.437; p < .001; adjusted R^2 = .229) account for 22.9% of the variance for lower flexibility. Step 4 is added in which *group* proved as a prominent predictor for lower flexibility between the Tai Chi and the Control groups (B = -3.02; p < .001; R^2 = .390; adjusted R^2 = .381) which explains 38.1% of variance in lower flexibility for *group*.

Table 4.32. Hierarchical regression models: Upper flexibility

	Unstandardized coefficients: regression coefficient B			
Predictors	Step 1	Step 2	Step 3	Step 4
Education[a]	-.237	-.188	-.147	-.375
Sex[b]		.446	.233	.185
Age[c]			-.348***	-.357***
Group[d]				-2.59***
R^2	.002	.004	.165***	.252***
R^2 change	.002	.003	.161***	.087***
Adjusted R^2	-.002	-.004	.155***	.240***

*[a]0 = < 5 years, 1 = 5 to 9 years, 2 = 10 to 12 years, 3 = > 12 years; [b]0 = male, 1 = female; [c]60 to 79 years; [d]0 = Tai Chi, 1 = Control; *p < 0.05, **p < 0.01, ***p < 0.001; (Education df=1.257; Sex df=1.256; Age df=1.255; Group df=1.254)*

Regression models show that education and *sex are* not predictors for dependent variable (upper flexibility). Whereas, age and *group* are predictors, step 3 introduces *age* as a predictor (table 4.32), which shows that younger participants have a better level than older ones in upper flexibility (B = .348; p < .001; adjusted R^2 = .155) accounting for 15.5% of the variance for upper flexibility. Step 4 is added in which *group* proved as a prominent predictor for upper flexibility between the Tai Chi and the Control groups (B = -2.59; p < .001; R^2 = .252; adjusted R^2 = .240) which explains for 24% of variance in upper flexibility for *group*.

Aerobic fitness is highly dependent on *age* (B = -.340; p < .001) and *group* (B = -5.48; p < .001) (table 4.33). Adjusted R^2 = .092, which explains 9.2% of variance for *age* of step 3 and adjusted R^2 = .224 of step 4 accounts for 22.4% of variance for *group*.

Table 4.33. The hierarchical regression models: Aerobic fitness (2 minute step)

	Unstandardized coefficients: regression coefficient B			
Predictors	Step 1	Step 2	Step 3	Step 4
Education[a]	-2.23***	-2.30***	-2.26***	-2.74***
Sex[b]		-.600	-.809	-.911
Age[c]			-.340***	-.358***
Group[d]				-5.48***
R^2	.048***	.050	.103***	.236***
R^2 *change*	.048***	.002	.053***	.134***
Adjusted R^2	.044***	.042	.092***	.224***

*[a]0 = < 5 years, 1 = 5 to 9 years, 2 = 10 to 12 years, 3 = > 12 years; [b]0 = male, 1 = female; [c]60 to 79 years; [d]0 = Tai Chi, 1 = Control; *p < 0.05, **p < 0.01, ***p < 0.001; (Education df=1.257; Sex df=1.256; Age df=1.255; Group df=1.254)*

Table 4.34. The hierarchical regression models: Dynamic balance (8foot up and go)

	Unstandardized coefficients: regression coefficient B			
Predictors	Step 1	Step 2	Step 3	Step 4
Education[a]	.069	.068	.060	.126
Sex[b]		-.007	.034	.048
Age[c]			.067**	.070***
Group[d]				.757***
R^2	.004	.004	.116***	.365***
R^2 *change*	.004	.000	.163***	.198***
Adjusted R^2	.000	-.004	.157***	.355***

*[a]0 = < 5 years, 1 = 5 to 9 years, 2 = 10 to 12 years, 3 = > 12 years; [b]0 = male, 1 = female; [c]60 to 79 years; [d]0 = Tai Chi, 1 = Control; *p < 0.05, **p < 0.01, ***p < 0.001; (Education df=1.257; Sex df=1.256; Age df=1.255; Group df=1.254)*

The regression models show that education and *sex* are not predictors for dependent variable (dynamic balance). Whereas, *age* and *group* are predictors, step 3 introduces *age* as a predictor (table 4.34), which shows that younger participants have a better level than older ones in dynamic balance (B = .067; p < .01; adjusted R^2 = .157) account for 15.7% of

the variance for dynamic balance. Step 4 is added in which *group* proved as a prominent predictor for dynamic balance between the Tai Chi and the Control groups (B = .757; $p < .001$; $R^2 = .365$; adjusted $R^2 = .355$) which explains 35.5% of variance in dynamic balance for *group*. *Group* functions as a stable predictor for dynamic balance.

There is only *group* is considered as a prominent predictor in this sector. Regression models show that *education, sex* and *age* are all not predictors for dependent variable (physical component) (table 4.35). Step 4 is added and gives higher significant results for *group* (B = -18.81; $p < .001$; $R^2 = .116$; adjusted $R^2 = .153$) which explains 15.3% of variance in physical component for *group*. This means that the participants in the Tai Chi group show a better level in physical component than those in the Control group.

Table 4.35. The hierarchical regression models: Physical component summary

	Unstandardized coefficients: regression coefficient B			
Predictors	Step 1	Step 2	Step 3	Step 4
Education[a]	.090	-.307	-.349	-2.00
Sex[b]		-3.63	-3.42	-3.76
Age[c]			.353	.293
Group[d]				-18.81***
R^2	.000	.006	.011	.116***
R^2 change	.000	.006	.006	.155***
Adjusted R^2	-.004	-.002	.000	.153***

*[a]0 = < 5 years, 1 = 5 to 9 years, 2 = 10 to 12 years, 3 = > 12 years; [b]0 = male, 1 = female; [c]60 to 79 years; [d]0 = Tai Chi, 1 = Control; *p < 0.05, **p < 0.01, ***p < 0.001; (Education df=1.257; Sex df=1.256; Age df=1.255; Group df=1.254)*

Similarity to physical component sector, *group* is the only one predictor for dependent variable (mental component) (table 4.36). The fourth step gives a highly significant level for *group* (B = -14.45; $p < .001$; $R^2 = .146$; adjusted $R^2 = .133$) accounting for 13.3% of variance in mental component.

Table 4.36. The hierarchical regression models: Mental Component Summary

	Unstandardized coefficients: regression coefficient B			
Predictors	Step 1	Step 2	Step 3	Step 4
Education[a]	-.420	-.884	-.900	-2.17
Sex[b]		-4.24	-4.16	-4.43
Age[c]			.136	.090
Group[d]				-14.45***
R^2	.000	.012	.013	.146***
R^2 *change*	.000	.011	.001	.133***
Adjusted R^2	-.004	.004	.001	.133***

*[a]0 = < 5 years, 1 = 5 to 9 years, 2 = 10 to 12 years, 3 = > 12 years; [b]0 = male, 1 = female; [c]60 to 79 years; [d]0 = Tai Chi, 1 = Control; *p < 0.05, **p < 0.01, ***p < 0.001; (Education df=1.257; Sex df=1.256; Age df=1.255; Group df=1.254)*

Group is considered as a prominent predictor in this sector. Regression models show that *education, sex* and *age* are not predictors for dependent variable (physical component) (table 4.37). General health component is dependent highly on *group* (B = -18.19; p < .001; R^2 = .161; adjusted R^2 = .148) which explains 18.8% of variance in physical component for *group*.

Table 4.37. The hierarchical regression models: General health component summary

	Unstandardized coefficients: regression coefficient B			
Predictors	Step 1	Step 2	Step 3	Step 4
Education[a]	-.055	-.498	-.527	-2.12
Sex[b]		-4.05	-3.90	-4.24
Age[c]			.245	.187
Group[d]				-18.19***
R^2	.000	.007	.010	.161***
R^2 *change*	.000	,007	.003	.151***
Adjusted R^2	-.004	.000	-.001	.148***

*[a]0 = < 5 years, 1 = 5 to 9 years, 2 = 10 to 12 years, 3 = > 12 years; [b]0 = male, 1 = female; [c]60 to 79 years; [d]0 = Tai Chi, 1 = Control; *p < 0.05, **p < 0.01, ***p < 0.001; (Education df=1.257; Sex df=1.256; Age df=1.255; Group df=1.254)*

Results in sleep quality did not show significant values for most of the selected predictors (table 4.38). Only *group* shows significance (B = 1.501; $p < .05$). Adjusted R^2 = .025 proves the *group* as a predictor for sleep quality and accounts for 2.5% of variance in sleep quality for *group*.

Table 4.38. The hierarchical regression models: Sleep quality

	Unstandardized coefficients: regression coefficient B			
Predictors	Step 1	Step 2	Step 3	Step 4
Education[a]	-.334	-.391	-.390	-.258
Sex[b]		-.524	-.530	-.503
Age[c]			-.011	-.006
Group[d]				1.501*
R^2	.003	.007	.008	.040*
R^2 *change*	.003	.004	.000	.032*
Adjusted R^2	.000	.000	-.004	.025*

*[a]0 = < 5 years, 1 = 5 to 9 years, 2 = 10 to 12 years, 3 = > 12 years; [b]0 = male, 1 = female; [c]60 to 79 years; [d]0 = Tai Chi, 1 = Control; *p < 0.05, **p < 0.01, ***p < 0.001; (Education df=1.257; Sex df=1.256; Age df=1.255; Group df=1.254)*

Table 4.39. The hierarchical regression models: Cognitive performance (A)

Part A

	Unstandardized coefficients: regression coefficient B			
Predictors	Step 1	Step 2	Step 3	Step 4
Education[a]	-.405	-.424	-.498	-.039
Sex[b]		-.178	.202	.637
Age[c]			.620***	.637***
Group[d]				5.21***
R^2	.002	.002	.222***	.372***
R^2 *change*	.002	.000	.220***	.150***
Adjusted R^2	-.002	-.006	.213***	.362***

*[a]0 = < 5 years, 1 = 5 to 9 years, 2 = 10 to 12 years, 3 = > 12 years; [b]0 = male, 1 = female; [c]60 to 79 years; [d]0 = Tai Chi, 1 = Control; *p < 0.05, **p < 0.01, ***p < 0.001; (Education df=1.257; Sex df=1.256; Age df=1.255; Group df=1.254)*

Table 4.40. The hierarchical regression models: Cognitive performance (B)

Part B

	Unstandardized coefficients: regression coefficient B			
Predictors	Step 1	Step 2	Step 3	Step 4
Education[a]	-1.04	-.907	-.987	-.085
Sex[b]		1.28	1.69	1.88
Age[c]			.697***	.712***
Group[d]				10.25***
R^2	.007	.011	.142***	.431***
R^2 *change*	.007	.004	.131***	.289***
Adjusted R^2	.003	.003	.132***	.422***

*[a]0 = < 5 years, 1 = 5 to 9 years, 2 = 10 to 12 years, 3 = > 12 years; [b]0 = male, 1 = female; [c]60 to 79 years; [d]0 = Tai Chi, 1 = Control; *p < 0.05, **p < 0.01, ***p < 0.001; (Education df=1.257; Sex df=1.256; Age df=1.255; Group df=1.254)*

Age and *group* are predictors for dependent variable (cognitive performance) (table 4.39 and table 4.40). In part A, step 3 gives highly significant results for *age* (B = .620; p < .001; adjusted R^2 = .213) accounts for 21.3% of variance in *age*. Step 4 also shows highly significant results for *group* (B = .521; p < .001; adjusted R^2 = .362) explains for 36.2% of variance in cognitive performance for *group*. In part B, step 3 gives highly significant results for *age* (B = .697; p < .001; adjusted R^2 = .132) accounts for 13.2% of variance in *age*. Step 4 shows highly significant results for *group* (B = .10.25; p < .001; adjusted R^2 = .422) explains for 42.2% of variance in cognitive performance for *group*.

Results in valuation of life did not show significant values for most of selected predictors (table 4.41). Only *group* showed significance (B = -6.19; p < .001). Adjusted R^2 = .192 proves the *group* as a predictor for valuation of life and accounts for 19.2% of variance in valuation of life for *group*.

Table 4.41. The hierarchical regression models: Valuation of life

	Unstandardized coefficients: regression coefficient B			
Predictors	Step 1	Step 2	Step 3	Step 4
Education[a]	.479	.426	.440	-.104
Sex[b]		-.478	-.559	-.674
Age[c]			-.118	-.138
Group[d]				-6.19***
R^2	.003	.004	.011	.204***
R^2 *change*	.003	.001	.007	.193***
Adjusted R^2	-.001	-.004	.000	.192***

*[a]0 = < 5 years, 1 = 5 to 9 years, 2 = 10 to 12 years, 3 = > 12 years; [b]0 = male, 1 = female; [c]60 to 79 years; [d]0 = Tai Chi, 1 = Control; *p < 0.05, **p < 0.01, ***p < 0.001; (Education df=1.257; Sex df=1.256; Age df=1.255; Group df=1.254)*

Similarity to sleep quality, only *group* shows connection to balance ability (table 4.42) with significant results (B = 7.41; p < .001; adjusted R^2 = .122) proves the *group* as a predictor for valuation of life and accounts for 19.2% of variance in balance ability for *group*.

Table 4.42. Hierarchical regression models: Balance ability

	Unstandardized coefficients: regression coefficient B			
Predictors	Step 1	Step 2	Step 3	Step 4
Education[a]	-.330	-.432	-.420	.232
Sex[b]		-.943	-1.01	-.837
Age[c]			-.109	-.085
Group[d]				7.41***
R^2	.001	.003	.006	.135
R^2 *change*	.001	.002	.003	.130
Adjusted R^2	-.003	-.005	-.006	.122

*[a]0 = < 5 years, 1 = 5 to 9 years, 2 = 10 to 12 years, 3 = > 12 years; [b]0 = male, 1 = female; [c]60 to 79 years; [d]0 = Tai Chi, 1 = Control; *p < 0.05, **p < 0.01, ***p < 0.001; (Education df=1.257; Sex df=1.256; Age df=1.255; Group df=1.254)*

4.8 Within the group comparison of the Tai Chi exercise at end-point and follow-up

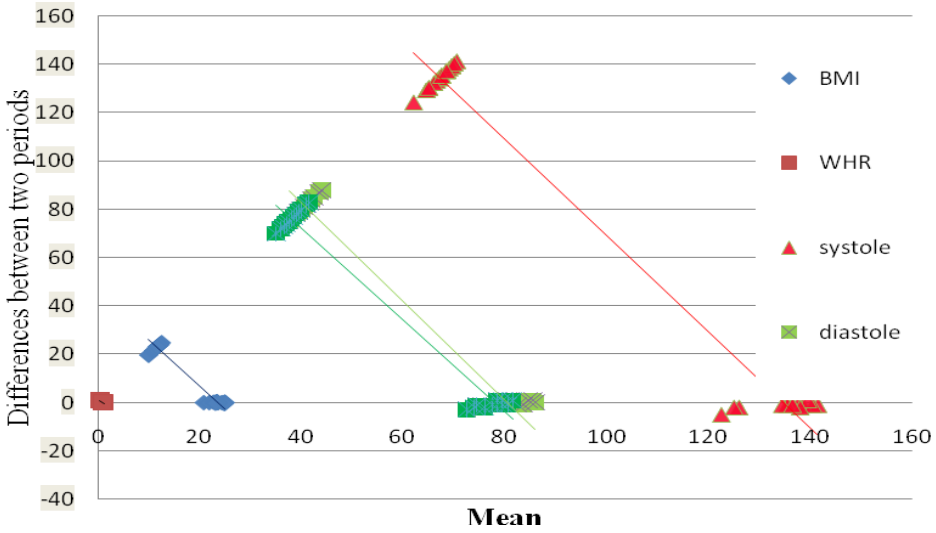
Results of table 4.43 showed that there are no significant differences in correlation between the variables of the two periods of test (Endtest and Follow up) in the Tai Chi group. With sig. = 1.73 (p >.05) for BMI; similarity to the rest of all variables: WHR (sig. = 1.24, p > .05); systole (sig. = 3.97, p > .05); diastole (sig. = 5.41, p > .05); pulse (sig. = 1.39, p > .05); chair stand (sig. = 3.40, p > .05); arm curl (sig. = 1.38, p > .05); 2mintute step (sig. = 2,41, p > .05); chair sit reach (sig. = .60, p > .05); back scratch (sig. = .13, p > .05); 8foot up and go (sig. = 3.46, p > .05); PCS (sig. = 1.49, p > .05); MCS (sig. = 3.75, p > .05); SF36 total (sig. = 4.41, p > .05); respectively.

Table 4.43. Comparisons of variables between Endtest and Follow up of Tai Chi group

Dependent variables	Endtest (n=39)	Follow-up (n=14)	Difference	R[a]	Sig.
	Mean (SD)	Mean (SD)			
BMI(kg/m2)	23.22 (1.24)	23.40 (1.24)	-0.18	.97	1.73
WHR (cm)	.91 (.05)	.93 (.06)	-0.02	.97	1.24
Systole(mmHg)	134.51 (4.96)	135.50 (5.50)	-0.99	.98	3.97
Diastole(mmHg)	80.95 (3.63)	80.21 (3.76)	0.74	.98	5.41
Pulse (bpm)	76.72 (3.23)	78.29 (2.33)	-1.57	.98	1.39
Chair stand (stands)	20.26 (2.39)	20.14 (2.24)	0.12	.89	3.40
Arm curl (times)	20.69 (2.46)	20.00 (1.96)	0.69	.88	1.38
2 minute step(steps)	91.62 (6.28)	91.14 (7.22)	0.48	.96	2.41
Chair sit reach (cm)	3.67 (3.23)	4.07 (3.95)	-0.4	.08	.60
Back scratch (cm)	3.10 (2.68)	2.64 (3.00)	0.46	.05	.13
8foot up and go (s)	6.11 (.71)	6.08 (.64)	0.03	.89	3.46
PCS (scale)	80.31 (6.85)	81.07 (5.78)	-0.67	.95	1.49
MCS (scale)	76.36 (5.76)	77.43 (4.45)	-1.07	.96	3.75
SF36 total (scale)	80.18 (6.56)	81.36 (5.19)	-1.18	.96	4.41

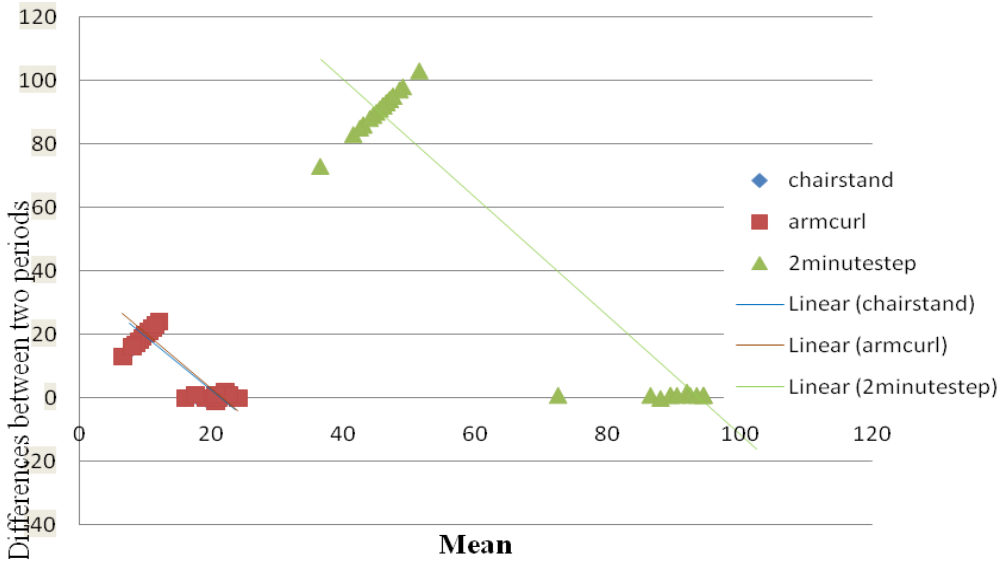
[a]. Determined by Pearson regression; BMI = Body Mass Index; WHR = Waist Hip Ratio; PCS = Physical Component Summary; MC S= Mental Component Summary; SF36=Short Form 36; bpm = beat per minute.

Figure 4.6. The differences between endtest and follow up periods for BMI, WHR and blood pressure of Tai Chi group



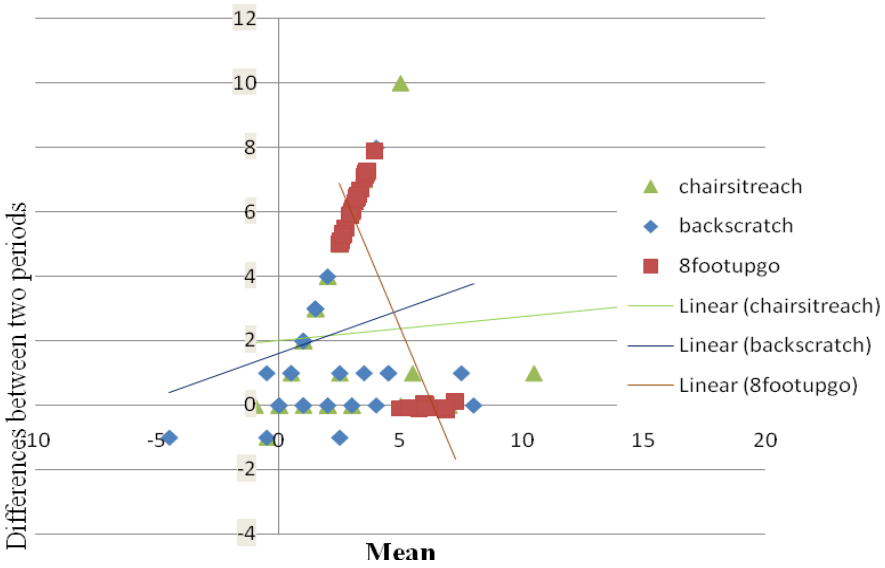
Bland-Altman plots of data (figure 4.6) obtained from paired samples analysed on the endtest and follow up periods. For BMI: Correlation R = .97 (p > .05), slope = -.05 (p > .05), intercept = 23.31 (p > .05); WHR: R = .97 (p > .05), slope = -.53 (p > .05), intercept = .93 (p > .05); systole: R = .98 (p > .05), slope = -.49 (p > .05), intercept = 113.9 (p > .05); diastole: R = .98 (p > .05), slope = -.47 (p > .05), intercept = 79.70 (p > .05); pulse: R = .98 (p > .05), slope = -.51 (p > .05), intercept = 77.24 (p > .05)

Figure 4.7. The differences between endtest and follow up periods for lower-upper strength and aerobic fitness of Tai Chi group



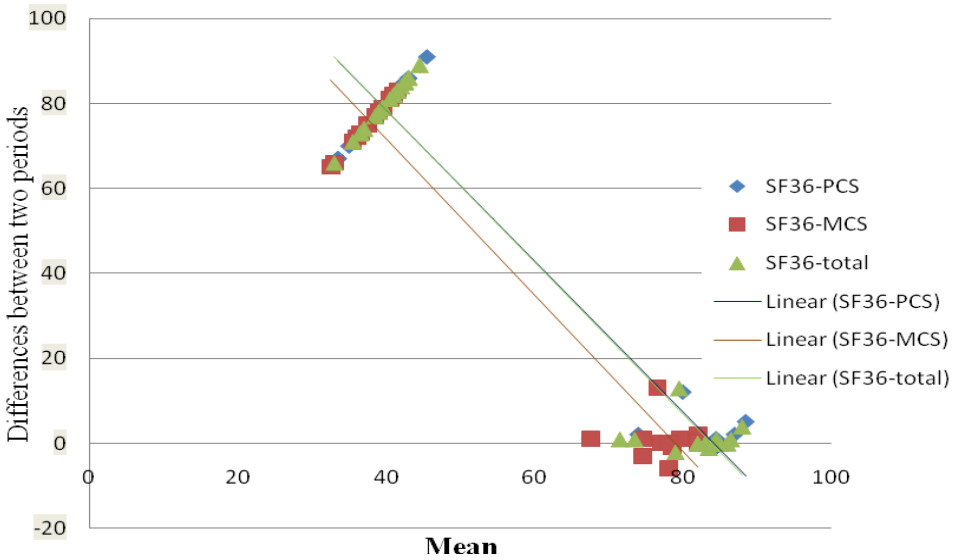
Bland-Altman plots of data (figure 4.7) obtained from paired samples analysed on the endtest and follow up periods. For chair stand: R = .89 (p > .05), slope = -.46 (p > .05), intercept = 19.81 (p > .05); arm curl: R = .88 (p > .05), slope = -.44 (p > .05), intercept = 19.93 (p > .05); 2minute step: R = .96 (p > .05), slope = -.49 (p > .05), intercept = 19.49 (p > .05)

Figure 4.8. The differences between endtest and follow up periods for lower-upper flexibility and dynamic balance of Tai Chi group



Bland-Altman plots of data (figure 4.8) obtained from paired samples analysed on the endtest and follow up periods. For chair sit reach: R = .085 (p > .05), slope = .09 (p > .05), intercept = 2.34 (p > .05); back scratch: R = .059 (p > .05), slope = .21 (p > .05), intercept = 1.55(p > .05); 8foot up go: R = .89 (p > .05), slope = -.44 (p > .05), intercept=5.87

Figure 4.9. The differences between endtest and follow up periods for SF36 (PCS, MCS and SF36 total of Tai Chi group



Bland-Altman plots of data (figure 4.9) obtained from paired samples analysed on the endtest and follow up periods. For PCS: R = .95 (p > .05),slope = -.51 (p > .05),intercept = 81.70; MCS: R = .09 (p > .05), slope = -.51 (p > .05), intercept = 77.39 (p > .05); SF36 total: R = .96 (p > .05), slope = -.51 (p > .05), intercept = 81.89 (p > .05)

4.9 Differences of means among the Tai Chi, the Control and the Drop out

Table 4.44. One-way Anova among three groups

Variables	SS	df	MS	F	Sig.
BMI	41.712	2.281	20.856	15.751	.000
WHR	.043	2.281	.021	9.631	.000
systole(mmHg)	3440.355	2.281	1720.178	23.834	.000
diastole(mmHg)	2.858	2.281	1.429	.056	.946
pulse(beat/minute)	176.421	2.281	88.211	3.691	.026
chair stand (times)	308.227	2.281	154.113	19.695	.000
arm curl (times)	379.792	2.281	189.896	26.025	.000
2 minute step (times)	1540.772	2.281	770.386	15.194	.000
chair sit and reach (cm)	624.760	2.281	312.380	11.483	.000
back scratch (cm)	383.330	2.281	191.665	10.645	.000
8 foot up and go(s)	37.250	2.281	18.625	30.813	.000
PCS	26653.414	2.281	13326.707	28.022	.000
MCS	15754.721	2.281	7877.360	23.728	.000
SF36total	24872.726	2.281	12436.363	27.229	.000
FES	4193.732	2.281	2096.866	24.020	.000
VOL	2446.617	2.281	1223.308	30.352	.000
TMT part a	2030.370	2.281	1015.185	26.165	.000
TMT part b	7416.555	2.281	3708.277	55.801	.000
PSQI	196.602	2.281	98.301	5.768	.004

Notes: *BMI = Body Mass Index; WHR = Waist Hip Ratio; PCS = Physical Component Summary; MC S = Mental Component Summary; SF36 = Short Form 36; FES = the Falls Efficacy Scale; VOL = Valuation of Life; TMT = Trail Making Test; PSQI = Pittsburgh Sleep Quality Index.*

The results of One-way Anova indicates that there is significant difference in all dependent variables ($p < .001$), pulse and PSQI ($p < .05$), except for diastole blood pressure (sig. = .946) (table 4.44). This means that the means among the three research groups are almost significantly different. The Tai Chi group shows significantly better results than the Control and the Drop out groups.

Table 4.45. One-way Anova Post hoc

Dependent Variable	(I) groups	(J) groups	Mean Difference (I-J)	Std. Error	Sig.
BMI	Tai Chi	Control	-.78117*	.14303	.000
		Drop out	-.69473*	.25099	.006
	Control	Drop out	.08643	.25177	.732
WHR	Tai Chi	Control	-.02398*	.00587	.000
		Drop out	-.02763*	.01030	.008
	Control	Drop out	-.00365	.01033	.724
systole(mmHg)	Tai Chi	Control	-7.155*	1.056	.000
		Drop out	-5.868*	1.853	.002
	Control	Drop out	1.287	1.859	.489
diastole(mmHg)	Tai Chi	Control	-.163	.630	.796
		Drop out	-.304	1.106	.784
	Control	Drop out	-.141	1.110	.899
pulse(beat/minute)	Tai Chi	Control	-1.400*	.608	.022
		Drop out	-2.161*	1.066	.044
	Control	Drop out	-.761	1.070	.477

**. The mean difference is significant at the 0.05 level.*

Regarding the BMI, WHR and blood pressure, the results of Post-hoc show that the difference of mean is highly significant between the Tai Chi and the Drop out groups at significant level ($p < .05$) (table 4.45), except for diastole ($p > .05$). There is no significant difference between the Control and the Drop out for all variables ($p > .05$). This means that the Tai Chi group shows significantly better results than Control and Drop out groups.

Results of Post-hoc show that the difference of mean is highly significant between the Tai Chi and the Drop out groups at significant level ($p < .05$) (table 4.46), except for 2 minute step test (sig. = .304). There is no significant difference between the Control and the Drop out for all variables ($p > .05$).

Table 4.46. One-way Anova Post hoc

Dependent Variable	(I) groups	(J) groups	Mean Difference (I-J)	Std. Error	Sig.
chair stand (times)	Tai Chi	Control	2.144*	.348	.000
		Drop out	1.733*	.610	.005
	Control	Drop out	-.411	.612	.502
arm curl (times)	Tai Chi	Control	2.320*	.336	.000
		Drop out	2.311*	.589	.000
	Control	Drop out	-.009	.591	.988
2 minutestep (times)	Tai Chi	Control	4.857*	.885	.000
		Drop out	1.598	1.553	.304
	Control	Drop out	-3.259*	1.558	.037
chair sit reach (cm)	Tai Chi	Control	2.604*	.648	.000
		Drop out	4.132*	1.138	.000
	Control	Drop out	1.527	1.141	.182
back scratch (cm)	Tai Chi	Control	2.404*	.527	.000
		Drop out	1.815	.926	.051
	Control	Drop out	-.589	.928	.526
8 foot up go(s)	Tai Chi	Control	-.70987*	.09664	.000
		Drop out	-.79887*	.16958	.000
	Control	Drop out	-.08900	.17011	.601

*. *The mean difference is significant at the 0.05 level.*

The results of Post-hoc show that the difference of mean is highly significant between the Tai Chi and the Drop out groups at a significant level ($p < .05$) (table 4.47). There is no significant difference between the Control and the Drop out for all variables ($p > .05$). The Tai Chi group shows significantly better results than the Control and the Drop out groups.

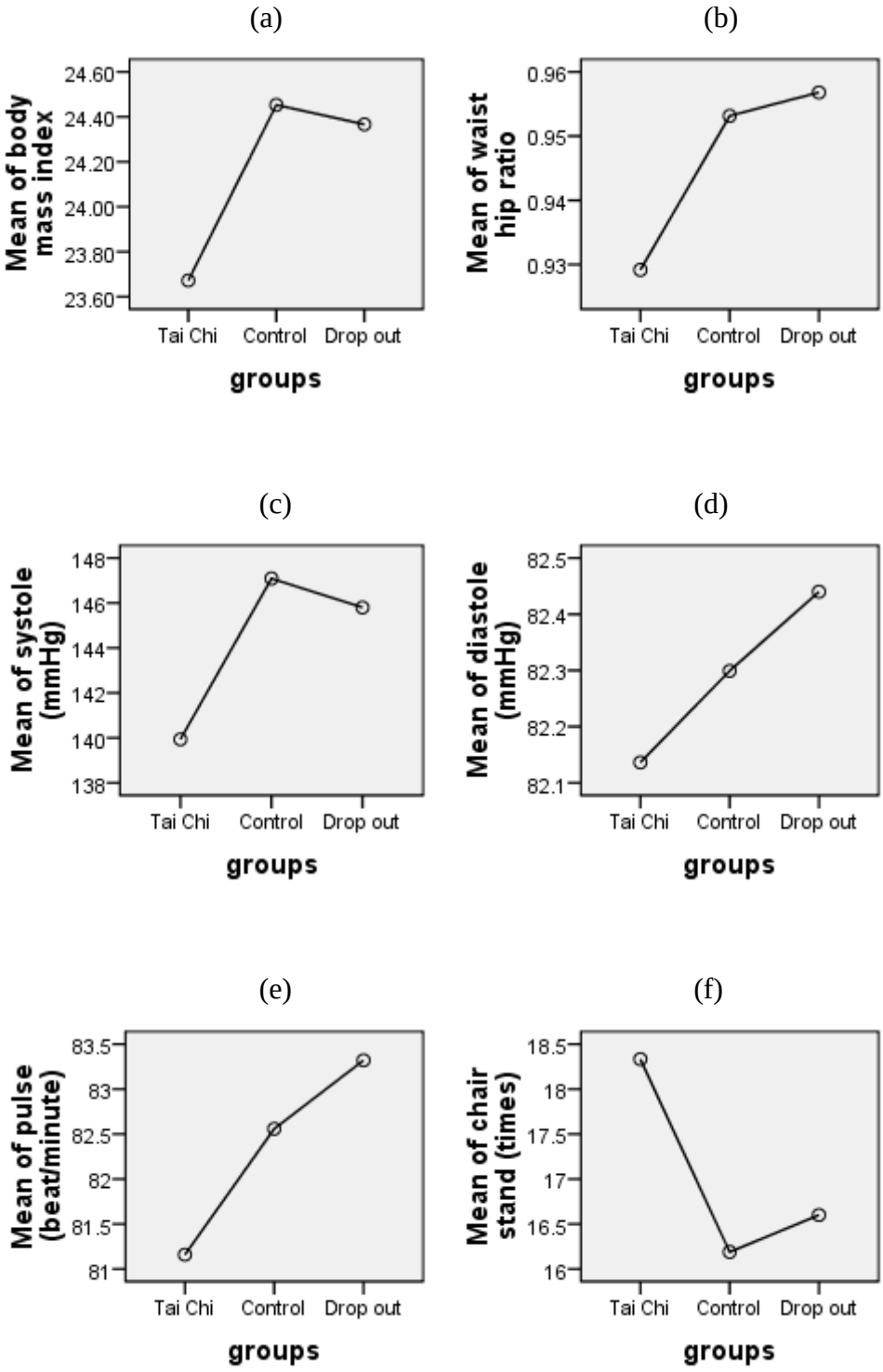
Table 4.47. One-way Anova Post hoc

Dependent Variable	(I) groups	(J) groups	Mean Difference (I-J)	Std. Error	Sig.
PCS	Tai Chi	Control	18.564*	2.711	.000
		Drop out	22.911*	4.757	.000
	Control	Drop out	4.347	4.772	.363
MCS	Tai Chi	Control	14.102*	2.265	.000
		Drop out	18.158*	3.974	.000
	Control	Drop out	4.056	3.987	.310
SF36total	Tai Chi	Control	17.885*	2.656	.000
		Drop out	22.293*	4.661	.000
	Control	Drop out	4.409	4.676	.347
FES	Tai Chi	Control	-7.398*	1.161	.000
		Drop out	-8.972*	2.038	.000
	Control	Drop out	-1.574	2.044	.442
VOL	Tai Chi	Control	6.126*	.789	.000
		Drop out	3.891*	1.385	.005
	Control	Drop out	-2.235	1.389	.109
TMT part a	Tai Chi	Control	-5.00072*	.77424	.000
		Drop out	-6.70182*	1.35865	.000
	Control	Drop out	-1.70110	1.36290	.213
TMT part b	Tai Chi	Control	-10.03090*	1.01327	.000
		Drop out	-11.21515*	1.77811	.000
	Control	Drop out	-1.18425	1.78367	.507
PSQI	Tai Chi	Control	-1.54856*	.51312	.003
		Drop out	-2.10667*	.90043	.020
	Control	Drop out	-.55811	.90325	.537

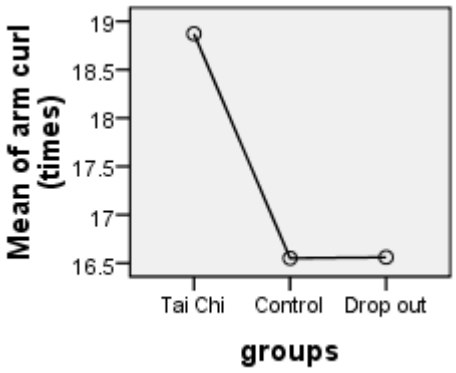
**. The mean difference is significant at the 0.05 level.*

PCS = Physical component summary; MCS = Mental component summary; SF36total = Short form 36; FES = the Falls efficacy scale; VOL = Valuation of life; TMT = Trail making test; PSQI = Pittsburgh sleep quality index.

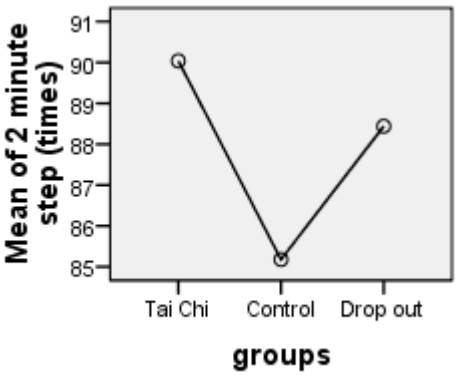
Figure 4.10. Mean of dependent variables



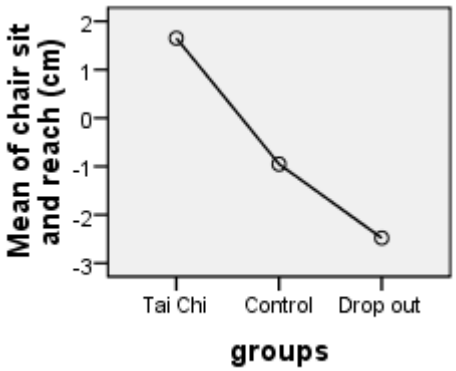
(g)


Mean of arm curl (times)
19
18.5
18
17.5
17
16.5
Tai Chi
Control
Drop out
groups

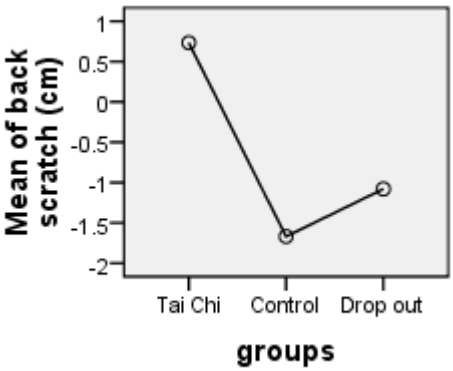
(h)


Mean of 2 minute step (times)
91
90
89
88
87
86
85
Tai Chi
Control
Drop out
groups

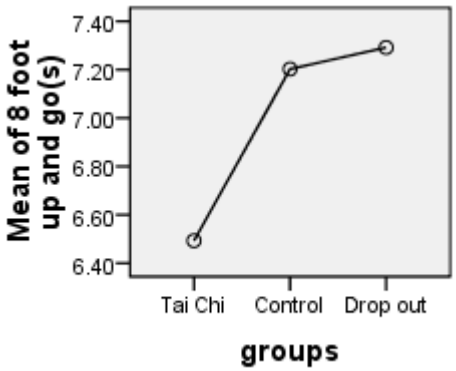
(h)


Mean of chair sit and reach (cm)
2
1
0
-1
-2
-3
Tai Chi
Control
Drop out
groups

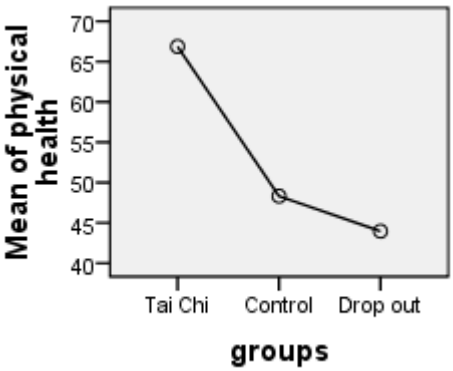
(i)


Mean of back scratch (cm)
1
0.5
0
-0.5
-1
-1.5
-2
Tai Chi
Control
Drop out
groups

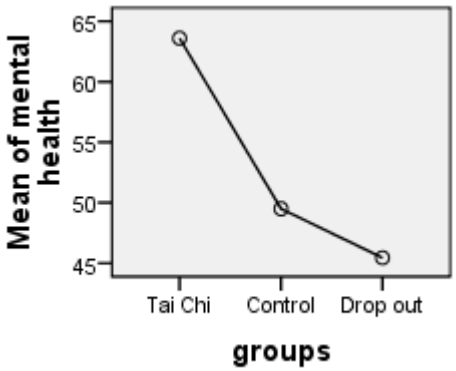
(j)


Mean of 8 foot up and go(s)
7.40
7.20
7.00
6.80
6.60
6.40
Tai Chi
Control
Drop out
groups

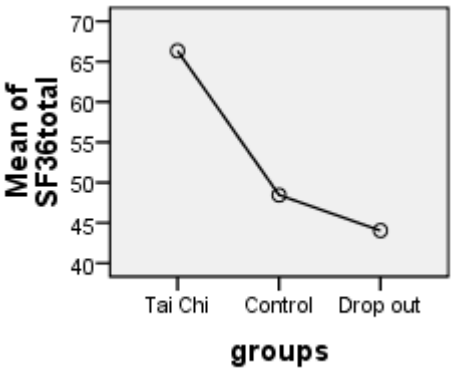
(k)


Mean of physical health
70
65
60
55
50
45
40
Tai Chi
Control
Drop out
groups

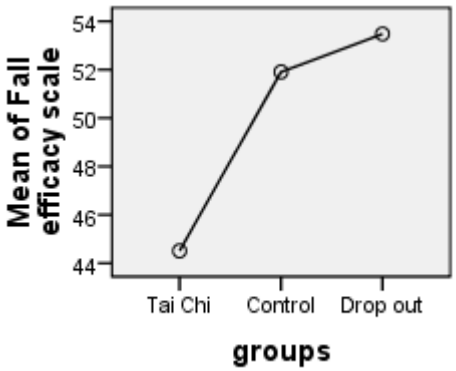
(l)


Mean of mental health
65
60
55
50
45
Tai Chi
Control
Drop out
groups

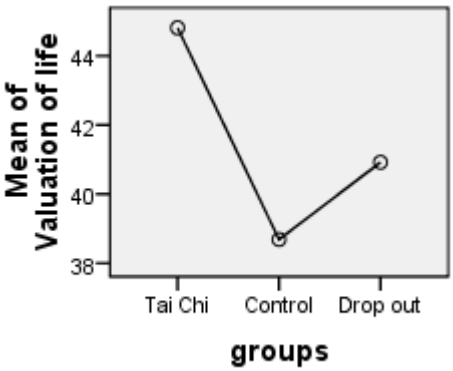
(m)


Mean of SF36total
70
65
60
55
50
45
40
Tai Chi
Control
Drop out
groups

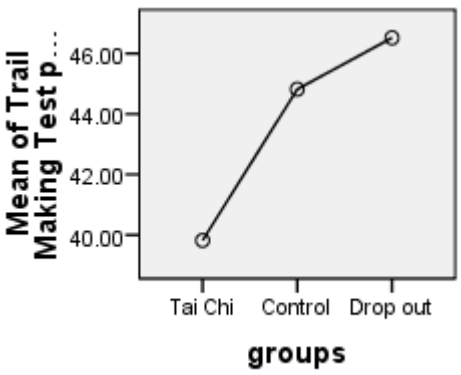
(n)


Mean of Fall efficacy scale
54
52
50
48
46
44
Tai Chi
Control
Drop out
groups

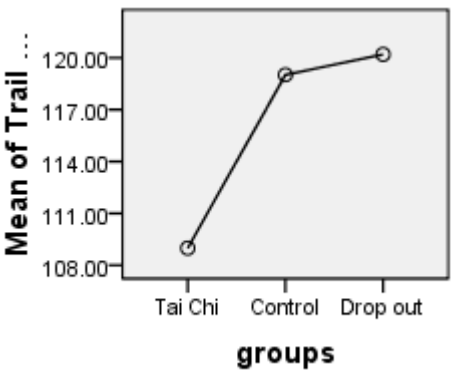
(o)


Mean of Valuation of life
44
42
40
38
Tai Chi
Control
Drop out
groups

(p)


Mean of Trail Making Test p...
46.00
44.00
42.00
40.00
Tai Chi
Control
Drop out
groups

(q)


Mean of Trail ...
120.00
117.00
114.00
111.00
108.00
Tai Chi
Control
Drop out
groups

(r)

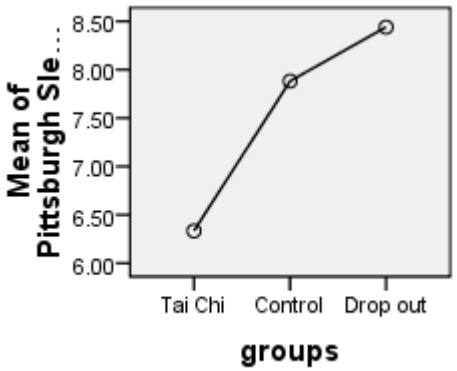


Figure 4.10 illustrates the mean of all dependent variables among three groups: The Tai Chi, the Control and the Drop out groups. The Tai Chi group shows a better result than the Control and the Drop out groups in almost variables. BMI (a), WHR (b), systole (c), diastole (d), pulse (e), Chair stand (f), Arm curl (g), 2 minute step (h), Back scratch (i), 8foot up and go (j), Physical health (k), Mental health (l), SF-36 total (m), the Falls Efficacy Scale (n), Valuation of life (o), Trail Making Test A (p), Trail Making Test B (q) and Pittsburgh Sleep Quality index (r)

4.10 Differences in physical fitness and subjectively rated health between German and Vietnamese older adults

Table 4.48 shows descriptive data for the entire sample. Data are mean ±SD or percentage (and number). Group differences were calculated by independent sample t-test for continuous variables and χ^2 test for categorical variables. T or χ^2 values (and degrees of freedom) are shown.

Table 4.48. Demographic characteristics of Vietnamese and German samples

Variable	Total (N=255)	Vietnam (N=96)	Germany (N=159)	group differences
Sex (% female)	65.5(167)	50(48)	74.8(119)	16.35(1) ***
Age (years)	71.0 ±6.0	69.0 ±5.1	72.2 ±6.1	4.27(253) ***
Education (%)				9.12(3) *
< 5 years	0.8(2)	0(0)	1.3(2)	
5-9 years	34.4(87)	24.0(23)	40.8(64)	
10-12 years	40.7(103)	47.9(46)	36.3(57)	
> 12 years	24.1(61)	28.1(27)	21.7(34)	
Height (cm)	163 ±0.1	159 ±0.1	166 ±0.1	6.55(252) ***
Weight (kg)	69.4 ±13.5	61.6 ±5.4	74.1 ±14.7	9.68(216.1) ***
BMI (kg/m²)	25.9 ±3.7	24.3 ±1.1	26.9 ±4.4	7.01(188.0) ***
WHR	0.93 ±0.1	0.95 ±0.1	0.92 ±0.1	-3.17(250.8) **

**p < 0.05, ** p < 0.01, *** p < 0.001; BMI = Body Mass Index; WHR = Waist Hip Ratio*.

Hierarchical regression models

Tables 4.49 to 4.54 show hierarchical regression analyses for all examined physical abilities i.e. endurance, strength (leg and arm) and flexibility (upper and lower). Table 56 gives the results for subjectively rated physical health factors (SF-36). All tables show the predictive value of selected variables. The overall predictors, which were chosen for regression analyses, were education, sex, age and country. The variable-coding of each predictor is given in the tables´ footnotes. Unstandardized regression coefficients (B) show

the value of each predictor for each motor ability, while R^2 and adjusted R^2 give the amount of explained variance in different steps of the hierarchical regression analyses.

Table 4.49. Hierarchical regression model for endurance

	Unstandardized coefficients: Regression coefficient B			
Predictor	Step 1	Step 2	Step 3	Step 4
Education[a]	3.20*	2.50	1.72	0.92
Sex[b]		-6.16*	-5.60*	-2.59
Age[c]			-1.16***	-0.90***
Country[d]				13.16***
R^2	0.02*	0.04*	0.17***	0.26***
R^2 Change	0.02*	0.02*	0.13***	0.10***
Adjusted R^2	0.01	0.03	0.16	0.25

*[a]0 = < 5 years, 1 = 5 to 9 years, 2 = 10 to 12 years, 3 = > 12 years; [b]0 = male, 1 = female; [c]59 to 90 years; [d]0 = Germany, 1 = Vietnam; *p < 0.05, **p < 0.01, ***p < 0.001*

Regarding the motor ability endurance, regression analyses show that age and country are the most prominent predictors (Table 4.49). While step 3 gives highly significant results for age (B = -1.16; $p < 0.001$) explaining 16% of the variance in endurance, step 4 introduces country as a predictor, which shows that Vietnamese study participants had a significantly higher level in endurance than German participants (B = 13.16; $p < 0.001$; adjusted $R^2 = 0.25$). This means that older participants showed a lower performance in endurance tests than younger ones and that Vietnamese consistently achieved better results than Germans. The change in R^2 was higher in step 3 than in step 4 (R^2 change 0.13 vs. 0.10), which underlines the strong effect of age for the performance level in endurance for untrained older adults, but nevertheless states that country functions as a stable predictor for endurance performance levels.

The two dimensions of strength (leg and arm) show similar results except for the predictor *country*. While leg strength (Table 4.50) is highly dependent on country (B = 2.02, $p < 0.001$), arm strength (Table 4.51) shows no connection in this sector. Sex and age are predictors in both strength abilities and explain 19% of the variance in both models. Here men and younger people showed better results. Vietnamese participants had clear advantages in leg strength and constantly showed a higher performance level.

Table 4.50. Hierarchical regression model for leg strength

	Unstandardized coefficients: Regression coefficient B			
Predictor	Step 1	Step 2	Step 3	Step 4
Education[a]	0.67*	0.41	0.26	0.14
Sex[b]		-2.30***	-2.18***	-1.74***
Age[c]			-0.21***	-0.17***
Country[d]				2.02***
R^2	0.02*	0.10***	0.20***	0.26***
R^2 Change	0.02*	0.08***	0.11***	0.06***
Adjusted R^2	0.01	0.09	0.19	0.25

*[a]0 = < 5 years, 1 = 5 to 9 years, 2 = 10 to 12 years, 3 = > 12 years; [b]0 = male, 1 = female; [c]59 to 90 years; [d]0 = Germany, 1 = Vietnam; *p < 0.05, **p < 0.01, ***p < 0.001*

Table 4.51. Hierarchical regression model for arm strength

	Unstandardized coefficients: Regression coefficient B			
Predictor	Step 1	Step 2	Step 3	Step 4
Education[a]	0.68*	0.50	0.34	0.33
Sex[b]		-1.51**	-1.40**	-1.34**
Age[c]			-0.24***	-0.23***
Country[d]				0.25
R^2	0.02*	0.06**	0.20***	0.20***
R^2 Change	0.02*	0.04**	0.14***	0.001
Adjusted R^2	0.02	0.05	0.19	0.18

*[a]0 = < 5 years, 1 = 5 to 9 years, 2 = 10 to 12 years, 3 = > 12 years; [b]0 = male, 1 = female; [c]59 to 90 years; [d]0 = Germany, 1 = Vietnam; *p < 0.05, **p < 0.01, ***p < 0.001*

Regression models for the two different dimensions of flexibility show diverse results. While lower flexibility (Table 4.53) was not related to education, sex and country, only showing a small age effect (B = -0.32, $p < 0.01$, adjusted $R^2 = 0.04$), upper flexibility revealed several significant predictors (Table 4.52). Here sex, age and country showed

significant values. Country proved as the strongest predictor for upper flexibility (B = 8.14, $p < 0.001$, R^2 change = 0.13, Adjusted R^2 = 0.20).

Table 4.52. Hierarchical regression model for upper flexibility

	Unstandardized coefficients: Regression coefficient B			
Predictor	Step 1	Step 2	Step 3	Step 4
Education[a]	-0.41	-0.12	-0.51	-1.01
Sex[b]		1.92	2.15	3.96**
Age[c]			-0.48***	-0.32**
Country[d]				8.14***
R^2	0.001	0.01	0.08***	0.21***
R^2 Change	0.001	0.01	0.08***	0.13***
Adjusted R^2	-0.003	0	0.07	0.20

*[a]0 = < 5 years, 1 = 5 to 9 years, 2 = 10 to 12 years, 3 = > 12 years; [b]0 = male, 1 = female; [c]59 to 90 years; [d]0 = Germany, 1 = Vietnam; *p < 0.05, **p < 0.01, ***p < 0.001*

The examined effect of sex only shows significant values in the forth step, which adds country and age to sex as predictors. This suppression effect is caused by the fact that age and sex are not equally distributed in the data of the two different examined countries. While the German sample holds a higher percentage of female participants ($\chi^2 = 16.346$, $p < 0.001$) the Vietnamese sample consists of younger people ($t = 4.272$, $p < 0.001$). This leads to an interaction between these factors in step 2 and 3 in the regression model for upper flexibility, only revealing the additional predictive value of sex in step 4 of the analysis, which then explains 20% of the variance in upper flexibility and beyond that shows the highest change of R^2 in this model (R^2 change = 0.13, $p < 0.001$).

Table 4.53. Hierarchical regression model for lower flexibility

	Unstandardized coefficients: Regression coefficient B			
Predictor	Step 1	Step 2	Step 3	Step 4
Education[a]	-0.04	0.11	-0.12	-0.10
Sex[b]		1.24	1.38	1.34
Age[c]			-0.32**	-0.32**
Country[d]				0.19
R^2	0	0	0.05**	0.05**
R^2 Change	0	0	0.05**	0
Adjusted R^2	0	0	0.04	0.04

*[a]0 = < 5 years, 1 = 5 to 9 years, 2 = 10 to 12 years, 3 = > 12 years; [b]0 = male, 1 = female; [c]59 to 90 years; [d]0 = Germany, 1 = Vietnam; *p < 0.05, **p < 0.01, ***p < 0.001*

Results in the physical domain of subjectively rated health did not show significant values for one of the selected predictors (Table 4.54). Country only slightly exceeded the significance level (B = 4.30, p = 0.068) marking a possible tendency for the Vietnamese sample to show higher values, but adjusted R^2 (0.01) supports the unstableness of country as a predictor for subjectively rated physical health status.

Table 4.54. Hierarchical regression model for subjectively rated physical health

	Unstandardized coefficients: Regression coefficient B			
Predictor	Step 1	Step 2	Step 3	Step 4
Education[a]	0.67	0.21	0.16	-0.09
Sex[b]		-4.31	-4.29	-3.42
Age[c]			-0.08	-0.01
Country[d]				4.30
R^2	0.001	0.02	0.02	0.03
R^2 Change	0.001	0.02	0.001	0.01
Adjusted R^2	-0.003	0.01	0.004	0.01

[a]0 = < 5 years, 1 = 5 to 9 years, 2 = 10 to 12 years, 3 = > 12 years; [b]0 = male, 1 = female; [c]59 to 90 years; [d]0 = Germany, 1 = Vietnam; *p < 0.05, **p < 0.01, ***p < 0.001

Age-related performance levels

After having examined the predictive value of different variables, especially of country, for performance in motor abilities and subjectively rated health, the question

arises if the performance level of the Vietnamese and German participants differs with regard to different age groups. In reference to the median of the whole sample, the age of 70 years was chosen to divide the participants in dichotomic age groups. Figure 30 shows age-related performance levels for the three abilities which revealed significant values with respect to country. In addition, a figure for subjectively rated health is displayed.

The depicted performance levels in leg strength (a) repeat the difference between Vietnam and Germany as the Vietnamese participants show a higher performance level than the German participants ($F = 35.196$, $p < 0.001$). In both countries the ANOVA states that younger people (age group ≤ 70 years) had a higher level in leg strength than the older age group (> 70 years) ($F = 8.154$, $p = 0.005$). Age-related performance levels, however, show no clear difference between both countries. ANOVA for the inner subject effects between country and age group slightly exceed the significance level ($F = 3.321$, $p = 0.070$), which gives a tendency for a cultural performance drift in the ability of leg strength, but does not prove this.

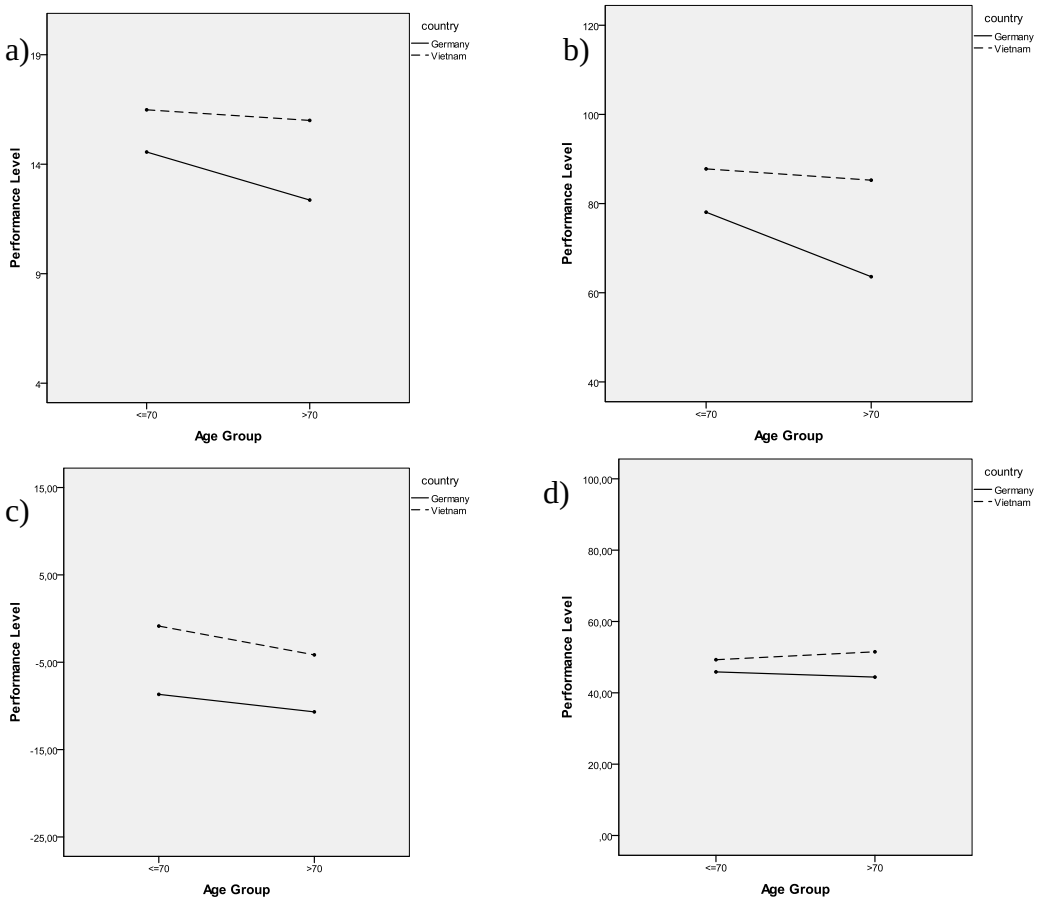
Endurance shows significant values in all important analyses (b). Different levels in country ($F = 49.853$, $p < 0.001$) and age group ($F = 14.654$, $p < 0.001$) as well as in age-related performance levels ($F = 7.227$, $p = 0.008$) state that the Vietnamese sample not only shows a higher level of endurance in both age groups but also shows a lower difference in performance level between the age groups. A drift of performance levels between Vietnam and Germany can be seen with respect to age groups.

The figure 4.29 for upper flexibility (c) illustrates that the Vietnamese performance level was higher than the German level ($F = 30.410$, $p < 0.001$) and that this was the case in both examined age groups ($F = 4.157$, $p = 0.043$). Inner subject effects between country and age group reveal, however, that there is no cultural drift in performance level from the younger age group to the older one ($F = 0.246$, $p = 0.620$), stating that flexibility was subject to a moderate decrease in both countries.

Data for subjectively rated health in the physical dimension (d) show no differences in age group ($F = 0.028$, $p = 0.868$) and age-related performance levels between the two countries ($F = 0.653$, $p = 0.420$). ANOVA for country as independent variable indeed produces a significant value ($F = 5.332$, $p = 0.022$), but as the hierarchical regression model (Table 4.54) and for education and age controlled ANCOVA ($F = 3.236$, $p = 0.073$)

show, this can be explained by the influence of other factors (education, age, sex). With respect to subjectively rated physical health status the Vietnamese and German participants did not show any level- differences in or between age groups, stating that an average level of self-rated physical health was produced in both countries and in both age groups.

Figure 4.11. Age-related performance levels of (a) leg strength, (b) endurance, (c) upper flexibility and (d) subjectively rated physical health



Conclusion of this chapter: This chapter is about the results of study. All data has been processed precisely by SPSS software and Microsoft Excel. Results of study show highly significant difference in research groups. The Tai Chi group shows better performance level in all variables of physical fitness test. In comparison to the Control group, the Tai Chi group also outperforms the Control group in all items of physical and mental component summary. The Tai Chi group shows better results in sleep quality, balance ability, motor speed and visual attention than the Control group. Higher

performance levels of the Vietnamese sample represent a more active lifestyle. This more active lifestyle is maintained up to old age and leads to an even greater advantage of the Vietnamese sample in performance levels in the age group over 70 years. Lower performance levels in the higher age group of the German sample might lead to higher risks for cardiovascular diseases (aerobic fitness) and falls (leg strength).

Chapter 5 Discussion

Tai Chi has been widely practiced in Asia and Europe. It is believed to bring benefits in physiological and psychological aspects. The study process consisted of three main stages: baseline-midpoint and endpoint (drop out is only for the intervention group). Samples of study were recruited from community-dweller in Vinh city. To compare the benefits of Tai Chi exercise, we recruited older people aged from 60-79, which included 96 participants divided into two groups: Tai Chi and Control groups (as described previously in chapter three).

Results of the study proved that Tai Chi has strong effects on both the physical and mental health of older adults. Participants in the Tai Chi group have the advantages in achieving better levels of physical fitness as shown in the Senior Fitness Test, as well as in mental health than their counterparts. After 6 months of Tai Chi training, participants outperformed in sleep quality, balance ability, cognitive performance as well. There is one item of blood pressure was not be improved with Tai Chi training, diastole blood pressure showed no significant difference between the Tai Chi and Control groups after 24-month Tai Chi training.

In this study, we examined the effects of 24-form Tai Chi exercise for six months on physical fitness, blood pressure and perceived health as well as sleep quality, cognitive performance and balance ability of older people living in a dwelling community. On the basis of the study it may be concluded that 24-week Tai Chi training does not affect only the variable of diastole. However, we found Tai Chi improved BMI, WHR, systole, pulse and physical fitness and perceived health as well as sleep quality, cognitive performance and balance of older adults.

There was a significant difference in the Body mass index and Waist hip ratio of the samples between the Tai Chi group and the Control group. There was no significant difference in all variables between the Tai Chi group and Control group at the baseline. But there are highly significant changes between the Tai Chi group and Control group at midpoint and endpoint. There was an 8-week follow-up period. In the follow-up period, only participants in the Tai Chi group took part in. There was no significant change

between the lasted endpoint and follow-up period. That means the effects of Tai Chi exercise, at least, maintains two months after participants stopped training with Tai Chi.

5.1 Effects on blood pressures

The results of our findings showed that after 24 weeks Tai Chi training, participants in the Tai Chi group showed an improvement in blood pressure. Previous studies support Tai Chi as a measure to improve balance and blood pressure for middle-aged women (Thornton et al., 2004; Tsai et al., 2003).The present Tai Chi training improved systolic blood pressure and pulse but did not improve diastolic blood pressure. This may be due to the structure and movement of Tai Chi exercise which is not suitable for improving blood pressures. This change is consistent with the finding of (Ko et al., 2006) that a 10 week Tai Chi exercise program improved systolic blood pressure, lipid profiles, and some parameters of health related quality of life in Hong Kong women.

5.2 Effects on physical fitness

In our study, we also found that Tai Chi improved physical functions in the community-dwelling elderly. Participants in the Tai Chi group showed better results in Senior Fitness Test than the Control group. Both men and women in the Tai Chi group reached higher level in physical fitness performance in comparison to their counterparts. It has been shown elsewhere that Tai Chi has a considerable effect on strength, balance and overall physical functioning (Li et al., 2001). The study of Caminiti et al (2011) reported that the association of Tai Chi and Education training can improve the exercise tolerance of patients with chronic heart failure more than Education training alone.

Previous findings indicated that Tai Chi is a potent intervention that has been shown to improve flexibility, endurance, and upper-and lower body muscular strength (Audette et al., 2006; Chen et al., 2007; Lan et al., 1996; Taylor-Piliae et al., 2006; Tsang et al., 2005). Tai Chi has been shown to increase strength, improve joint flexibility, and relieve muscular tension (Woflson et al., 1996).

Tai Chi is a traditional Chinese aerobic exercise. Its benefits are to improve balance, flexibility, muscle strength, neuromuscular reaction and endurance in elderly

individuals (Hong, Li & Robinson, 2000; Lan et al., 2000; Taylor-Piliae et al., 2004; Xu et al., 2005). It has been documented in previous studies that Tai Chi could improve the muscle strength of knee extensor (Jacobson et al., 1997), have better scores in the sit and reach test and total body rotation (Hong, Li, Robinson, 2000), reduce fall risk for fall-prone older adults (Choi, Moon, & Song, 2005), and blood pressure (Ko et al., 2006; Tsai et al., 2003). The results of our study are consistent with the studies which stated that Tai Chi could improve the balance ability of older people (Hain et al., 1999; Hackney & Earhart., 2008; Fong & Ng, 2006). It was reported in the study of Jacobson et al (1997) that a 12-week Tai Chi program could improve the muscular strength of knee extensors. The present study also indicates that Tai Chi participants outperformed their counterparts in control group on almost parameters of physical and mental health. Previous studies demonstrated that regular Tai Chi exercise leads to improvement in postural stability, functional mobility and balance control (Hong, Li & Robinson, 2000; Wolf et al., 1996; Wolfson et al., 1996).

5.3 Effects on balance and falls

Results of the study showed that participants in the Tai Chi group acchieved better scores in self-report fall efficacy than the Control group. Beneficial effects of Tai Chi exercise on the prevention of falls and improved balance are also documented within the literature. Tai Chi interventions have been shown to prevent a decline in functional balance and gait among older people (Gatts & Woollacott, 2006; Lin et al., 2006). Tai Chi has also been found to improve the mechanism by which forward momentum is generated and to improve coordination during gait initiation, suggesting improvements in postural control (Hass et al., 2004) and dynamic balance (Maciaszek et al., 2007). It also significantly enhanced balance responses by more effective use of mechanisms controlling stepping strategies of the swinging leg and improved ability to tolerate unsteadiness also increased neuromuscular responses controlling the ankle joint, which also enhance balance responses (Gatts & Woollacott, 2006). The movements of Tai Chi training have been shown to simulate proprioception amd functionally strong influence on balance control. The potential influence on balance control is supported by measurements (Mao, Li & Hong, 2006). Tai Chi also appears to lead to improved physical status (Wolf et al., 1997).

5.4 Effects on self-rated health

The study also found a concomitant change in physical and mental functions. Compared with participants in the Control group, Tai Chi participants showed significant improvements on all physical and mental scores of SF-36 and valuation of life. Higher mental summary scores of Tai Chi group may due to the program that offers participants an opportunity to communicate and interact socially. These findings are consistent with the other findings that psychological benefits were observed with Tai Chi exercise, such as better perceived social support and mood state and superior relaxation among Tai Chi practitioners (Lee et al., 2007; Taylor-Piliae et al., 2006). From a behavioral - immunological perspective, Tai Chi has been found to be associated with significantly decreased sympathetic nervous system activity (Motivala et al., 2006). Based on previous studies, we may know that Tai Chi enhance physiological well-being and improve cardiopulmonary functions which are both related to quality of life (Ko et al., 2006; Kutner et al., 1997; C. Wang et al., 2004; Zeeuwe et al., 2006). Tai Chi can improve the quality of life among the elderly (Ho et al., 2007) and its characteristics are highly relevant for promoting health among older people particularly effecting to nursing home residents (Lee, Lee & Woo, 2009).

5.5 Effects on sleep and cognitive performance

The sub-findings of this study were that older adults benefited from Tai Chi exercise. These results were generally congruent with the other findings that Tai chi appears to be effective as a non-pharmacological approach to sleep enhancement for sleep-disturbed elderly individuals (Li et al., 2004). The study of Irwin et al., (2008) stated that people participating in Tai Chi chih obtained slightly greater improvements in self-reported sleep quality and may be helped to prevent the onset of insomnia. It is consistent with our findings that Tai Chi improved sleep quality via self-report sleep after 24 weeks of Tai chi training. Findings also indicated that participants participating in Tai Chi showed better scores in cognitive performance (Trail Making Test), in comparison with participants in the Control group. It is congruent with the finding of Matthews et al (2008) suggested that

with non-controlled study, Tai Chi may bring the possibility of beneficial effects on cognitive function in older adults.

5.6 Cross-cultural preliminary study

This study clearly shows the differences in physical fitness between an Asian and a European country. Vietnamese older adults continuously had higher performance levels in endurance, leg strength, and upper flexibility, which were not only seen in the younger age group but could also be examined in the higher age group of over 70 years. The fact that the Vietnamese sample maintained a higher performance level throughout the age span, and that it showed a smaller difference in the performance level of under 70-year-olds and that of over 70-year-olds clearly underlines the finding that older Vietnamese participants had stable advantages in important motor abilities. The sample revealed that there seems to be a clear decline in motor ability performance in Germany around the age of retirement, when labor and, in the course of that, physical requirements decline. Vietnamese, on the contrary, did not only show higher performance levels before retirement, but also after it. Especially in aerobic fitness (endurance) Vietnamese sample showed only small differences in performance levels over the age groups, which might lead to a lower risk for cardiovascular diseases. In addition to this, leg strength performance levels of the Vietnamese sample were higher in both age groups with the tendency to stay more stable than in the German sample, which clearly showed lower results for leg strength in the older age group. Leg strength represents a basic ability in the prevention of falls, which are a major threat in older age group for losing one's independence and social participation (Gillespie et al., 2009; Tinetti et al., 3003). Therefore the Vietnamese sample presented a higher preventative potential for falls, which especially plays an important role in the older age group examined. Leg strength and flexibility are major factors in the performance of the activities of daily living. A self-reported high level of strength and flexibility correlates with an objectively examined functional plus in important every day activities (not only activities of daily living but also instrumental activities of daily living) and therefore constitutes the basis for independent living and social participation (Bravell, Zarit, & Johanson, 2011). In flexibility the Vietnamese sample also showed a higher performance level throughout both age groups, which together with the findings in endurance and leg

strength, develops the potential of preserving independence much longer than the German sample. Even if no cultural drift could be observed in upper flexibility, i. e. no disparity in performance level between the two age groups in both countries was seen, the steadily higher performance level contributes to a possible advantage of the Vietnamese in functional ability over the examined life span.

Sub-findings in this study showed that age was a predictor in all observed motor abilities. Younger people had clear advantages over older people and revealed higher performance in endurance, strength and flexibility domains. Men reached higher levels in both domains of strength (leg and arm), while women showed higher upper flexibility values. Education was no predictor for fitness at all. These results in socio-demographic factors stress the importance of individually tailored conditions and demands so that older people need to be more physically active to maintain a certain functional level, while biological and social factors contribute to different gender-related advantages and disadvantages and therefore need to be addressed from a gender-specific aspect. The fact that in our study no predetermined educational influences existed, emphasises the possibility and responsibility for every individual to maintain a high functional level through an active and healthy lifestyle.

Subjectively rated physical health factors did not differ between Vietnam and Germany. Considering the higher functional level of the Vietnamese sample in important motor abilities, it is a quite surprising result that both samples rated their physical health status on a comparable level. This might be the result of a culturally mitigated understanding of health, because on a cross-cultural basis, health can not only be seen as the physical status of the body and is interpreted through cultural knowledge (Fry, 2007). One factor for self rated functional level and health status in this context, is the degree to which a society provides technological assisting devices like pacemakers, glasses or walkers and the state of development in medicine, for example in orthopaedic surgery, to compensate functional loss. The different organization of life in cultures with extended families as a buffer for elderly people with functional impairments, serves as a totally different structure, in which other values and perceptions of physical health and functionality exist (Fry, 2007). These cultural differences are especially large between Asian and European countries and could explain why objectively assessed levels of motor abilities are not reflected in subjectively rated physical health levels in this study.

The study findings represent a higher level of motor abilities in Vietnamese participants, which maintain a higher level over the age span and even tend to expand the distance of performance levels to the German participants in the higher age group. The consequences for the German sample might result in an earlier loss of independence, social participation and general health. The higher levels of Vietnamese participants reflect a more active lifestyle throughout the whole life span, especially after retirement, which are not only reached by systematic physical activities like sports, but may be the result of a generally more challenging, physically active lifestyle in everyday activities. This could serve as an explanation for the convergence of life expectancy of Vietnam and Germany from birth (e_0) to the age of 60 years (e_{60}), stating that a physically active lifestyle is able to contribute to an extension of life expectancy in older age. German older people would profit by an enhancement of their physical demands in everyday life, and thus could use the potentials of their living conditions to full capacity. Researching the circumstances, situations and stimuli after retirement in different cultures could provide a basis for the future constitution of physically demanding living environments for older people.

5.7 Limitations and problems faced in the study

Over the 6-month Tai chi program, there was a 18.75% drop-out rate (not including follow-up period) in the Tai Chi group. It is evident that relatively high rate of participants were likely to engage in Tai Chi training. The attrition of participation was due mainly to travelling or leaving the city rather than dissatisfaction with the training program. Tai Chi is a low - technology exercise that can be easily carried out in variety of communities.

It may be necessary to have skills for performing physical tests, because some participants found difficult to understand and perform the tests. Measurements for all physical tests should be more accurate and need more accurate devices in the laboratory with specialized machines. Some of the questionnaires are directly translated from English to Vietnamese which may lead participants to difficulty to have in understanding some of the questions.

The study has a small sample size, a low-frequency training schedule of only twice per week. The Follow-up period should be longer in order to examine how long the effects of Tai Chi remain. Furthermore, we have used two research groups, while the Tai Chi

group received treatment but the control group did not. The social effects and biased opinions resulting from individuals in both groups might be raised. It should be, therefore, comparative design that account for equal condition of intervention. Moreover, all participants come from urban areas which may not be representative for the whole Vietnamese population.

Chapter 6 Conclusion

6.1 Implication

In this randomized controlled trial study, results showed that a 24 week Tai Chi program can be an alternative form of exercise for older adults. The 24-form Tai Chi brings physical and psychological benefits to older adults. The strength, aerobic fitness, flexibility, dynamic balance of people who engaged in Tai Chi program was remarkably improved. Blood pressure was also significantly improved except diastole blood pressure. The scores of self-report health in the two domains of Short form 36 of Tai Chi group were better than the Control group. It showed that physical and mental health was much improved after the Tai Chi training. There was much improvement in balance and cognitive performance in Tai Chi group. Sleep quality was enhanced with Tai Chi exercise. The Tai Chi program showed its benefits and effects on maintaining the physical and mental functioning of older adults in community. It also enhances and promotes the older adults to participate in Tai Chi in public. These results answer the questions of whether Tai Chi exercise would improve the physical, mental domains of older adult health as well as promote balance, sleep quality and cognitive performance. As discussed previously, aging in Vietnam is sharply increasing. Therefore, Tai Chi exercise is meaningful to promote the healthy elderly not only people living in dwelling communities but also in nursing homes or people with chronic diseases to participate in.

6.2 Further study

This study focused on a healthy group of older adults living in a dwelling community. Other populations should be observed such as frail populations. The effects of Tai Chi for people with osteoporosis, Parkinson's, arthritis and other chronic diseases have been documented elsewhere. However, empirical and controlled trial studies should be widely carried out. In future research, Tai Chi program should be compared to other sport or recreational activity programs to see the less biased effects of Tai Chi exercise. In addition, Tai Chi exercise should be carried out in large samples that can represent the whole population.

6.3 Conclusion

Base on the findings of this randomized controlled trial, it may be concluded that after 24-Tai Chi training, 24-form Tai Chi exercise is a good form for older adults. It brings physical and mental benefits to the elderly participants. Results of study show highly significant difference in research groups. Tai Chi group shows better performance level in all variables of physical fitness test. In comparison to Control group, Tai Chi group also outperforms Control group in all items of physical and mental component summary. Tai Chi group shows better results in sleep quality, balance ability, motor speed and visual attention than Control group. Higher performance levels in physical fitness and self-reported health of the Vietnamese sample represent a more active lifestyle than German sample. This more active lifestyle in maintained up to old age and leads to an even higher advantage of the Vietnamese sample in performance levels in the age group over 70 years. Future Tai Chi program should be longer and more frequent in order to have much improvement in physical and mental domains of elderly health.

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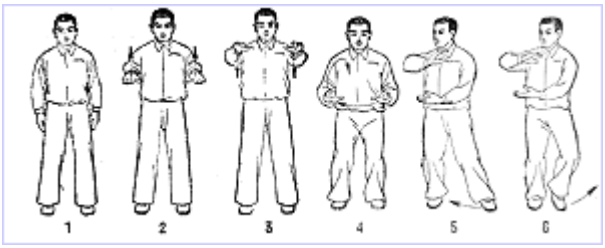
Appendixes

Appendix 1.24-form Tai Chi

1. Open Tai Chi - Start with the feet together, body upright, relaxed and stable, mind calm and within the body. Sink into the right foot; step out with the left foot to form a shoulder width stance. Centre the weight. Hands rise to just under shoulder height. Relax and sink slightly, hands come down to waist height. Knees slightly bend.

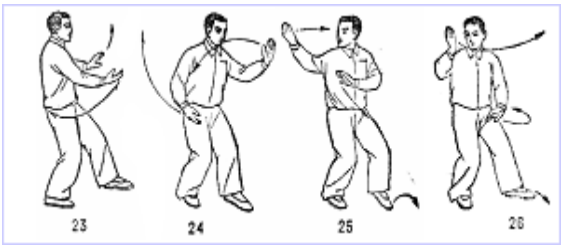
Commence



2. Part The Wild Horses Mane - Sink weight to the left foot, center turns to right, turning right foot 90 degrees. Right hand rises, shift weight to the right foot, step in and hold the ball. Step to left and forwards sink weight to centre and left had rises, right hand falls, hips turn to form Left Bow Stance.

3. Ward Off, Roll Back, Press, Push - Sink weight forwards, step in with right foot, hold the ball. Turn to right, step to right, form Right Bow Stance, right arm rises and goes out slightly, left hand sinks to side (Ward Off). Turn to right another 15 degrees, right hand turns down, left hand turns up, sink back, turn to left, hands rise to rear corner. Turn to right, palms meet; push forwards to from Right Bow Stance (Press). Sink slightly forwards, shift weight back, palms separate, move forwards into Push, Right Bow Stance.

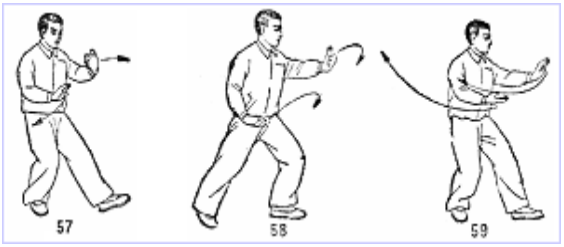
4. Single Whip - Sink slightly forwards, move back, right hand sinks, turn to left, left hand sinks, right hand rises. Shift to right leg, turn slightly to right, right palm turns out. Turn to left, right hand goes out to form hook, left hand rises. Step to left to form Bow Stance, left hand turns out.



5. Raise Hands - Sink slightly forwards. Shift weight to right, turn to right, hand follow and turn 180 degrees clockwise. Shift to left leg, turn to left, then to turn to right. Sink into left leg, place heel on ground. Left hand is opposite right elbow.

6. White Crane - Turn to left, right hand drops in beneath left palm (holding ball). Shift weight to right, turn to right, raise right hand to corner. Turn to left and open, left hand comes down and across in front of left hip.

7. Brush Knee and Press - Turn to left, deflect with right hand. Right hand falls, left hand rises, turn and deflect to the right. Step in (right hand rises), step out right hand comes to right ear. Press forwards and come into Left Bow Stance (left hand comes round to left hip).

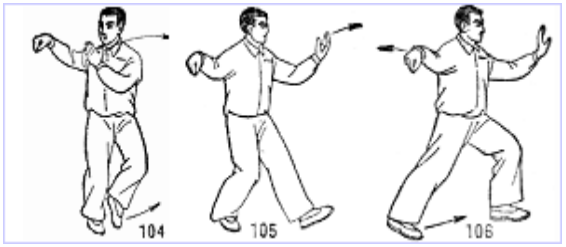


8. Strum The Lute- Sink weight into front leg, turn to left. Sink into right leg, turn to right. Turn to left (ahead) place heel on ground. Left hand is near to right elbow.

9. Repulse The Monkey - Turn to right, right arm to corner behind. Palms turned up. Step in with left foot (right arm comes in to ear), step back to left. Sink into back leg, palms cross, face forwards.

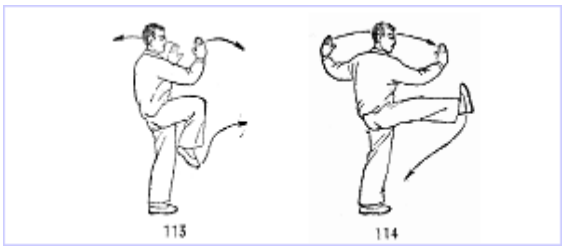
10. Slanted Flying - Turn to left, hold ball (left over right). Step to right corner, turn to form right Bow Stance. Right arm comes up and left hand comes down to side.

11. Cloud Hands - Sink into front leg, turn to the right. Right hand begins to circle down as you step up with the left foot (feet now parallel). Shift weight to the left, turn to the left, left hand comes down as you step in with the right foot (narrow parallel stance). Right hand circles up (on the inside of the left arm), shift weight to the right leg, turn to the right.



12. Single Whip - Right hand turns out, turn to the left, left hand rises. Form hook with right hand. Step to the left and come into a Bow Stance. Left hand turns outwards.

13. High Pat On Horse - Step in with right foot, half a step, sink back into right leg turn to the right. Open up the arms (left arm forwards, right arm to the right corner) palms turning up. Sink into right leg and turn to front, right palm comes in to ear and down (slap down). Left foot touches the ground.



14. Kick with Right Heel - Step in with left foot, left hand comes up to the right wrist. Step to left corner, left hand turns out. Form left Bow Stance, arms open to sides. Sink weight forwards to left leg; step in, hands circle down. Right knee and hands rise, turn to right corner, kick with right heel, arms open like a fan.

15. Strike Ears with Fists - right leg comes in, hands turn in and lower. Step to right corner to form Bow Stance. As this happens, hands come to hips and circle out and inwards to form fists (connect with imaginary opponents temples). Keep shoulders relaxed.

16. Kick with Left Heel - Shift weight bac d turn (as far as stability allows) to the left, hooking right foot to the left. Sink weight back in to your right leg. Hands circle down and cross in front of body. Left knee and hands rise. Turn to left corner and kick with left heel, arms open like a fan. Keep upright, relaxed and stable.

17. Snake Creeps Down - Turn to the right and form a hook with your right hand. Step in to the right instep with your left foot. Bring you left hand to beneath your right elbow. Sink down slightly into the right foot. Step out with your left foot to the side (left toes on line with the right heel). Sink further into right leg. Left arm comes down. Begin to shift the weight forwards and turn to the left. Come into a long Bow Stance, right hook having descended to the right thigh. Left arm forwards in front of the centre line of the body.

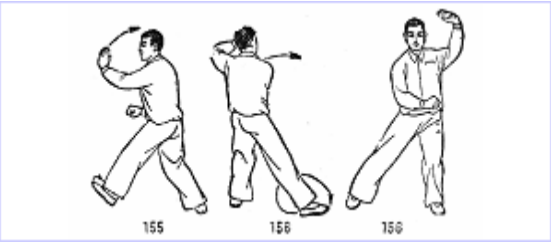
18. Golden Rooster - Shift the weight forwards and raise right knee to the right elbow. Left arm sinks down to the side of the body.

19. Fair Lady Weaves Shuttles - Step forwards and place right heel ahead. Turn to the right and shift weight forwards into right leg. Hold ball (right over left) and step in with left

foot. Step to left corner as you raise the left arm, turn, Form Bow Stance, rotate left arm outwards and press forwards with right palm.

20. Needle at The Bottom Of The Sea - Shift weight forwards to left leg. Step in half a step with right foot (position at 45 degrees to forwards direction). Shift weight back and turn to deflect to the right with your left arm. Raise right arm in a circle, turn to left, deflect low with left arm and strike forwards and down with right hand (tilting forwards). Sink into right leg.

21. Fan Penetrates the Back - Step in with left foot, left hand comes up to your right wrist. Step forwards to form a Left Bow Stance. Press forwards with left palm and out and up slightly with your right palm.



22. Block Parry and Punch - Sink weight slightly forwards, sink weight back into right leg. Turn to the right, as close to 180 degrees and possible. Hook left foot round to the right (hands circle up slightly). Turn slightly to the left, left hand at head height, right hand forms a fist in front of groin. Turn to the right, strike down and forwards with the back of the fist. Left hand to the side of the fist (Block). Turn to the right, right foot turns, fist turns outwards (Parry). Step up to right leg with left foot, step forwards with left foot. Fist comes in to hip as the left foot touches the ground. Come into a Bow Stance and punch past the left palm (Punch)

23. Palm Under The Elbow and Push - Turn left hand under right arm to the elbow. Turn slightly to the left and sink slightly forwards. Sink weight back and separate palms. Push forwards back into Bow Stance.

24. Close - Sink slightly forwards and shift weight back into centre. Turn to the right, turn left foot and then right foot 90 degrees. Open arms. Sink back into left leg, palms cross and sink to hip height. Step in with right leg to form a shoulder width stance. Hands go forwards, legs lengthen. Sink arms to sides of body. Step in with left foot, feet together. Finish!

Appendix 2.Short form 36 (SF-36)

Bảng câu hỏi ngắn-36
(SF-36)

Bây giờ tôi xin phép được hỏi về nhận định của bạn về sức khoẻ của chính mình. Bạn hãy trả lời tất cả các câu hỏi. Các câu hỏi có thể nhìn giống nhau nhưng thực chất là khác nhau. Hãy đọc kỹ câu hỏi và trả lời câu hỏi bằng cách khoanh tròn số tương ứng với câu trả lời. Nếu bạn không chắc chắn phải trả lời như thế nào thì xin chọn câu trả lời tốt nhất có thể được.
(This survey asks your views about your health status. Please answer every question. Some questions may look like others. But each one is different. Please take the time to read and answer each question carefully by circling the number that best presents your response. If you are unsure about how to answer a question, please give the best answer you can)

1. Nói chung bạn tự đánh giá sức khoẻ của mình là:
(In general, would you say your health is)

Hoàn hảo **(Excellent)**..... 1
Rất tốt **(Very good)** 2
Tốt **(Good)**..... 3
Vừa **(Fair)**..... 4
hay Kém**?** (Or poor)?..... 5

2. So với năm trước, bạn thấy sức khoẻ của mình hiện nay như thế nào? bạn có cho rằng sức khoẻ của mình là:
(Compared to one year ago, how would you rate your health in general now?)

Tốt hơn năm trước rất nhiều 1
(Much better now than one year ago)
Tốt hơn năm trước 2
(Somewhat better now than one year ago)
Cũng như năm trước 3
(About the same as one year ago)
Kém hơn năm trước 4
(Somewhat worse now than one year ago)
hay kém hơn năm trước rất nhiều? 5
(Or much worse now than one year ago)

3. Những câu sau đây hỏi về các hoạt động tiêu biểu bạn thường làm trong ngày. Bạn có trở ngại gì trong những vệc sau vì lý do sức khoẻ không? Nếu có thì ở mức độ nào, nhiều hay ít hay không hề trở ngại gì?
(The following questions are about activities you might do during a typical day. Does your health now limit you in these activities? If so, how much?
Bạn gặp trở ngại nhiều, hơi trở ngại hoặc không hề trở ngài gì cả?

	Còn nhiều trở ngại (Yes, limited a lot)	Hơi trở ngại (Yes, limited a little)	Không hề trở ngại (No, not limited at all)
a. Hoạt động mạnh, như chạy, nâng vật nặng hay tham gia thể thao đòi hỏi nhiều sức lực..... (Vigorous activities, such as running, lifting heavy objects, participating in strenuous sport)	1	2	3
b.Hoạt động vừa phải, như khiêng bàn, đẩy máy hút bụi, hoặc chơi golf, bowling ..... (Moderate activities, such as moving a table, pushing a cacuum cleaner, bowling, or playing golf)	1	2	3
c. Nhấc hoặc mang thực phẩm đi chợ mua sắm thường ngày..... (Lifting or carrying groceries)	1	2	3
d.Leo cầu thang lên vài tầng lầu ..... (Climbing several flights of stairs)	1	2	3
e.Leo cầu thang lên một tầng lầu ..... (Climbing one flight of stairs)	1	2	3
f.Cúi người, quỳ gối hay khom ..... (Bending, kneeing, or stooping)	1	2	3
g.Đi bộ trên vài km..... (Walking more than one mile)	1	2	3
h.Đi bộ nửa km..... (Walking several hundred yards)	1	2	3
i.Đi bộ nửa km ..... (Walking one hundred yards)	1	2	3
j.Tự tắm rửa thay quần áo ..... (Bathing or dressing yourself)	1	2	3

4. Trong 4 tuần vừa qua có bao giờ sức khỏe thể lực của bạn làm ảnh hưởng tới công việc hay các sinh hoạt hàng ngày của mình không? Ở mức độ nào
(During the past 4 weeks, how much of the time have you had any of the following problems with your work or other regular daily activities as a result of you physical health?)

	Yes (có)	No (không)
a. Giảm thời gian làm việc hoặc các hoạt động khác (Cut down on the amount of time you spent on work or other activities)	1	2
b.Hoàn thành được ít hơn bạn muốn…….. (Accomplished less than you would like)	1	2
c.Bị hạn chế trong công việc hoặc các hoạt động khác …… (Were limited in the kind of work or other activities)	1	2
d.Gặp khó khăn khi làm một số công việc hoặc hoạt động khác (VD. phải nỗ lực) (Had difficulty performing the work or other activities (for example, it took extra effort)	1	2

5.Trong 4 tuần qua, bạn có gặp trở ngại gì trong cộng việc hoặc các hoạt động hằng ngày vì lý do tinh thần không?
(During the past 4 weeks, how much of the time have you had any of the following problem with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)

	Yes (có)	No (không)
a. Giảm thời gian làm việc hoặc các hoạt động khác (Cut down on amount of time you spent on work or other activities)	1	2
b.Hoàn thành được ít hơn bạn muốn (Accomplished less than you would like)	1	2
c.Làm việc hay các hoạt động khác một cách thiếu cẩn thận hơn thông thường (Did work or other activities less carefully than usual)	1	2

6.Trong 4 tuần qua, yếu tố sức khỏe thể chất hoặc tinh thần như là buồn, hay lo lắng có tác động như thế nào đối với sinh hoạt gia đình, bạn bè, hàng xóm hay đoàn thể của bạn?
(During the past 4 weeks, to what extent has physical health or emotional problems interfered with your normal social activities with family, friends, neighbors, or group?)

Không hề **(Not at all)** 1
Một ít **(Slightly)** 2
Vừa phải **(Moderately)** 3
Nhiều **(Quite a bit)** 4
hay rất nhiều? **(Or Extremely)** 5

7.Trong 4 tuần qua, bạn có thấy đau gì trong cơ thể?
(How much bodily pain have you had during the past 4 weeks?)

Không **(None)** 1
Rất ít **(Vey mild)** 2
Vừa phải **(Moderate)** 4
Khá nhiều **(Severe)** 5
hay Rất nhiều? **(0r very severe)** 6

8.Trong 4 tuần qua, việc bạn bị đau về thể lực vừa kể đã có ảnh hưởng như thế nào đối với việc làm hằng ngày của bạn? **(During the past 4 weeks, how much did pain interfere with your normal work (including both work outside the home and housework?)**

[READ]

Không h **(not at all)** 1
Một ít **(A little bit)** 2
Vừa phải **(Moderately)** 3
Nhiều **(Quite a bit)** 4
hay Rất nhiều? **(Extremely)** 5

9.Những câu hỏi sau đây hỏi về tâm trạng cũng như những gì xảy ra cho bạn trong 4 tuần qua Xin chọn câu trả lời diễn tả chính xác nhất. Trong 4 tuần qua, bạn có thường cảm thấy?. (These questions are about how you feel and how things have been with you during the past 4 weeks. For each question, please give the one answer that comes closest to the way you have been feeling.

	Luôn luôn (all of the time)	Phần lớn (Most of the time)	thường xuyên (Often)	Thỉnh thoảng (Some of the time)	Ít khi (seldom)	Không khi nào (None of the time)
a.Phấn khởi yêu đời? **(Did you feel full of life?)**	1	2	3	4	5	6
b.Tinh thần căng thẳng? **(Have you been nervour?)**	1	2	3	4	5	6
c.Buồn chán đến nỗi không gì làm bạn vui lên được? **(Have you feel so down in the dumps that nothing could cheer you up?)**	1	2	3	4	5	6
d.Yên tâm, thanh thản? **(Have you felt calm and peaceful?)**	1	2	3	4	5	6
e. Tràn đầy sinh lực? **(Did you have a lot of energy?)**	1	2	3	4	5	6
f. Chán nản, trầm cảm? **(Have you felt downhearted and depressed?)**	1	2	3	4	5	6
g.Kiệt sức? **(Did you feel worn-out?)**	1	2	3	4	5	6
h.Hạnh phúc)? **(Have you been happy?)**	1	2	3	4	5	6
i.Mệt mỏi? **(Did you feel tired?)**						

10.Trong 4 tuần qua, yếu tố sức khoẻ và tinh than có thường ảnh hưởng đế các hoạt động xã hội của bạn không (thăm bạn bè, bà con…)? (During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting friends, relatives, etc?))

[READ]

Luôn luôn (**All of the time**) 1
Phần lớn **(Most of the time)** 2
Thỉnh thoảng **(Some of the time)** 3
Ít khi **(A little of the time)** 4
hay không có khi nào**? (none of the time)** 5

11. Theo bạn những câu sau đây Đúng hay Sai?
(How True or False is each of the following statements for you?)

	Hoaøn toaøn ñuùng (Definitely true)	Phaàn nhieàu ñuùng (Mostly true)	Khoâng bieát (Don't known	Phaàn nhieàu sai (Mostly false)	Sai hoaøn toaøn (Definitely false)
a.Hình như tôi dễ mắc bệnh hơn người khác **(I seem to get sick easier than other people)**	1	2	3	4	5
b.Tôi khoẻ mạnh như mọi người quanh tôi **(I am as healthy as anybody I know)**	1	2	3	4	5
c.Tôi nghĩ sức khoẻ của tôi rồi sẽ kém hơn bây giờ (I expect my health to get worse)	1	2	3	4	5
d.Sức khỏe tôi hoàn hảo **(My health is excellent)**	1	2	3	4	5

Xin chân thành cảm ơn.
(Thank you)

Appendix 3.Score card for Senior fitness test

Scorecard: Senior Fitness test

Date:……
Name:……M……...F…… A Waist:…… Hip:…….

Test Item	Trial 1	Trial 2	Comments
1. Chair Stand test (in 30 sec)	……	N/A	Systole:
2. Arm Curl Test (in 30 sec)	……	N/A	Diastole:
3. 2-minute Step Test (of steps)	……	N/A	
4. Chair sit-and-reach test (nearest ½ in (3.8cm).: +/-)	……	…….	Extended leg: R or L
5. Back Scratch Test (nearest ½ in (3.8cm).: +/-)	……	……..	Handover: R or L shoulder
6. 8-Foot up-and-go Test (nearest 1/10 sec)	……..	……..	
6-Minute Walk Test (of yd)	……	N/A	

* Omit 2-minute step test if 6-minute walk test is given

Translate version

Bảng ghi kết quả: Kiểm tra thể chất người cao tuổi

Ngày: Bụng…….Mông…..
Tên:……Nam……Nữ……Tuổi…….Cao……...Nặng……..

Mục kiểm tra	Lần 1	Lần 2	Nhận xét
1. Test Đứng-ngồi ghế (30 giây)	……	K	
2. Test Co tay (30 giây)	……	K	HATĐ:
3. Test Bước 2 phút (số bước)	……	K	HATT:
4. Test Ngồi duỗi chân (gần nhất ½ in (3.8cm): +/-)	……	…….	Chân duỗi: P hay T Mạch:
5. Test Với tay lưng	……	……..	Tay với Vai P hay T
6. Test 8-foot đứng dậy-đi	……	……..	
Test 6-phút đi bộ (số yd (0.914m)	……	N/A	

* Bỏ Test Bước 2 phút nếu Test 6-phút đi bộ được sử dụng

Appendix 4.The Falls efficacy scale questionnaire

Falls Efficacy Scale (Thang độ đánh giá ngã)

Name (tên)……

Date (ngày)……..

On a scale from 1 to 10, with *1 being very confident and 10 being not confident at all*, how confident are you that you do the following activities without falling? (Trong thang độ từ 1-10, với 1 là mức rất tự tin và 10 là mức kém tự tin nhất. Bạn cảm thấy tự tin như thế nào trong các hoạt đống sau đây)?

Activities (Các hoạt động)	Circle the number that suits the best for your answer (khoanh tròn số thích hợp nhất cho cấu trả lời của bạn) **Tự tin nhất ⟷ Kém tự tin nhất**
Take a bath or shower? (Tắm rửa)	1 2 3 4 5 6 7 8 9 10
Reaching into cupboard? (Với lên giá bát đĩa, quần áo…)	1 2 3 4 5 6 7 8 9 10
Preparing a meal (not requiring carrying heavy or hot objects? (Chuẩn bị bữa an nhưng không phải khiêng đồ vật nặng và nóng)	1 2 3 4 5 6 7 8 9 10
Walking around the house? (Đi bộ xung quanh nhà)	1 2 3 4 5 6 7 8 9 10
Getting in and out of bed? (Lên xuống giường)	1 2 3 4 5 6 7 8 9 10
Answering the door or telephone? (Mở cửa hoặc trả lời điện thoại)	1 2 3 4 5 6 7 8 9 10
Getting in and out of chair? (Đứng lên khỏi ghế)	1 2 3 4 5 6 7 8 9 10
Getting dressed of undressed? (Thay quần áo)	1 2 3 4 5 6 7 8 9 10
Doing light housekeeping? (Làm công việc quản gia nhẹ)	1 2 3 4 5 6 7 8 9 10
Doing simple shopping? (Mua sắm)	1 2 3 4 5 6 7 8 9 10
Score (Tổng điểm)	

Source: Tinetti, M., Richman, D., Powell, L. (1990). Falls Efficacy as a Measure of Fear of Falling. *Journal of Gerontology*. 45;239

Appendix 5.Mini-Mental State Exemination questionnaire

MINI-MENTAL STATE EXAMINATION (MMSE)
(THANG ĐÁNH GIÁ TRẠNG THÁI TÂM THẦN)

Name (Họ và tên):……(Age)tuổi……(Sex)giới tính
(Date of test) ngày làm test: ……

I. Orientation to time (Đánh giá về định hướng thời gian và không gian (đúng cho mỗi câu -1 điểm) (10pts)

	Correct	**Incorrect**
What is today's date? (Hãy cho biết hôm nay là ngày mấy)	1	0
What is day today? (Hãy cho biết hôm nay là thứ mấy)	1	0
What is the month? (Hãy cho biết tháng này là tháng mấy)	1	0
What is the season? (Hãy cho biết mùa này là mùa gì)	1	0
What is the year? (Hãy cho biết nặm này là năm nào)	1	0
Whose is this hause? (Hãy cho biết đây là nhà của ai)	1	0
What floor are we on? (Hãy cho biết đây là phòng (tầng) nào)	1	0
What city are we in? (Hãy cho biết đây là thành phố nào)	1	0
What country are we in? (Hãy cho biết đây là nước nào)	1	0
What state are we in? (Hãy cho biết đây là quận (phường) nào)	1	0
Total (tổng)		

II. Immediate recall (Đánh giá năng lực ghi nhận (trí nhớ tức thì) (3pts)

Ask the subject if you may test his/her memory. Say "ball", "coin", "flag" clearly and slowly, about one second for each. Then ask the subject to repeat them. Give one point each for each correct response. (Đọc tên 3 đồ vật bất kỳ (quả bóng, lá cờ, đồng xu…) một cách chập rãi, rõ ràng khoảng 1 giây cho mỗi đồ vật. Sau đó yêu cầu người được kiểm tra nhắc lại các đồ vật đó. 1 điểm cho câu đọc đúng.

Ball (Quả bong)	1	0
Flag (Lá cờ)	1	0
Coin (Đồng xu)	1	0

Total (tổng):

III. Attention and calculation (Đánh giá năng lực chú ý và tính toán. (5pts)

1. Counting backwards test (Test đếm ngược):

Ask the subject to begin with 100 and count backwards by 7. Stop at five times of substraction. Each point for correct response. (Yêu cầu người được kiểm tra làm phép tính 100-7 liên tiếp. Dừng lại sau 5 lần làm phép trừ. Cho 1 điểm cho mỗi lần trừ đúng.

93	1	0
86	1	0
79	1	0
72	1	0
65	1	0

Total (tổng):

2. Spelling backwards test (Test đánh vần ngược):
Ask the subject to spell the word "HUONG" backwards. Each point for correct response. (Yêu cầu người được kiểm tra đánh vần chữ "Hương" ngược lại. Cho 1 điểm vào vị trí đúng của mỗi từ).

G	1	0
N	1	0
Ơ	1	0
Ư	1	0
H	1	0

Compare the score of the Counting backwards and Spelling backwards tests. Write the greater of the two scores in the box labeled FINAL SCORE on the next line and use it in deriving the TOTAL SCORE. Max Score is five. (so sánh điểm của 2 phần trên, lấy điểm tổng điêm cao hơn của phần đó. Tối đa là 5 điểm.

Total (tổng)
:

IV. Recall (Đánh giá năng lực hồi ức. (3pts)

Ask the subject to recall the three words you previously asked him/her to remember. Give one point for each correct response. (Yêu cầu người được kiểm tra nhăc lai 3 đồ vật ở phần C. 1 điểm cho câu trả lời đúng).

Ball (Quả bong)	1	0
Flag (Lá cờ)	1	0
Coin (Đồng xu)	1	0

Total (tổng):

V. Language (Đánh giá về ngôn ngữ). (9pts)

1. Naming (Gọi tên)
Show the subject a wrist watch and ask him/her what it is. Repeat for pencil. Each point for correct object. (Đưa ra một chiếc đồng hồ và hỏi người tập cái gì đây. Lặp lại với bút chì. 1 điểm cho đồ vật đúng)

Watch (Đồng hồ)	1	0
Pencial (Bút chì)	1	0

Total (tổng):

2. Repetition (Nhắc lại câu).
Ask the subject to repeat "no if and or but" each point for correct response (Yêuc cầu nhắc lại "không nếu, và hoặc nhưng". nhắc đúng hoàn toàn cho 1 điểm).

1	0

tổng:

3. Three stages command (Mệnh lệnh theo 3 giai đoạn)
Establish the subjects's dominant hand. Give the subject a sheet of blank paper and say, "take the paper in your right/left hand, fold it in half and put it on the floor or

table. (Đưa cho người được kiểm tra một tờ giấy trắng và nói "cầm lấy tờ giấy bằng tay phải/trai, gấp đôi lại và đặt nó xuống nền nhà (bàn))

Take the paper in hand (Cầm lấy tờ giấy)	1	0
Fold paper in half (Gấp làm đôi)	1	0
Put paper on floor (Đặt xuống nền nhà)	1	0
	tổng:	

4. Reading (Đọc)

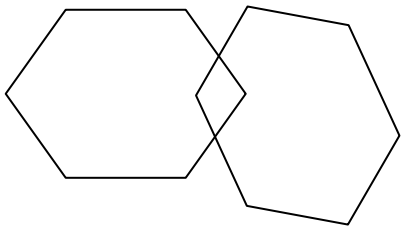
Hold up the card that reads, "close your eyes". Ask him/her to read it and do what it says. 1 point for correct response. (Đưa cho người được kiểm tra một tấm thẻ có ghi "nhắm mắt lại". Bảo người được kiểm tra đọc và làm theo. 1 điểm cho nếu làm đúng.)

5. Writing (Viết).

Give the subject a sheet of blank paper and ask him/her to write a sentence. It is to be written spontaneously. If the sentence contains a subject and a verb, and is sensible, give credit. Correct grammar and punctuation are not necessary. (Đưa cho được người kiểm tra một tờ giấy trắng, yêu cầu viết một câu theo suy nghĩ. Câu phải có chủ ngữ, động từ và có nghĩa. Ngữ pháp và chính tả sai cũng được. 1 điểm cho viết đúng yêu cầu)

5. Copying (Sao chép).

Show the subject the drawing of the intersecting pentagons. Ask him/her to draw the pentagons (about one inch each side) on the paper provided. It ten angles are present and two intersect. Ignore tremor and rotation. One point for correct drawing. (Cho người được kiểm tra một hình vẽ ngũ giác. Yêu cầu vẽ lại (chiều dài mỗi cạnh khoảng 2,54 cm). Hình vẽ phải gồm 10 góc, và có 2 góc lồng vào nhau. Hình vẽ rung hoạc quay ngược đều được. 1 điểm nếu vẽ đúng)



Total (Tổng điểm): 30 points

Evaluation (Đánh giá):

24-30: Normal
19-23: Borderline
< 19: Impaired

Appendix 6.Pittsburgh Sleep Quality Index questionnaire

PITTSBURGH SLEEP QUALITY INDEX (PSQI)
(Thang đánh giá chất lượng giấc ngủ)

Name_____ ID#_____ Date_____ Age_____

Instructions:

The following questions relate to your usual sleep habits during the past month ONLY. Your answers should indicate the most accurate reply for the majority of days and nights in the past month. For each of the remaining questions, check the one best response. Please answer all questions. (Các câu hỏi sau đây chỉ lên quan đến thói quen đi ngủ thường ngày của anh (chị) trong tháng vừa qua. Anh (chị) hãy trả lời về tình trạng giấc ngủ của mình gần đúng nhất với tình trạng của anh (chị) trong đa số ngày và đêm của tháng vừa qua. Xin hãy trả lời tất cả các câu hỏi.

1. **During the past month, when have you usually gone to bed at night**? (Trong tháng qua, anh (chị) thường lên giường đi ngủ lúc mấy giờ?

Usual bed time (giờ đi ngủ thường là):_____

2. During the past month, how long (in minutes) has it usually taken you to fall asleep each night?(Trong tháng qua, mỗi đêm anh (chị) thường mất bao nhiêu phút để chợp mắt)?

Number of minutes (Số phút thường là) _____

3. During the past month, when have you usually gotten up in the morning? (Trong tháng qua, anh (chi) thức giấc buổi sang lúc mấy giờ)?

Usually getting up time (Giờ thức giấc thường là) _____

4. During the past month, how many hours of *actual sleep* did you get at night? (This may be different than the number of hours you spend in bed.) (Trong tháng qua, mỗi đêm anh (chị) thường ngủ được mấy tiếng đồng hồ-khác với số thời gian nằm trên giường)?

Hours of sleep per nights (Số giờ ngủ được mỗi đêm là)_____

5. During the past month, how often have you had trouble sleeping because you (Trong tháng qua, anh (chị) có thường gặp các vấn đề sau gây mất ngủ cho anh (chị) không?……..

(a) cannot get to sleep within 30 minutes (Không thể ngủ được trong vòng 30 phút)

past month_____ once a week_____ twice a week_____ times a week_____

(không) (1 lần/tuần) (2 lần/tuần) (3 hoặc nhiều hơn/tuần)

(b) Wake up in the middle of the night or early morning (Tỉnh dậy lúc nửa đêm hoạc quá sớm vào buổi sang)

past month_____ once a week_____ twice a week_____ times a week_____

(không) (1 lần/tuần) (2 lần/tuần) (3 hoặc nhiều hơn/tuần)

(c) Have to get up to use the bathroom (Phải thức dậy để tắm)

past month_____ once a week_____ twice a week_____ times a week_____

(không) (1 lần/tuần) (2 lần/tuần) (3 hoặc nhiều hơn/tuần)

(d) Cannot breathe comfortably (khó thở)

past month_____ once a week_____ twice a week_____ times a week_____

(không) (1 lần/tuần) (2 lần/tuần) (3 hoặc nhiều hơn/tuần)

(e) Cough or snore loudly (Ho hoặc ngáy to)

past month_____ once a week_____ twice a week_____ times a week_____

(không) (1 lần/tuần) (2 lần/tuần) (3 hoặc nhiều hơn/tuần)

(f) Feel too cold (cảm thấy rất lạnh)

past month_____ once a week_____ twice a week_____ times a week_____

(không) (1 lần/tuần) (2 lần/tuần) (3 hoặc nhiều hơn/tuần)

(g) Feel too hot (cảm thấy rất nóng)

Past month_____ once a week_____ twice a week_____ times a week_____

(không) (1 lần/tuần) (2 lần/tuần) (3 hoặc nhiều hơn/tuần)

(h) Had bad dreams (có ác mộng)

Past month_____ once a week_____ twice a week_____ times a week_____

(không) (1 lần/tuần) (2 lần/tuần) (3 hoặc nhiều hơn/tuần)

(i) Have pain (thấy đau)

Past month_____ once a week_____ twice a week_____ times a week_____

(không) (1 lần/tuần) (2 lần/tuần) (3 hoặc nhiều hơn/tuần)

(j) Other reason(s), please describe (lý do khác, hãy mô tả)_____

_____

How often during the past month have you had trouble sleeping because of this (Trong tháng qua, vấn đề này có gây mất ngủ cho anh (chị) không?

Past month_____ once a week_____ twice a week_____ times a week_____

(không) (1 lần/tuần) (2 lần/tuần) (3 hoặc nhiều hơn/tuần)

6. During the past month, how often have you taken medicine (Prescribed or "over the counter") to help you sleep? (Trong thang qua, anh (chị) co thường phai sử dụng thuốc ngủ (sử dụng theo đơn hoặc mua về dung)?

Past month_____ once a week_____ twice a week_____ times a week_____

(không) (1 lần/tuần) (2 lần/tuần) (3 hoặc nhiều hơn/tuần)

7. During the past month, how often have you had trouble staying awake while driving, eating

meals, or engaging in social activity? (Trong tháng qua, anh (chị) có hay gặp khó khăn đê giữ đầu hóc tỉnh táo lúc lái xe, lúc ăn sang hay lúc tham gia vào các hoạt động xã hội hay không)?

Past month_____ once a week_____ twice a week_____ times a week_____

(không) (1 lần/tuần) (2 lần/tuần) (3 hoặc nhiều hơn/tuần)

8. During the past month, how much of a problem has it been for you to keep up enough enthusiasm to get things done?(Trong tháng qua, anh (chị) có gặp khó khăn để duy trì hứng thú hoàn thành các công việc không)?

No problem at all (không vấn đề gì) _____

Only a very slight problem (một ít) _____

Somewhat of a problem (chừng mực nào đó)_____

A very big problem (khó khăn lớn)_____

9. During the past month, how would you rate your sleep quality overall? (Trong tháng qua, nhìn chung anh (chị) đánh giá về chất lượng giấc ngủ của mình như thế nào?

Very good (Rất tốt)_____

Fairly good (Tương đối tốt) _____

Fairly bad (tương đối kém) _____

Very bad (Rất kém)_____

Citation: [Buysse DJ, Reynolds CF, Monk TH, Berman SR, DJ Kupfer (1989) The Pittsburgh Sleep Quality Index: A NewInstrument for Psychiatric Practice and Research, ***Psychiatry Research, 28****: 193-213*].

Appendix 7.Valuation of life questionnaire

Valuation of life
(Đánh giá chất lượng cuộc sống)

Name (tên):
Time of test (thời gian kiểm tra):

Item number	Items (mục)	1	2	3	4	5
1	I feel hopeful right now. (Bây giờ tôi cảm thấy hi vọng)					
2	Each new day I have much to look forward to.(Tôi trông đợi nhiều điều vào mỗi ngày)					
3	My life these days is a useful life.(Cuộc sống của tôi những ngày này là bổ ích)					
4	My life is guided by strong religious or ethical beliefs.(Tôi sống bằng tôn giáo và tín ngưỡng)					
5	I have strong will to live right now.(Tôi sống bằng ý chí mạnh mẽ)					
6	Life has meaning for me.(Cuộc sống thật ý nghĩa đối với tôi)					
7	I feel able to accomplish my life goals.(Tôi có thể hoàn thành mục đích sống của tôi)					
8	My personal beliefs allow me to maintain a hopeful attitude. (Niềm tin cho phép tôi duy trì hi vọng)					
9	I intend to make the most of my life.(Tôi có ý định tận dụng cuộc sống của tôi)					
10	I can think of many ways to get out of the jam.(Tôi có thể tìm ra nhiều cach để thoát khỏi sự bế tắc)					
11	I can think of many ways to get the things in life that are most important for me.(Tôi có thể có nhiều cách để đạt được những thứ quan trọng cho bản thân)					
12	Even when the others get discouraged, I know I can find my way to solve the problem.(thậm chí khi những người khác nản chí, tôi vẫn có thể tìm ra cách để giải quyết vấn đề của mình)					
13	I meet the goals that I set for myself.(Tôi đặt được mục đích mà tôi đặt ra cho cuộc sống của tôi)					

1- Strongly disagree (Rất không đồng ý)

5- Strongly agree (Rất đồng ý)

*Source: Lawton, M. P., Moss, M., Hoffman, C., Kleban, M.H., Ruckdeschel, K. (2001). "Valuation of life: a concept and a scale." Journal of aging and health **13**(1): 3-31*

Appendix 8.Trail making test questionnaire

Trail Making Test (TMT) parts A and B
(Kiểm tra nhận thức phần A và B)

Instructions:

Both parts of the Trail Making Test consist of 25 circles distributed over a sheet of paper. In Part A, the circles are numbered 1 – 25, and the patient should draw lines to connect the numbers in ascending order. In Part B, the circles include both numbers (1 – 13) and letters (A – L); as in Part A, the patient draws lines to connect the circles in an ascending pattern, but with the added task of alternating between the numbers and letters (i.e., 1-A-2-B-3-C, etc.). The patient should be instructed to connect the circles as quickly as possible, without lifting the pen or pencil from the paper. Time the patient as he or she connects the "trail." If the patient makes an error, point it out immediately and allow the patient to correct it. Errors affect the patient's score only in that the correction of errors is included in the completion time for the task. It is unnecessary to continue the test if the patient has not completed both parts after five minutes have elapsed.

Step 1: Give the patient a copy of the Trail Making Test Part A worksheet and a pen or pencil.

Step 2: Demonstrate the test to the patient using the sample sheet (Trail Making Part A – *SAMPLE*).

Step 3: Time the patient as he or she follows the "trail" made by the numbers on the test.

Step 4: Record the time.

Step 5: Repeat the procedure for Trail Making Test Part B.

Scoring:

Results for both TMT A and B are reported as the number of seconds required to complete the

task; therefore, higher scores reveal greater impairment.

	Average	**Deficient**	**Rule of Thumb**
Trail A	29 seconds	> 78 seconds	Most in 90 seconds
Trail B	75 seconds	> 273 seconds	Most in 3 minutes

Hướng dẫn

Cả 2 phần Kiểm tra nối số và ký tự này bao gồm 25 vòng tròn được vẽ lên giấy. Ở phần A, các vòng tròn được đánh dấu từ 1-25 và người được kiểm tra sẽ vẽ một đường nối các số theo thứ tự tăng dần. Trong phần B, các vòng tròn bao gồm các số (từ 1-13) và các ký tự (A-L). Cũng giống như ở phần A, người được kiểm tra sẽ vẽ đường nối các vòng tròn theo thứ tự tăng dần nhưng với một nhiệm vụ khác nữa là phải nối giữa các số và ký tự (VD: 1-A-2-B-3-C, vv…). Người tham gia được hướng dẫn để hoàn thành việc nối các vòng tròn với nhau càng nhanh càng tốt và không được nhấc bút chì lên khỏi mặt giấy. Ghi lại thời gian mà người tham gia nối các vị trí. Nếu người tham gia mắc lỗi thì chỉ ra ngay và cho phép sửa lại. Các lỗi ảnh hưởng đến điểm số của người tham gia khi việc sửa lỗi đó nằm trong thời gian nối các vòng tròn. Nếu thời gian nối các vòng tròn vượt quá 5 phút thì không cần tiếp tục kiểm tra nữa.

Bước 1: Đưa cho ngươi được kiểm tra bản sao của Kiểm tra nối số và ký tự, bút máy hoạc bút chì.

Bước 2: Làm mẫu cho người được kiểm tra xem

Bước 3: Nêu thời gian cho người được kiểm tra biết cho mỗi phần kiểm tra

Bước 4: Ghi lại thời gian

Bước 5: Làm lại các bước đối với phần B

	Bình thường	**kém**	**Theo kinh nghiệm**
Phần A	29 giây	> 78 giây	trong 90 giây
Phần B	75 giây	> 273 giây	trong 3 phút

Sources:

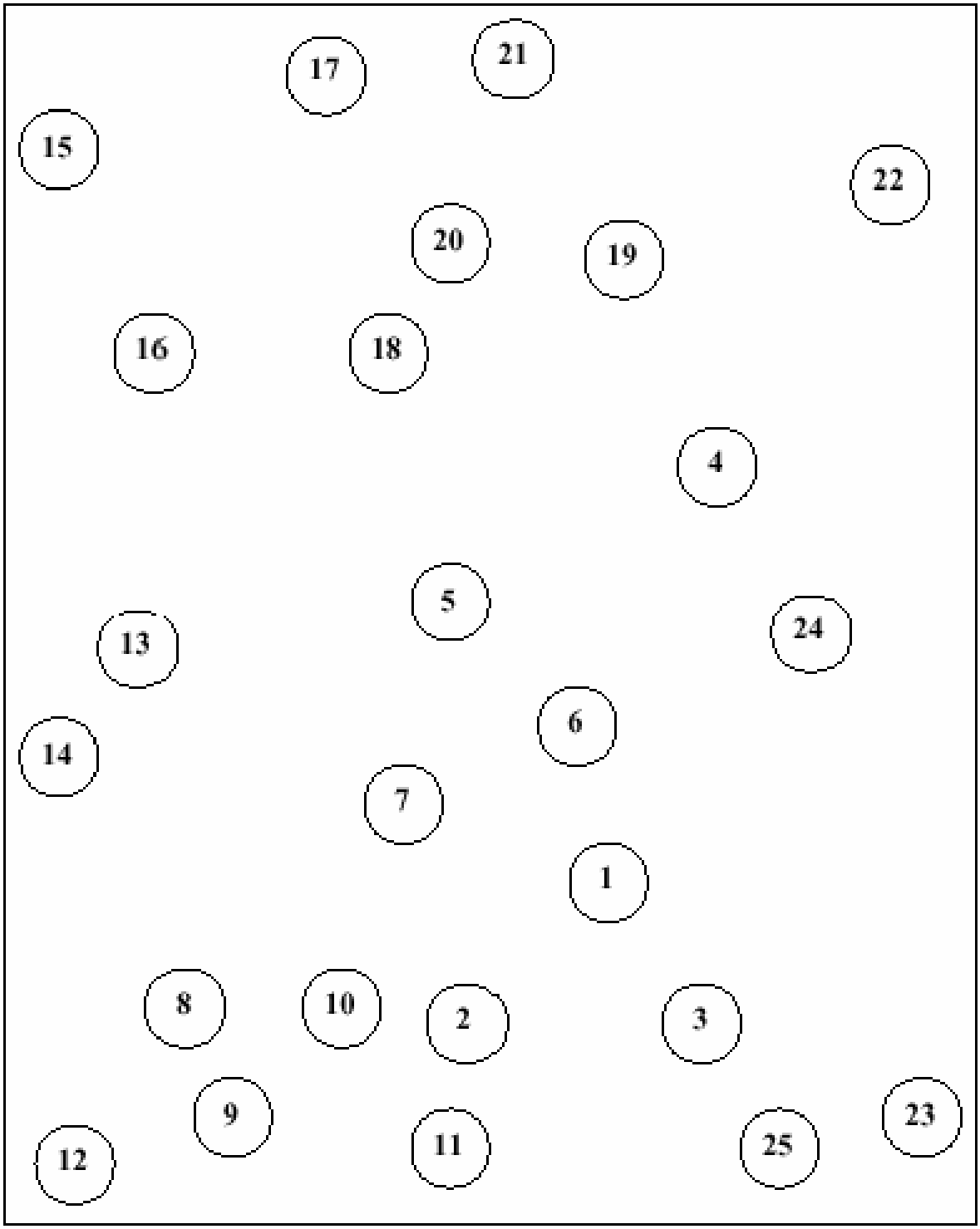
• Corrigan JD, Hinkeldey MS. Relationships between parts A and B of the Trail Making Test. *J Clin Psychol*. 1987;43(4):402–409.

• Gaudino EA, Geisler MW, Squires NK. Construct validity in the Trail Making Test: what makes Part B harder? *J Clin Exp Neuropsychol*. 1995;17(4):529-535.

• Reitan RM. Validity of the Trail Making test as an indicator of organic brain damage. *Percept Mot Skills*. 1958;8:271-276.

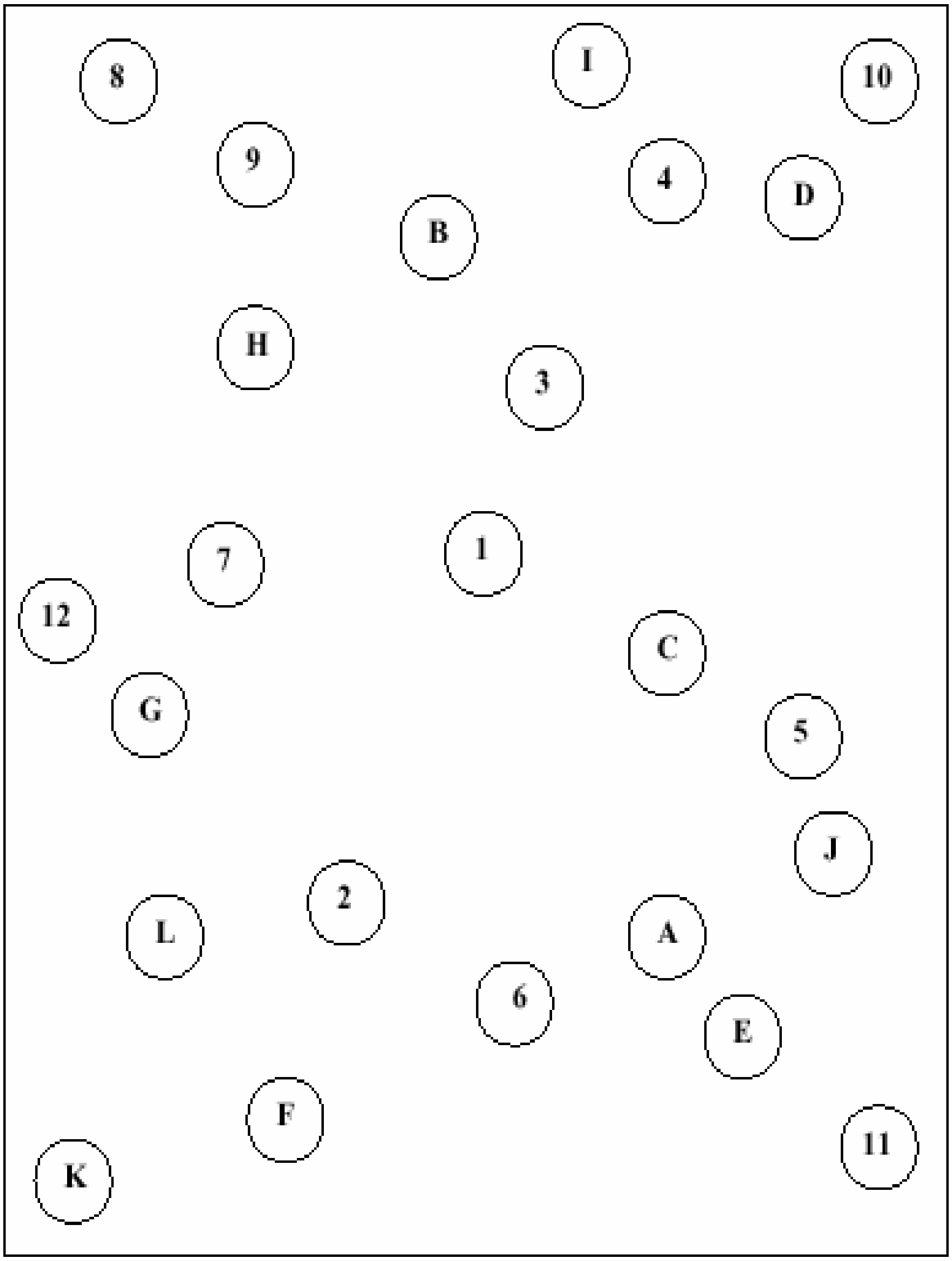
Trail Making Test Part A
(Bài kiểm tra nhận thức A)

Name (tên):……..
Date of test (ngày kiểm tra)……..



Trail Making Test Part B
(Bài kiểm tra nhận thức B)

Name (tên):……..
Date of test (ngày kiểm tra)……..



Appendix 9.Participants consent form

Participant Consent form

Dear Mr. Nguyen Manh Hung,

I have read carefully you Information Letter for participants. I understand that I will be asked to complete the questionnaires and physical assessments as mentioned. The researcher or instructor will be by my side during assessment process. I am also aware of that I can refuse or withdraw from your study anytime I want and it will not affect my relationship to other people in any way.

I understand that my information will be kept totally confidential. I can freely ask any questions and get acceptable answer. I can contact with Mrs Hoang Thi Ai Khue, phone number +84909818886; Mr. Nguyen Manh Hung, tel: +4915227591217 (Germany) or +84912169906 (Vietnam) or Email: hung.nguyen@gero.uni-heidelberg.de

I can refuse and withdraw from this study if I want without penalty. With fully foregone knowledge, I agree, with my own decision, to participate in this study.

Location, date:……
Participant's Name:…….
Signature:……

Translation

Đơn đồng ý tham gia nghiên cứu

Kính gửi ông Nguyễn Mạnh Hùng,
Tôi đã đọc các thông tin ông gửi một cách cẩn thận. Tôi biết rằng tôi sẽ được yêu cầu để hoàn thành bản câu hỏi và các đánh giá về thể chất theo yêu cầu. Người nghiên cứu cũng như người hướng dẫn sẽ làm việc với tôi trong quá trình đánh giá. Tôi có thể từ bỏ không tham gia nghiên cứu này bất cứ lúc nào và nó sẽ không ảnh hưởng đến quan hệ của tôi với mọi người.
Tôi biết rằng các thông tin của tôi sẽ được giữ kín. Tôi có thể đặt câu hỏi và sẽ được câu trả lời thoả đáng. Tôi có thể liên hệ với Bà Hoàng Thị Ái Khuê, số điện thoại 0909818886, hoặc Ông Nguyễn Mạnh Hùng, số điện thoại 004915227591217 (tại Đức) hoặc 0912169906 (tại Việt Nam) hoặc thư điện tử: hung.nguyen@gero.uni-heidelberg.de

Tôi có thể từ chối và từ bỏ tham gian nghiên cứu này nếu tôi muốn mà không bị đền bù gì. Với hiểu biết của mình, tôi tự quyết định tham gia vào nghiên cứu này.
Địa điểm, ngày……..
Người tham gia…….
Ký tên……

Republic socialist of Vietnam
Independent-Freedom-Happiness

Asking for permission

To: Tai Chi club-Truong Thi ward, Vinh city

My name is Nguyen Manh Hung.
Employer: Physical education department, Vinh University, Vietnam. Currently, I am a PhD student at Institute of Gerontology, Heidelberg University, Germany.

I am a scholarship-holder of MOET (Ministry of Education and Training of Vietnam) and DAAD. I am conducting a study "evaluating the effect of Tai Chi on the elderly in Vietnam".

I am writing to ask for permission to carry out my study at your Tai Chi club. The planned duration of study is from December, 2010 to June, 2011.

I am looking for your consideration and help.

Date, 02.08.2010

Confirmation of Tai Chi club
(signed and stamped)

T/M ban Chủ nhiệm CLB. SK NCT phường TT
Chủ nhiệm

Nguyễn thị Lan

Hội NCT Phường xác nhận
Cô Nguyễn Thị Lan là chủ nhiệm
CLB SK NCT -

BCH. HỘI PHƯỜNG TRƯỜNG THI

CHỦ TỊCH

Đào Văn Long.

PhD student
(signed)

Nguyen Manh Hung

Appendix 10.Information letter for participants at the Tai Chi club

Ruprecht-Karl-University of Heidelberg
Institute of Gerontology

Institut für Gerontologie der Universität Heidelberg

Dear Chairman of Tai Chi club of Truong Thi Ward, Vinh city, Vietnam

My name is Nguyen Manh Hung, from Physical education department, Vinh University and a PhD student at Institute of Gerontology, Heidelberg University. I am currently conducting a study as my doctoral dissertation. I am doing my doctoral research under supervision of Professor Andreas Kruse and Professor Eric Schmitt who are from the Institute of Gerontology, University of Heidelberg, Germany and I have cooperation for this study with Dr. Hoang Thi Ai Khue and my colleagues, from Physical education department of Vinh University, Vietnam.

We are conducting a study relating to the health of the elderly who are living in community dwelling. In particular, we are interested in one kind of physical exercise, Tai Chi for older adults. We are looking for several classes at your senior club in Vinh area. Our study consists of three stages. The first phase is to recruit participants and collecting data at the baseline. The second phase is carry out Tai Chi classes and to collect data at the follow-up (midpoint) and the third phase is termination (endpoint) with which the data are collected for the last time. There are two primary parts in our research; first one is an investigation of Tai Chi training. The second one is to evaluate the effect of Tai Chi on several health outcomes such as strength, flexibility, balance, self-perception of health status and mental health.

I am asking for your permission to conduct my empirical study at your center and start in **December, 2010**. The study will be carefully explained to the participants at the beginning for class. Those who volunteer to participate will be asked to sign an informed consent and will be given a background questionnaire to complete and return to the instructors. The questionnaires are about demography, self-perception of health status and balance. I have a plan to call to interview or deliver the questionnaire to participants. It is required their phone number on consent form.

Participants will be told that their involvement in this study is completely voluntary and as mentioned, I will require their consent prior participation. The results of questionnaires will be kept totally confidential. I have presented my

research proposal for my supervisors and they have also asked me that I receive approval from your club from which I may to draw my sample.

All tests and questionnaires are listed below:

- Senior Fitness Test
- SF-36
- MMSE (Mini Mental State Examination)
- Tandem
- The Fall efficacy Scale
- Bittsburgh sleep quality index
- Trail Making Test
- Demographic characteristics
- Anthropometrical measurements
- Cardio-respiratory indices

Intended period programme:

December, 2010:

- Recruiting participants
- Recruiting instructors
- Gathering and collecting data at the baseline
- Organizing Tai Chi classes

March, 2011:

- Gathering and collecting data at the follow-up period

June, 2011:

- Gathering and collecting data at the termination period

I understand that the present study is as my dissertation under the supervision of Institute of Gerontology, University of Heidelberg. All participants will be explained carefully prior participation in this study. All participants can freely withdraw from this study any time. I am also aware of the responsibility of safety of the subjects

I do hope that your club will agree to help me to carry out my study. I would be ready to speak with you regarding any questions you may have and provide you all completed research proposal if requested. I can give you my admission of faculty of behavioral and cultural studies that I once obtained. I am also reached at hung.nguyen@gero.uni-heidelberg.de or telephone number: 0049.6221.54 8170 or 004915227591217.

At the end of this page, I have made a form for you to sign. That simply states that you are aware of the study and have given me a permission to approach the Tai Chi class at your club. If you do not feel comfortable signing this form you can sign in another form as long as it shows that you give me permission.

Thank you for your considering my study.

Truong Thi Tai Chi Club, Vinh city, we are aware of the adherence study described above. I understand that participants have to sign an informed consent before participation in the study. No individual will be identified in the finding. I give Nguyen Manh Hung permission to conduct his study at Tai Chi Club.

Vinh, Date 02.08.2010

Signature
(Stamp)

T/M ban Chủ nhiệm CLB
SK. NCT Phường TT
Chủ nhiệm
Nguyễn thị Lan
Hội NCT Phường xác nhận
Cụ Nguyễn Thị Lan là Chủ nhiệm
CLB SK NCT
CHỦ TỊCH
Đào Văn Long

Nguyen, Manh Hung
PhD student
Institute of Gerontology
University of Heidelberg
Germany

Bản dịch-Vietnamese version

Trường Đại học tổng hợp Heidelberg
Viện Lão khoa

Institut für Gerontologie der Universität Heidelberg

Kính gửi: **Chủ tịch câu lạc bộ Thái cực quyền phường Trường Thi Thành phố Vinh, Việt Nam**

Tên tôi là Nguyễn Mạnh Hùng, khoa Giáo dục thể chất, trường Đại học Vinh, tôi hiện nay đang là nghiên cứu sinh tại Viện Lão khoa, Đại học tổng hợp Heidelberg. Tôi đang thực hiện một vấn đề nghiên cứu cho luận án của mình dưới sự hướng dẫn của giáo sư Andreas Kruse và giáo sư Eric Schmitt đang giảng dạy tại Viện Lão khoa, Đại học Heidelberg, Đức và tôi cũng có hợp tác với Tiến sĩ Hoàng Thị Ái Khuê và đồng nghiệp của tôi tại khoa Giáo dục thể chất, trường Đại học Vinh cho vấn đền nghiên cứu này. Chúng tôi đang thực hiện đề tài liên quan đến sức khoẻ của người cao tuổi đang sinh sống tại cộng đồng. Đặc biệt, chúng tôi rất quan tâm đến một loại hoạt động thể chất đó là Thái cực quyền cho người cao tuổi. Chúng tôi đang tìm một số lớp Thái cực quyền tại câu lac bộ của ông (bà) trong phạm vi khu vực thành phố Vinh. Nghiên cứu của chúng tôi gồm 3 giai đoạn: giai đoạn một là tuyển người tham gia nghiên cứu và thu thập số liệu tại thời điểm ban đầu. Giai đoạn hai là tiến hành các lớp Thái cực quyền và tiếp tục thu tập số liệu (thời điểm giữa) và giai đoạn 3 là giai đoạn cuối, các số liệu được thu thập lần cuối cùng và tổng hợp xử lý. Nghiên cứu của chúng tôi bao gồm có hai phần chính, phần thứ nhất là khảo sát vấn đề tập luyện Thái cựu quyền, phần thứ hai là đánh giá hiệu quả của Thái cực quyền lên một yếu tố về sức khoẻ như sức mạnh, linh hoạt, thăng bằng, tự đánh giá về tình trạng sức khoẻ thể chất và tinh thần.

Tôi muốn xin phép được tiến hành nghiên cứu thực nghiệm của mình tại câu lạc bộ của ông (bà) vào **tháng 12 năm 2010**. Nghiên cứu này sẽ được giải thích cụ thể cho người tham gia khi bắt đầu tiến hành lớp tập luyện. Những người tình nguyện tham gia vào nghiên cứu sẽ ký vào văn bản đồng ý và sẽ được phát bản câu hỏi liên quan đến vấn đề nghiên cứu, họ sẽ điền vào bản câu hỏi và nộp lại cho người hướng dẫn. Các bản câu hỏi bao gồm các vấn đề về nhân khẩu, tự cảm nhận về tình trạng sức khoẻ của mình, khả năng thăng bằng. Tôi có kế hoạch là gọi điện thoại phỏng vấn hoặc phát bản câu hỏi cho đối

tượng tham gia. Người tham gia sẽ cung cấp số điện thoại trong bản đồng ý tham gia nghiên cứu.

Chúng tôi sẽ thông báo cho đối tượng nghiên cứu biết rằng việc tham gia vào nghiên cứu của họ là tự nguyện, và như đã đề cập trên thì tôi sẽ yêu cầu bản đồng ý của họ trước khi họ tham gia. Các thông tin trong bản câu hỏi sẽ được giữ kín. Tôi đã báo cáo với người hướng dẫn của tôi về nghiên cứu của mình và họ yêu cầu tôi phải có sự chấp thuận từ phía ông (bà), từ đó tôi có thể tiến hành lấy mẫu nghiên cứu của mình.

Dưới đây là danh sách các bài kiểm tra:

- Bài kiểm tra thể chất cho người cao tuổi
- Bảng câu hỏi ngắn (36) cho người cao tuổi
- Bài kiểm tra ngắn về trạng thái tinh thần
- Kiểm tra khả năng thăng bằng
- Chỉ số đánh giá giấc ngủ
- Bộ câu hỏi kiểm tra khả năng thăng bằng và bước đi
- Kiểm tra đánh dấu
- Câu hỏi về nhân khẩu
- Kiểm tra một số chỉ số nhân chủng học
- Kiểm tra một số chỉ số tim mạch

Dự kiến các giai đoạn:

Tháng 12, 2010:

- Tuyển đối tượng nghiên cứu
- Tuyển huấn luyện viên
- Thu tập số liệu ban đầu
- Tổ chức tập luyện

Tháng 3, 2011:

- Thu tập số liệu giai đoạn tiếp theo

Tháng 6, 2011:

- Thu thập số liệu giai đoạn cuối

Tôi hiểu rằng vấn đề nghiên cứu hiện tại này là luận văn của tôi, dưới sự hướng dẫn của các giáo sư thuộc viện Lão khoa, đại học Heidelberg. Tất cả đối tượng tham gia đề được hiểu rõ vấn đề nghiên cứu này trước khi tham gia. Đối tượng tham gia có thể từ chối hoặc bỏ cuộc bất cứ lúc nào. Tôi cũng ý thức được trách nhiệm đảm bảo an toàn cho đối tượng nghiên cứu.

Tôi hi vong rằng câu lạc bộ của ông (bà) sẽ đồng ý giúp đỡ tôi thực hiện nghiên cứu này. Tôi sẵn sang nói chuyện với ông (bà) về các câu hỏi liên quan đên nghiên cứu và cung cấp cho ông (bà) bản đề cương nghiên cứu đầy đủ nếu ông (bà) yêu cầu. Tôi có thể gửi cho ông (bà) thông báo trúng tuyển vào Viện Lão khoa thuộc khoa nghiên cứu Văn hoá và Ứng xử nếu cần thiết. Địa chỉ thư điện tử của tôi là hung.nguyen@gero.uni-heidelberg.de hoặc số điện thoại: 0049.6221.54 8170 hoặc 004915227591217.

Ở cuối trang này, tôi có tạo một mẫu để ông (bà) cho ý kiến đồng ý, nó đơn giản là để ông (bà) biết về nghiên cứu của tôi và đồng ý cho phép tôi nghiên cứu tại câu lạc bộ của ông (bà). Nếu ông (bà) nhận thấy nó không phù hợp thì có thể dùng mẫu khác miễn là cho phép tôi.

Xin cảm ơn sự xem xét của ông (bà)

Câu lạc bộ Thái cực quyền phường Trường Thi đã xem xét vấn đề nghiên cứu trên. Tôi biết rằng người tham gia nghiên cứu phải ký văn bản đồng ý. Thông tin cá nhân về đối tượng nghiên cứu sẽ không bị tiết lộ. Tôi đồng ý cho ông Nguyễn Mạnh Hùng tiến hành nghiên cứu tại câu lạc bộ Thái cực quyền.

Vinh, ngày 02.08.2010

Ký tên

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Nghiên cứu sinh

Viện Lão khoa

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Đức

Hội NCT xác nhận cô Nguyễn Thị Lan là chủ nhiệm CLB SK NCT.

CHỦ TỊCH

Đào Văn Long

Photos taken at tests

Presentation and publications

Nguyen, M.H. & Cihlar, V. (2013). Differences in physical fitness and subjectively rated health between Vietnamese and German older adults. ***Journal of Cross-Cultural Gerontology***. 28 (2): 181-194. **Springer US**.

Nguyen, M. H & Kruse, A. (2012). The effects of Tai Chi training on physical fitness, perceived health, and blood pressure in elderly Vietnamese. ***Open Access Journal of Sports Medicine***. 2012:7-16.

Nguyen, M. H & Kruse, A. (2012). A randomized controlled trial of Tai chi for balance, sleep quality and cognitive performance in elderly Vietnamese. ***Clinical Intervention Aging***. 2012:185-90.

Cihlar, V. & Nguyen, M.H. (2011, September). *Differences in physical fitness and subjectively rated health between German and Vietnamese older adults*. Poster präsentiert im Rahmen der gemeinsamen Jahrestagung der Sektion III und der Sektion IV der Deutschen Gesellschaft für Gerontologie und Geriatrie, Frankfurt am Main.

List of abbreviations

ANOVA	Analysis of Variance
BMI	Body Mass Index
BP	Body Pain
CHD	Coronary Heart Disease
CT	Control
DBP	Diastole Blood Pressure
e.g.	For example
FES	The falls Efficacy Scale
Fig(s).	Figure(s)
GH	General Health
HRQL	Health Related Quality of Life
MCS	Mental Component Summary
MH	Mental Health
mmHg	millimeters of mercury
MMSE	Mini-Mental State Examination
PCS	Physical Component Summary
PD	Parkinson’s disease
PF	Physical Function

PSQI	Pittsburgh Sleep Quality Index
QOL	Quality of Life
RE	Role Emotion
RP	Role Physical
SBP	Systole Blood Pressure
SF	Social Functioning
SF-36	Short Form 36
SFT	Senior Fitness Test
SPSS	Statistical Package for Social Sciences
TC	Tai Chi
TMT	Trail Making Test
VOL	Valuation of Life
VT	Vitality
WHR	Waist Hip Ratio

Erklärung gemäß § 8 Abs. 1 Buchst. b) und c) der Promotionsordnung der Fakultät für Verhaltens- und Empirische Kulturwissenschaften

Ich erkläre, dass ich die vorgelegte Dissertation selbstständig angefertigt, nur die angegebenen Hilfsmittel benutzt und die Zitate gekennzeichnet habe.

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