A STUDY TO DETERMINE THE EFFECTS OF ARM SWING EXERCISE AND HULA HOOP EXERCISE ON PERSONS AT RISK OF DYSLIPIDEMIA DISEASE

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ABSTRACT

The objective of this study was to compare the effects of arm swing exercise and hula hoop exercise on lipid profiles in persons at risk of dyslipidemia disease. A total of 50 participants at risk of dyslipidemia disease aged 25-50 years were randomly assigned to arm swing exercise (ASE) group (n=25), and hula hoop exercise (HHE) group (n=25). ASE and HHE training programs were designed to yield the same energy expenditure/exercise sessions and included performing for 30 minutes/day, 3 times/week for 8 weeks. The ASE and HHE in this study were designed to be moderate aerobic exercise for individual. Lipid profile variables between pretest and posttest were analyzed by paired t-test. Independent t-test was used to compare the variables among groups. Differences were considered to be significant at $p<0.05$. The results of the present study were as follows: levels of cholesterol, triglyceride, HDL, and LDL in both the ASE and HHE groups were not significantly different when compared with pretest results. For the ASE group, there was no significant difference in the levels of cholesterol ($p=0.81$), triglyceride ($p=0.25$), HDL ($p=0.44$), and LDL ($p=0.46$). For the HHE group, there was no significant difference in the levels of cholesterol ($p=0.34$), triglyceride ($p=0.16$), HDL ($p=0.30$), and LDL ($p=0.20$). It was concluded that arm swing exercise and hula hoop exercise cannot improve lipid profiles in persons at risk of dyslipidemia.

However, arm swing exercise and hula hoop exercise can reduce percent body fat for persons at risk of dyslipidemia. Percent body fat in both the ASE and HHE groups decreased significantly when compared with pretest Valued: ASE ($p<0.001$) and HHE ($p<0.001$). Although arm swing exercise and hula hoop exercise cannot improve lipid profiles, both exercises can reduce percent body fat for persons at risk of dyslipidemia.

Keywords: Arm Swing Exercise/Hula Hoop Exercise/Dyslipidemia

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CHAPTER 1

INTRODUCTION

1.1 Background and Rationale

The health and healthy living of population has been a major concern of many countries including Thailand. According to the dyslipidemia in Thai population National Health Examination Survey IV, 2009, many leading institutes in Thailand discovered that cardiovascular diseases (CVD) were are among the leading causes of death in Thai Population. Low HDL and high LDL are associated with increased risk of CVD major events. The prevalence of dyslipidemia other than high total cholesterol level is not clear in Thai population due to low rate of screening and treatment. Therefore, it is very vital to monitor and evaluate the situation of dyslipidemia in Thai population (Aeplakorn et al., 2014).

Dyslipidemia is a risk factor of atherosclerosis and cardiovascular diseases and mostly coronary heart disease, cerebrovascular disease, and peripheral arterial disease. There are different disorders of lipoprotein abnormalilties such as high total cholesterol (TC), elevated low-density lipoproteins (LDL), elevated triglycerides (TG), and decreased high-density lipoproteins (HDL). Dyslipidemia is a major risk factor of developing cardiovascular disease (CVD). It is a significant public health problem of elderly worldwide including Thailand. Previous studies had limited information on the CVD risk factors for the different Thai population groups. Clinical observational surveys has clearly shown that Dyslipidemia is very common in Thai population and it increases with age, trends in prevalence of dislipidemia increase, the most common dyslipidemia is low HDL in women and High TG in men, and high LDL is more common in those living in urban areas (Aeplakorn et al., 2014).

Cardiovascular Disease

Cardiovascular disease includes illnesses that involve the blood vessels (vein, arteries, and capillaries or the heart, or both). It is a disease that affects the cardiovascular system. There are many risk factors that contribute to the development of cardiovascular disease. Some people are born with conditions that predispose them to heart disease and stroke, but most people who develop cardiovascular disease do so because of a combination of factors such as poor diet, lack of physical activity and smoking. The more risk factors a person expose him or herself to, the higher the chance of developing cardiovascular disease. Many of the risk factors for cardiovascular disease cause problems because they lead to atherosclerosis. Atherosclerosis is the narrowing and thickening of arteries and it develops for years without causing symptoms. It can happen in any part of the body. Around the heart, it is known as coronary artery disease, in the legs it is known as peripheral arterial disease. The narrowing and thickening of the arteries is due to the deposition of fatty material, cholesterol, and other substances in the walls of blood vessels. The deposits are known as plaques. The rupture of a plaque can lead to stroke or a heart attack.

According to Gersh, Sliwa, Mayosi and Yusuf (2010), the epidemic of CVD in the developing world is a global problem that remains the leading cause of death in the world. Approximately 80% of all cardiovascular-related deaths occur in a low-and middle-income country and at younger age in comparison to high-income countries. The economic impact in regard to loss of productive years of life and the need to divert scarce resources to tertiary care is substantial.

Gersh, et al. (2010) provided a useful framework for understanding changes in the patterns of disease as a result of socioeconomic and demographic developments. The framework included four basic stages: (1) pestilence and famine, (2) receding pandemics, (3) degenerative and manmade disease, and (4) the phase of delayed degenerative disease. In stage 3, improvements in socioeconomic status and urbanization are accompanied by marked changes in risk factors for CVD including increased fat and caloric intake, tobacco use, and reduced levels of exercise leading to hypertension, obesity, and atherosclerosis.

1.2 Thai Population and Dyslipidemia

In Thailand, during the past thirty years, there were many transitions which effect Thai population lifestyles. Many nation-wide surveys indicated that the population food consumption pattern had changed. Peoples tended to replace their rice, side dishes and vegetables to diets containing a higher proportion of fat and animal meat. Their lifestyle also had changed from preparing food at home to purchasing ready-to-eat food (Kosulwata, 2002).

According to Pongchaiyakul, Hongsprabhas, Pisprasert and Pongchaiyakul (2006), lifestyle changed and people tended to eat unhealthy diet and had low physical activities which resulted in a rising lipid level and prevalence of dyslipidemia. Dyslipidemia is a major risk factor of developing coronary artery disease (CAD). It is a significant public health problem of elderly worldwide including Thailand. Screening and management need to be intervened to encourage a healthy diet and lifestyle in order to turnaround the rising lipid problem and prevent coronary artery disease in the Thai population.

Thai Health Promotion Foundation, BOD Working Group (2009) reported the status of health of Thai population in "Burden of Disease in Thailand 2009." The report used Disability-Adjusted Life Year (DALY) to explain the magnitude of the health conditions. DALY is the sum of the years of life lost due to premature mortality (YLL) and the equivalent healthy years lost due to disability (YLD). One DALY is one lost year of healthy life. In this report, cardiovascular diseases ranked first in burden (DALY) among leading broad disease groups. In a closer look at the burden, 30-59 years of age, for male 13% of 2.6 million DALYs were lost due to cardiovascular disease, and for women 11% of 1.8 million DALYs were lost due to the same disease. For men and women who were 60 years of age and over 23% of 1.5 million DALYs for men and 23% of 1.7 million DALYs for women were lost due to CVD. This issue is significant to seek any treatment modalities for improving health conditions of Thai population.

Anti-Aging medicine encourages us all to rethink about aging-related heart disease in a way that we are in control of our heart health. Besides genetic and lifestyle our heart is damaged greatly by the oxidation and inflammation in the arteries and it all starts with cholesterol (Roizen, Oz & Hallgren, 2007)

Triglyceride is very important lipid to consider. Research is now showing that high level of triglycerides may also be linked to cardiovascular disease, especially when combined with low HDL and elevated LDL (Miller et al., 2011). LDL is the main source of artery-cloging plaque, increasing risk of heart disease, also known as "bad cholesterol" while HDL is responsible for transport of cholesterol from the blood and artery walls to the liver where it is converted to bile to be used for digestion or disposed of by the body, also known as "good cholesterol" (Vella, Kravitz & Janot, 2001). Triglyceride is the type of lipid that is accompanied by an increased content of intramyocellular triglyceride and largely reflects ineffective utilization of fat. In contrast, aerobic activity enhances lipid oxidation, thereby facilitating the hydrolysis and utilization of triglycerides in skeletal muscle. The effect of physical activity on triglyceride levels varies depending on baseline triglyceride, level of intensity, caloric expenditure, and duration of activity (Miller, et al., 2011). In a review of studies on cardiovascular disease, comprehensive analysis, it is confirmed that exercise reduce blood pressure and heart rate. Regular exercise programs reduce the risk of stroke, not only by lowering blood pressure, but also by increasing peripheral circulation and oxygen delivery. The conclusion regarding exercise is that it is never too late to reap the benefits for a properly structured program (Segala, 2004). Based on these data, one of the treatments of dyslipidemia is through adherence to exercise programs. Exercise adherence is important for enhancing the long-term effect of exercise as to promote the physical and psychological health of the exercisers.

Due to busy lifestyle, it is difficult to encourage people to exercise regularly. To help alleviate this problem, the researcher of this study attempts to develop exercise programs for adult population and encourage them to integrate exercise in their routines. In developing an exercise program, the nature of the exercise and health characteristics of individuals who will participate need to be considered. The researcher of this study will develop an arm swing exercise and a hula hoop exercise, and to investigate the effects of these two exercises on improving lipid profile levels.

1.3 Exercise Programs

Exercise can help people to lose their weight and that will lower their total cholesterol level. LDL is the kind of lipoprotein that has been link to CVD and tends to be higher in individual who is overweight (Davis, 2007).

Davis (2007) explained further how exercise could lower total cholesterol level. The first mechanism, exercise stimulates enzymes that help mobilized LDL-cholesterol from the blood and blood circulation and also to blood vessel walls to liver. Then, the cholesterol is converted into bile for digestion or excreted out of the liver. In conclusion, the more a person exercise, the more his or her body removes LDL. The second mechanism, exercise increases the size of lipoprotein, the protein particles that carry cholesterol through the blood. The small, dense LDL particles are more dangerous than bigger ones because the smaller ones can squeeze into the linings of the heart and blood vessels and damage the cardiovascular system. Exercise can help increases the size of the protein particles that carry both good and bad lipoproteins.

Arm Swing Exercise (ASE) is an Asian style of exercise. It seems to be appropriate for everyone because of its simple, low impact to joint and easily accessible, convenient for people to perform. There was a study to determine the effect of arm exercise on metabolic parameters in T2DM patients who lives in urban area in Khon Kaen province (Leelayuwat, 2006). The results suggested that thirty-minutes arm swing per day for 8 weeks contributed to a reduction in HbA1c and important risk factor of cardiovascular risks. Therefore, arm swing training may be an alternative intervention that reduces CVD risk of T2DM patients. Even though the results shown no differences on lipid profile, the researcher suggested that further study on a better pattern of arm swing that may improve the factors of cardiovascular risks should be performed.

Hula Hoop Exercise (HHE) is the other type of exercise proposed in this study. It is not a new invention; it had been around 1000 BC and became popular in 1950's. Hula hoop exercise is also an exercise for all ages, simple, enjoyable, and low cost exercise to maintain. There was a study on the effects of hula hoop exercise training program on health-related physical fitness, spot reduction and lipid profile level in overweight women (Rungudom & Suksom, 2012). The results conclude that hula hoop exercise program is

useful for reduce circumference and subcutaneous fat in specific parts. It can also improve muscle strength, but there was no change in body weight, percentage of body fat, or lipid profiles. There was another research supported by American Council on Exercise proposed that hula hoop exercise is comparable to step aerobic and kick boxing and can be developed to improve cardiovascular strength (Holthusen, Porcari, Foster, Doberstein & Anders, 2011).

This study was to determine the effects of ASE and HHE on lipid profiles in persons at risk of dyslipidemia in order to provide a guide to training and practice. The study focused on 25-50 years old participants who were at risk for dyslipidemia, lived in urban area, and were engaged in various life styles and occupations. The modifications of their lifestyle would be mainly on exercise programs. These 50 participants performed an ASE or HHE continuously for 30 minutes per day, 3 days per week. The ASE and HHE in this study were designed to be moderate aerobic exercise for each individual. The participants health characteristics and lipid profiles were measured prior to the exercise program intervention and after the eight week experimental exercise programs were completed.

1.4 The Purpose of the Study

The purpose of this study was to determine the effects of arm swing exercise on lipid profile in persons at risk of dyslipidemia disease compared to the effects of hula hoop exercise.

1.5 Research Question

Can arm swing exercise improve lipid profile better than hula hoop exercise in persons at risk of dyslipidemia disease?

1.6 Research Hypothesis

Arm swing exercise can improve lipid profile in person at risk of dyslipidemia disease better than hula hoop exercise.

1.7 Conceptual Framework

The conceptual framework in this study was shown in Figure 1.1

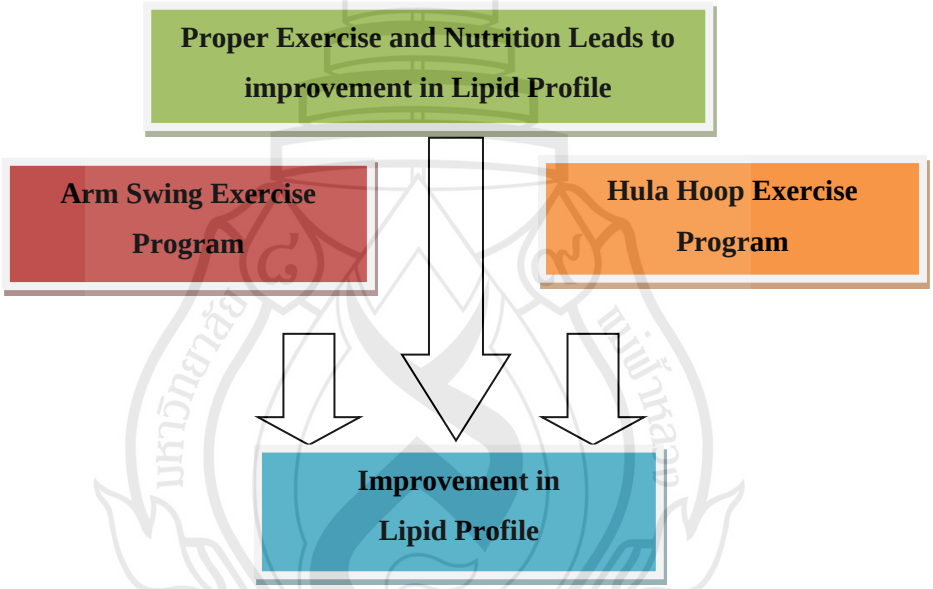


Figure 1.1 Conceptual Framework of the Research

1.8 Significance of the Research

1.8.1 This study would add to the body of knowledge on the effects of arm swinging and hula hoop exercises and the treatment of dyslipidemia disease.

1.8.2 This study could provide guidance to people who need exercises for the prevention or treatment of dyslipidemia.

1.8.3 The successful development of an exercise program which could promote continual practice of therapeutic exercise among persons with dyslipidemia was likely to lead to a reduction in health care costs.

1.8.4 This study could be a database for further study.

1.9 Scope of the Study

This study was limited to participants who were women or men in the 25- 50 years of age range, lived in Bangkok and were engaged in various life styles and occupations. The LDL levels of these participants were above 100 mg/dL and no medications for cholesterol were taken. These participants could perform arm swing exercise or hula hoop exercise continuously during the training period. From the total of 50 participants, 25 women or men were assigned to arm swing exercise group and the others were assigned to hula hoop exercise group. Each individual performed exercise continuously according to the assignment given for 30 minutes per day, 3 days per week. The ASE and HHE in this study were designed to be moderate aerobic exercise for each individual. The participants' health characteristics and lipid profile were collected prior to the exercise program intervention and after the eight week experimental exercise programs were completed. Variables in this study included arm swing exercise and hula hoop exercise as independent variables, and lipid profile as dependent variables.

1.10 Operational Definitions

Dyslipidemia is a disorder of lipoprotein metabolism, including lipoprotein overproduction or deficiency. Dyslipidemia, defined as elevated total or low-density lipoprotein (LDL) cholesterol levels, or low levels of high-density lipoprotein (HDL) cholesterol, is an important risk factor for coronary vascular disease (CVD), and stroke (Fodor, 2011).

Cholesterol is a waxy, fat like substance found in all animal products. The body can make cholesterol in the liver and it can absorb cholesterol from the diet. Cholesterol is essential to the body and is used to build cell membranes, produce sex hormones, and

form bile acids, which are necessary for the digestion of fats. Our body needs cholesterol in order to have optimal health, but too much cholesterol can builds up in the walls of the arteries, causing a process called atherosclerosis, a form of cardiovascular disease. This condition occurs in different patterns and is often preventable and treatable.

CHAPTER 2

LITERATURE REVIEW

Literature search for this study was conducted on available printed documents and electronic on line databases including TRF elibrary, ProQuest Research Library, MEDLINE, and other medical and physical exercise sources. Abstracts of the retrieved studies were assessed, and relevant studies were selected for this review. Additional searches were carried out by assessing the reference lists of all the included articles or reports. Related literatures included in this section were organized into (1) dyslipidemia, (2) exercise and health, (3) exercise and lipids, (4) exercise and LDL triglycerides, (5) exercise and triglycerides, (6) arm swing exercise, and (7) hula hoop exercise.

2.1 Dyslipidemia

2.1.1 Definition of Dyslipidemia

According to Fodor (2011), dyslipidemia is a disorder of lipoprotein metabolism, including lipoprotein overproduction or deficiency that leads to atherosclerosis, cardiovascular diseases, coronary heart disease, cerebrovascular disease, and peripheral arterial disease. Dyslipidemia may be manifested in many ways.

2.1.1.1 Elevation of the total cholesterol (TC)

2.1.1.2 Elevation of, the “bad” low-density lipoprotein (LDL) cholesterol

2.1.1.3 Elevation of the triglyceride (TG) concentrations

2.1.1.4 Decrease in the “good” high-density lipoprotein (HDL) cholesterol

2.1.1.5 Combination of two or more dyslipidemia manifestations.

2.1.2 Epidemiology of Dyslipidemia

According to Ginberg and Goldberg (2001) and Goldstein (2001) the epidemiology of dyslipidemia can be categorized into primary, secondary, and dietary causes of dyslipidemias.

2.1.2.1 Primary dyslipidemia (genetic)

Some genetic predisposition causes dyslipidemia such as Polygenic hypercholesterolemia, familial hypercholesterolemia (FH), and familial combined hyperlipidemia.

2.1.2.2 Secondary dyslipidemia (lifestyle and others)

Medical condition such as hypothyroidism, cholestasis, and nephritic syndrome can cause dyslipidemia by increasing LDL. Medications such as thiazides, progestogens, and cyclosporine are involved with the production or destruction of lipoprotein therefore can cause dyslipidemia. The most common causes of high triglyceride include diabetes, obesity, renal failure, alcohol consumption, pregnancy, stress, and taking medications or hormone such as estrogen, beta-blockers, glucocorticoids, thiazidea and protease inhibitors. The causes of low HDL include medical conditions such as diabetes, obesity, smoking cigarette, and taking anabolic steroids, testosterone, estogen, or beta-blockers.

2.1.2.3 Dietary dyslipidemia

High fat and high cholesterol diet such as animal fat, butter, sausage, egg yolk, liver and oyster increase LDL level. Excess consumption of calories, high sugar especially high fructose corn syrup and sucrose, high carbohydrate, alcohol consumption all increase triglyceride level.

2.1.3 Signs and Symptoms of Dyslipidemia

Dyslipidemia itself usually causes no symptoms but can lead to symptomatic vascular disease, including coronary artery disease (CAD), stroke, and peripheral arterial disease. High levels of TGs (> 1000 mg/dL [> 11.3 mmol/L]) can cause acute pancreatitis. High levels of LDL can cause arcus corneae and tendinous xanthomas at the Achilles, elbow, and knee tendons and over metacarpophalangeal joints. Patients with the homozygous form of familial hypercholesterolemia may have the above findings plus planar or tuberous xanthomas. Planar xanthomas are flat or slightly raised yellowish

patches. Tuberous xanthomas are painless, firm nodules typically located over extensor surfaces of joints. Patients with severe elevations of TGs can have eruptive xanthomas over the trunk, back, elbows, buttocks, knees, hands, and feet. Patients with the rare dysbetalipoproteinemia can have palmar and tuberous xanthomas (Goldberg & Manual, 1899).

Severe hypertriglyceridemia (> 2000 mg/dL [> 22.6 mmol/L]) can give retinal arteries and veins a creamy white appearance (lipemia retinalis). Extremely high lipid levels also give a lactescent (milky) appearance to blood plasma. Symptoms can include paresthesias, dypsnea, and confusion (Goldberg & Manual, 1899)

2.1.4 Assessment of Dyslipidemia

The American Association of Clinical Endocrinologists of Hyperlipidemia 2012, Adult treatment Panel (ATP) and National Cholesterol Education Program (NCEP) suggest that a person who is 20 years old and above should have blood test for lipid profiles which includes total cholesterol, triglyceride, LDL, and HDL. This blood test should be done after at least 12 hours of fasting (Panyakorn & Rintara, 2014).

According to the National Cholesterol Education Program (NCEP) (2002), a person who has low risk of CVD should have TC<200 mg/dL, LDL<100 mg/dL, HDL 40 mg/dL, and TG<150 mg/dL. Details were shown in Table 1.1

Table 2.1 Shows the Range of Dyslipidemia by National Cholesterol Education Program (NCEP)

Levels of Lipid Profiles (mg/dL)	Classification
LDL cholesterol	
<100	Optimal
100-129	Near Optimal/Above Optimal
130-159	Borderline high
160-189	High
≥190	Very high

Table 2.1 (continued)

Levels of Lipid Profiles (mg/dL)	Classification
Total Cholesterol	
<200	Optimal
200-239	Borderline High
≥240	High
HDL Cholesterol	
<40	Low
≥60	High
Triglyceride	
<150	Optimal
150-199	Borderline High
200-499	High
≥500	Very High

Third report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III). (NIH Publication No. 01-3670). Bethesda, MD: National Institutes of Health.

2.1.5 Treatment of Dyslipidemia

According to the National Lipid Association Annual Summary of Clinical Lipidology 2015, the treatment of dyslipidemia includes nutritional therapy, physical activity, weight management , bariatric surgery, and pharmacotherapy. Clinical trial data support several nutrition interventions as effective, with the greatest weight and metabolic benefits being observed among patients who are most adherent. The nutrition interventions must include appropriate education and follow up by a health professional trained in nutrition. For the physical activity, the exercise training volumes of 1200 to 2200 kcal/week can reduce triglyceride levels 4%to 37%, increase HDL by 2%-8%, and LDL levels ranging from no change to a 7% reduction. The lipid parameter most consistently improved with weight loss is the reduction in triglyceride levels, which is the

lipid parameter most associated with adiposopathic dyslipidemia. Gastric bypass procedures generally produce greater improvements in lipid and other metabolic parameters because of greater reductions in body fat, alterations in gut and other hormones, and improvements in inflammatory factors. Lipid pharmacotherapy is Statin. Non-statin drug classes for lipid management include cholesterol absorption inhibitors, bile acid sequestrants, fibric acids, long-chain omega-3 fatty acids, and nicotinic acid (Bay, Jones, Brown & Jacobson, 2014)

Dyslipidemia is a major risk factor of developing cardiovascular disease (CVD). It is a significant public health problem of elderly worldwide including Thailand. Previous studies had limited information on the CVD risk factors for the different Thai population groups, and clinical trials had clearly shown that there were great changes in cholesterol among different groups (Aeplakorn et al., 2014). As a result of this, the National Cholesterol Education Program (NCEP) developed guidelines for the detection, evaluation, and treatment of high blood cholesterol in adults. This guidelines released in May 2001 were to help people understand the association of dyslipidemia with CVD, improve understanding of other CVD risk factors, and advance in technical and therapy.

Kosulwata (2002) reported that overweight and obesity among children and adolescents had increased dramatically during the past 20 years. Children from private schools and urban communities experienced increasing weight more than those from public schools or rural areas. In addition, two nation surveys in 1991 and 1996 also indicated that Thai adults had problems of overweight and other risk factors for cardiovascular disease and these problems have increased significantly among Thai population.

The changes in dietary pattern and lifestyle affected high serum lipid levels. According to the data of the National Health Survey in Thai population, the prevalence of high cholesterol increased with age from below 10 percent in young adult to about 25 percent in elderly. Nillakupt et al. (2005) reported in their study that the cholesterol levels and prevalence of dyslipidemia of young adults in Thailand were slightly higher than young adults in Singapore and other countries in Southeast Asia who have a similar lifestyle changed from the past decades. Elevated serum total cholesterol and a low level of HDL cholesterol were risk factors for death from cardiovascular disease (CVD). Other risk factors include age, sex, cigarette smoking, high blood pressure, and depression.

There are different ways to manage high cholesterol in patients with metabolic disorder. Some patients might require pharmacologic therapy which others can be controlled with modification in lifestyle alone. Huang (2009) cited the guidelines recommended by The National Cholesterol Education Program (NCEP) Adult Treatment Panel III (ATP III). According to the NCEP ATP III (2002) guidelines, patients with at least 3 of the following clinical signs to be designated as having metabolic syndrome: (1) abdominal obesity shown in large waist circumference (men>40 inch, women>35 inch), (2) low HDL level (men<40 mg/dL, women<50 mg/dL), (3) high triglyceride level over 150 mg/dL, (4) high blood pressure 130/85 mmHg or on antihypertensive medications, and (5) fasting blood glucose over 100 mg/dL or treatment with antidiabetic medications.

The Fourth National Health Examination Survey conducted (2009) was the first national survey in Thailand by which major lipid parameters including total cholesterol, HDL, and triglyceride were measured. Aekplakorn et al. (2014), using data from the Survey, documented the distribution of lipid parameters and prevalence of dyslipidemia among Thai adults and provided useful information for prevention and control of the disease. The information could be used as the baseline data for monitoring and evaluation of dyslipidemia in the country. According to the Survey, prevalence of high LDL, low HDL, and high triglycerides were 29.6 %, 47.1 %, and 38.6%, respectively. The data also revealed that overall adults aged 20 years and over, 66.5% of them had some forms of dyslipidemia. Triglyceride level was the highest in the Northeast residents of Thailand.

Stone (2006) conducted a study on the control of dyslipidemia in patients with metabolic syndrome. He concluded that if there was no change in metabolic syndrome patient's lifestyle, existing metabolic and cardiovascular risk factors would be worse or a new one would be developed. The lifestyle changes recommended by NCEP ATP III (2002) for controlling dyslipidemia include: (1) reduced intake of saturated fats and dietary cholesterol, (2) intake of dietary options to enhance lowering of low-density lipoprotein cholesterol, (3) weight control, and (4) increased physical activity. Stone (2006) also recommended that if lifestyle changes were not successful for individuals at high risk of developing coronary heart disease (CHD), or for those who currently have CHD, a CHD risk equivalent, or persistent atherogenic dyslipidemia, then pharmacotherapy may be necessary as defined by NCEP ATP III guidelines. Increased physical activity is one of the viable solutions for prevention of developing dyslipidemia.

Due to busy lifestyle, it is difficult to encourage people to exercise regularly. To help alleviate this problem, the researcher of this study attempts to develop exercise programs for adult population and encourage them to integrate exercise in their routines.

Heart disease is also the number one killer of American women and is responsible for half of the deaths of women over 50 years of age. Menopause brings changes in the level of fats in a woman's blood called lipids and the elevated lipids can lead to stroke, heart attack, and death. Besides that stroke is also a leading cause of serious long-term disability. In the United States, stroke costs the nation $34 billion annually, including the cost of health care services, medications, and lost productivity (CDC, NCHS, 2015).

2.2 Exercise and Health

Exercise is the first-line major anti-aging intervention. Physical activity is essential to prolong life expectancy. Exercise improves the medical condition known as frailty, a state of vulnerability associated with increases risks of falls, hospitalization, cognitive deficits, and psychological stress (Goldman, 2012). Regular physical activity can improve an individual's mental health and cognitive functions, as well as physical wellbeing and quality of life. The exercise program should be fun and effective. Agency for Healthcare Research and Quality suggested a principle called "FITT" in performing exercise for health. The FITT principle is a guideline for frequency, intensity, time, and type. There were also safety techniques and other guidelines to consider such as determining readiness for physical activity, always having a warm up and cool down at each session, and monitoring exercise intensity (Agency for Healthcare Research and Quality, 2014).

Prevention of heart disease is one of the major goals for healthy living and life extension. Health care professionals recommended adults to have a routine of regular exercise. One of the guidelines recently proposed was from U.S. Department of Health and Human Services (Department of Health and Human Service, U.S., 2008). The guidelines suggested that a person should engage in 2 hours and 30 minutes per week of moderate-intensity physical activity, or 1 hour and 15 minutes per week of vigorous-intensity aerobic physical activity. Aerobic activity should be performed in episodes of at

least 10 minutes, preferably spread throughout the week. The World Health Organization (WHO) (2011) issued recommendations for physical activity in adults as follows: (1) Adults aged 18-64 should do at least 150 minutes of moderate-intensity aerobic physical activity throughout the week or do at least 75 minutes of vigorous-intensity aerobic physical activity throughout the week or an equivalent combination of moderate- and vigorous-intensity activity. (2) Aerobic activity should be performed in bouts of at least 10 minutes duration. (3) For additional health benefits, adults should increase their moderate-intensity aerobic physical activity to 300 minutes per week, or engage in 150 minutes of vigorous-intensity aerobic physical activity per week, or an equivalent combination of moderate- and vigorous-intensity activity. (4) Muscle-strengthening activities should be done involving major muscle groups on 2 or more days a week.

2.3 Exercise and Lipids

Eckel et al. (2014) studied aerobic exercise training and lipids. The results of the study provided evidence statements for Guidelines on Lifestyle Management to Reduce Cardiovascular Risks. These statements were summarized as follows: (1) Among adults, aerobic physical activity, compared with control interventions, reduces LDL-C 3–6 mg/dL on average. Strength of Evidence: Moderate, (2) Among adults, aerobic physical activity alone, compared with control interventions, reduces non–HDL-C 6 mg/dL on average. Strength of Evidence: Moderate, (3) Among adults, aerobic physical activity alone, compared with control interventions, has no consistent effect on triglycerides. Strength of Evidence: Moderate, and (4) Among adults, aerobic physical activity alone, compared with control interventions, has no consistent effect on HDL-C. Strength of Evidence: Moderate.

Kraus et al.(2002) conducted a study on effects of the amount and intensity of exercise on plasma lipoproteins. The researchers of this study concluded that just walk was not enough. They found that more intense exercise was actually better than moderate exercise for lowering cholesterol. In a study of overweight, sedentary people who did not change their diet, the researcher found that those who got moderate exercise did lower their LDL level to some extent, but people who did more vigorous exercise lower it even more.

2.4 Exercise and Triglycerides

Miller et al. (2011) cited 11 studies related to physical exercises and triglycerides. The findings of these studies can be used as guidelines for developing exercise programs for people with at risk of dyslipidemia. The summaries of the findings were:

The high triglyceride levels observed with sedentary living, high saturated fatty acid intake, visceral obesity, and insulin resistance commonly are accompanied by an increased content of intra-myocellular triglyceride that largely reflects ineffective utilization of fat (ie, reduced muscle fatty acid oxidation). In contrast, aerobic activity enhances lipid oxidation, thereby facilitating the hydrolysis and utilization of triglycerides in skeletal muscle. The effect of physical activity on triglyceride levels varies depending on baseline triglyceride, level of intensity, caloric expenditure, and duration of activity. For example, an optimal fasting triglyceride level (eg, <100 mg/dL) was associated with minimal (ie, <5%) reductions in post-exercise triglyceride levels compared with greater (ie, 15% to 20%) reductions if baseline triglyceride levels exceeded 150 mg/dL. Moreover, in a study of 2906 middle-aged men, moderately intensive activity (ie, jogging 10 miles weekly) versus no activity was associated with a 20% lower fasting triglyceride level; the highest activity level (>20 miles weekly) was also accompanied by the lowest mean fasting triglyceride level (86 mg/dL). Higher baseline triglyceride levels (mean 197 mg/dL) also translated into significant triglyceride reductions (26%) in a 6-month trial of overweight subjects who walked 12 miles weekly at 40% to 55% of peak oxygen consumption. However, other studies evaluating walking duration, frequency, and intensity (30 minutes daily at a maximum 65% to 75% of age-predicted heart rate) in the absence of weight loss did not demonstrate differences in post-exercise triglyceride levels. Similarly, increasing energy expenditure through physical activity without changing energy intake did not result in lower triglyceride levels if baseline levels were relatively normal (ie, mean 110 mg/dL). However, a reduction in energy intake (300 kcal/day) resulted in a 23% reduction in fasting triglyceride levels during the 1-year trial. Additional benefits of exercise include reduction in the TG response and attenuation of the triglyceride elevations observed after consumption of a low-fat, high-carbohydrate diet. In fact, 60 minutes of aerobic exercise daily abolishes the carbohydrate-induced

increases in triglyceride rich lipoproteins. Overall, exercise is most effective in lowering triglycerides (eg, 20% to 30%) when baseline levels are elevated (ie, >150 mg/dL), activity is moderate to intensive, and total caloric intake is reduced. The development of exercise programs to fit the need of individual who was at risk with high triglyceride level should be in line with these baseline data to get the maximum benefit of exercise.

2.5 Arm Swing Exercise (ASE)

During the past 10 years, a number of research and studies were conducted to determine the effects of arm swing exercise. Tunkamnerdthai, Auvichayapat, Donsom, and Leelayuwat (2015) investigated the effects of ASE on lung function and obesity in overweight T2DM patients. After ASE training period, pulmonary function tests were performed. The results of the tests revealed that the force vital capacity, forced expiratory volume in the first second of expiration, and maximal voluntary ventilation were increased when compared with after the control period. HbA1c, LDL, and the percent body fat were significantly decreased. The decrease in body fat in this study may be due to increased fat oxidation during the exercise. These data suggest that there was improvement of pulmonary functions in patients after ASE training.

Leelayuwat (2006) investigated the effects of arm exercise on blood glucose and high density lipoprotein (HDL) concentrations and insulin sensitivity in type 2 diabetic patients. The results of the study indicated that there was lower HbA1c concentration after exercise training than the control period. HbA1c concentrations were related to fasting blood glucose and triglycerides. These results suggested that 30 minutes arm swing per day for 8 weeks contributes to a reduction in blood HbA1c concentrations in type 2 diabetic patients. HbA1c concentration is an important factor of cardiovascular risks. Leelayuwat et al. (2008) conducted another study to determine beneficial effects of arm swing exercise on glycaemic control and oxidative stress in patients with diabetes type 2. Nine males and 33 females patients who had high cardiovascular risks participated in the study. Clinical analysis found that HbA1c concentration was 0.2% lower after ASE training for 8 weeks compared with the control period ($p<0.05$). Leelayuwat et al. (2008) cited data from United Kingdom Prospective Diabetes Study Group (UPKDS) which

suggested that a 1% rise in HbA1c concentration represents a 37% increased risk for microvascular complications. Based on this information, 0.2% decrease in HbA1c after ASE training founded in her study may reduce 7.4% of risk for microvascular complications. Other findings in this study were: ASE training significantly reduced plasma MDA concentration ($p<0.05$) and increased antioxidant blood GSH concentration ($p<0.05$).

Van Aggel, Wim, Gabby and Marleen (2002) also found that low-intensity exercise contributed to increased fat oxidation during exercise in obese subjects. Other effects and benefits of ASE were improvement in health-related physical fitness in the elderly women (Saelao & Kanungsukkasem, 2012), and involving family members to help encouraging and supporting the elderly to exercise consistently for long-term effect of exercise (Jewpattanakul, Reungthongdee & Tabkeaw, 2012). In the final analysis, arm swing exercise is a viable alternative for reducing weight and may lead to reduction in cholesterol and triglyceride.

2.6 Hula Hoop Exercise (HHE)

The hula hoop exercise is the other type of exercise proposed in this study. It is a popular form of exercise and is not a new invention. Collins and Mather (2014) traced historical development of the exercise. They founded that Egyptian children playing with hoop toys of dried grapevine in around 1000 BC. They played with the grapevine hoop around their bodies. The ancient Greeks were the first to popularize the hoop, and many of their documents, including illustrations on pottery, showed the hoop in action. The hoop was a toy for Greek children, but it was also an exercise device. Roman children also played with hoops. Both Greek and Roman versions were made of metal fashioned from scrap strips. In a study conducted by Collins and Mather (2014), hooping can burn up to 880 calories/hour, an average of 600 calories/hour is possible for the average hooper which is consistent with the previous study. From observation, when participants keep the same hooping pace, the heart rate and caloric consumption was observed to increase.

Porcari et al. (2011) released a study conducted to determine the effect of hooping on physical fitness and whether or not it helps improve cardiovascular fitness. The study

found that the average heart rate for the 30-minute class was 151 beats per minute, and the average caloric expenditure was equivalent to 210 calories for 30 minutes of hooping. The total energy cost, the researchers revealed, was enough to help people control their body weight. Another study conducted by McGill, Cambridge and Anderson (2015) found that, on average, participants experienced a significant decrease in waist and hip circumference -3.4 cm ($p<0.01$) and 1.4 cm ($p<0.05$), respectively and waist-to-hip ratio from 89.3 cm down to 87.3 cm ($p<0.01$). In addition to hard data, Porcari, the leader of the project, observed and suggested that given the variety of movements in hooping, it should be considered a total-body workout that has the potential to improve your flexibility and balance while strengthening and toning the muscles of the back, abdomen, arms and legs. The rhythmic nature of hooping may also be relaxing and almost meditative for some (Holthusen et al., 2011).

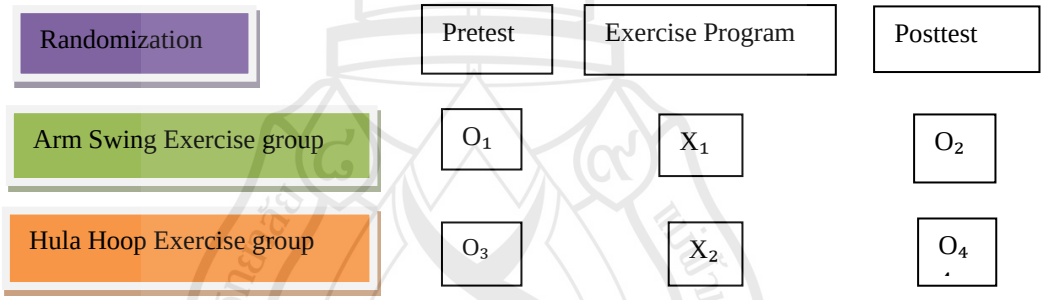
Rungudom & Suksom (2012) also conducted a study to determine the effects of hula hoop exercise on overweight women. The study found that hula hoop exercise program had a favorable effect to reduce circumference and subcutaneous fat in specific parts. Cardio-respiratory fitness and the whole body fat were not found to improve after hula hoop training. Asides from the physical fitness benefits of hula hoop, the exercise made people happy. People enjoyed the burst of endorphins after hooping which was good for reducing their stress level. While hula hoop exercise is increasingly popular among Thai population, research data concerning the effects on lipid profile are still lacking. Therefore, this study attempts to compare the effects of both arm swing exercise and hula hoop exercise on lipid profile of adult population.

CHAPTER 3

METHODOLOGY

3.1 Research Design

This study was a quasi-experimental design. The Pretest Posttest Control Group design was used. Elements included in this design are provided in Figure 3.1.



Note. O_1 : pretest arm swing exercise group

O_2 : posttest arm swing exercise group

O_3 : pretest hula hoop exercise group

O_4 : posttest hula hoop exercise group

X_1 : arm swing exercise 8 weeks training

X_2 : hula hoop exercise 8 weeks training

Figure 3.1 Lay out

In the first day of the first week, participants in both ASE group and HHE group had the following health characteristics measured: height, weight, BMI, percent body fat (by using body fat measuring caliper), blood pressure, pulse at rest and other needed

information. Lipid profile tests were done prior to the exercise intervention in the first week. In the eighth week, all measurements in the first week were repeated.

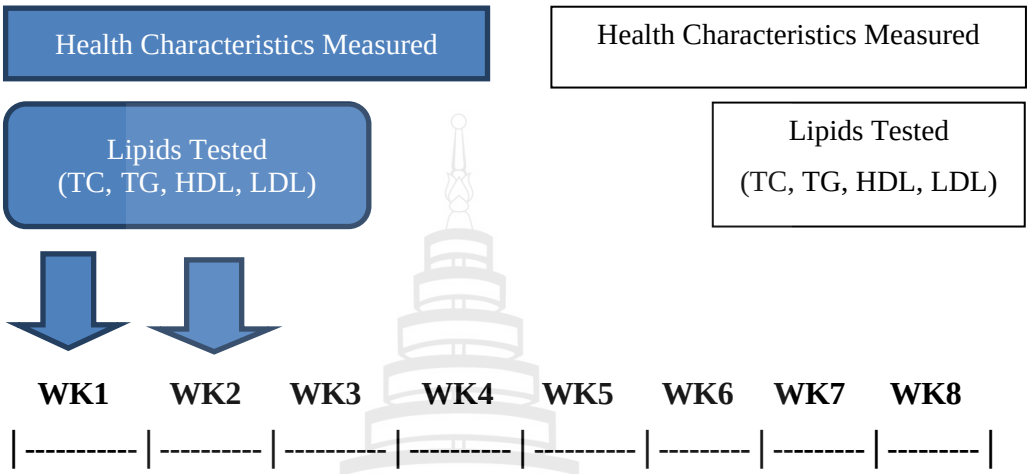


Figure 3.2 Data Collection

3.2 Population and Sample

Fifty participants were selected by purposive sampling method. These participants met the inclusion criteria and live in Bangkok area.

3.2.1 Sample

Fifty selected participants were randomized to groups of exercise by using simple random sampling: 25 participants for ASE group and 25 participants for HHE group. Both groups were assigned to exercise for 30 minutes per day, 3 days per week. ASE and HHE were designed to be moderate aerobic exercise programs. They were instructed to include warm up prior to and cool down after their 30 minutes exercise routines.

3.2.2 Inclusion Criteria

3.2.2.1 Eligible subjects included men and women between 25-50 years of age who had LDL above 100 mg/dL, not on lipid-lowering drugs (such as antihypertensives, thyroid medication, or hormonal replacement therapy).

3.2.2.2 All participants were able to exercise by ASE or HHE continuously.

3.2.2.3 All participants were free from cardiovascular disease and in good shape. They had completed the Physical Activity Readiness Questionnaire (PAR-Q) and all answers were "Never" therefore all of them were eligible to join the program.

3.2.2.4 All participants were willing to participate and had signed consent forms.

3.2.3 Exclusion Criteria

3.2.3.1 The participant who was a smoker

3.2.3.2 The participant who was pregnant or lactating

3.2.3.3 The participant who was on lipid-lowering drugs (such as antihypertensive, thyroid medication, or hormonal replacement therapy)

3.2.4 Discontinue Criteria

3.2.4.1 Participant who had injured or illness during training program and could no longer participate.

3.2.4.2 Participants who had completed less than 80% of training program.

3.2.4.3 Participant who no longer wished to participate.

3.3 Sample Size

The number of participants used in this study was from the formula:

$$n = \frac{\left(z_\alpha + z_\beta\right)^2(\sigma_1^2 + \sigma_2^2)}{\Delta^2}$$

n : number of participants

α : level of confidence

β : power of test

σ^2 : the variance of sample group to be studied

Δ : the difference between the mean of the first group and the second group

Since there was no prior research on this topic in Thailand, the researcher used a similar research as a reference. The selected research used was done by Tunkamnerdthai, et al (2015). Data on triglycerides (TG) of the experimental group (Group 1) and control group (Group 2) were used. Sample size was determined by using TG data as follows:

Group 1: TG Mean = 185 mg/dL, S.D. = 17

Group 2: TG Mean = 207 mg/dL, S.D. = 25

Given:

$\alpha = 0.05, \beta = 0.10$

$\Delta = 207\text{-}185 = 22$ mg/dL

Substitute:

$z_\alpha = z_{0.05} = 1.960$

$z_\beta = z_{0.10} = 1.282$

$$n = \frac{(1.960+1.282)^2(17^2+25^2)}{22^2}$$

$= 19.84 \approx 20$ subjects

From this formula, the researcher had at least 20 participants for each group to continue in the exercise training programs. Allowing 20% drop out rate, the researcher kept 25 participants for each group at the beginning of the exercise training programs.

3.4 Research Tools

3.4.1 Written forms included participant information sheet, Physical Activity Readiness Questionnaire form (PAR Q), inform consent form, food intake form, registration form, and participant check list form.

3.4.2 The ASE and HHE lots in a can (for simple random sampling when divided participants into ASE group and HHE group).

3.4.3 Pomo 37˚ heart rate monitors (Pomo House International Pte, Ltd., Singapore) and smart phones (Android or iOS) to download 37˚Bracelet Application.

3.4.4 Information and pictures of how to do ASE (Leeyanuwat, 2006) and personal video clips that the researcher made for participants to teach them proper techniques of ASE, HHE, warm up and cool down exercises for this study.

3.4.5 Hula hoops with diameter 100 cm.

3.4.6 Whole body Bioelectrical Impedance Analysis Analyzer (Biospace InBody 720 Body Composition Analysis, used at Mah Fah Luaung University Hospital Facility).

3.4.7 Digital blood pressure, Omron (SEM-1 model from Korea).

3.4.8 Skinfold caliper measurement tool (Beta technology, USA).

3.4.9 Instrument for measuring blood chemical data variables, enzymatic, colorimetric method, for example centrifuge, freezer-40C (use at Mah Fah Luang University Hospital Facility).

3.4.10 Certified medical technician who could perform the blood drawing for lipid profile test.

3.4.11 Snacks and drinks for participants after their lipid test and other assessments.

3.5 Instruments and Procedures

3.5.1 Arm Swing Exercise Program, adapted from Leelayuwat (2006).

3.5.1.1 Warm up for 5 minutes, then static stretching for 5 minutes.

3.5.1.2 Moderate Aerobic Arm Swing Exercise for 30 minutes 40-60% HRR (Heart rate reserve), use Karvonen Formula, Week 1-8, Arm Swing 30 minutes continuously/session/day, 3 days/week.

3.5.1.3 Cool down for 5 minutes and then static stretching for 5 minutes.

3.5.2 Hula Hoop Exercise Program, adapted from Rungudom and Suksom (2012).

3.5.2.1 Warm up for 5 minutes, then static stretching for 5 minutes.

3.5.2.2 Moderate Aerobic Hula Hoop Exercise for 30 minutes 40-60% HRR (Heart rate reserve), use Karvonen Formula, Week 1-8, Hula Hoop 30 minutes continuously/session/day, 3 days/week.

3.5.2.3 Cool down for 5 minutes and then static stretching for 5 minutes.

3.5.3 Tested for individual intensity level of exercise. Participant who enrolled in the programs should have LDL above 100 mg/dL. Use the heart rate monitor to determine heart rate which should be 40-60% of Heart Rate Reserve.

3.5.4 Selected participants perform exercise according to the assigned training program on Monday, Wednesday, and Friday for 30 minutes at their convenience for 8 weeks. Target heart rate was monitored by Pomo 37˚ Heart Rate Monitor. Target heart rate was determined by using the following Karnoven formula:

Target heart rate = ((max HR- resting HR) x %Intensity) + resting HR

For Formula HRR to determine moderate aerobic exercise, also uses 40-60%.

Relative exercise intensity was shown in Table 3.1

Table 3.1 Relative Exercise Intensity

Relative Intensity			
INTENSITY	**%HRR or VO2 max%**	**% HR MAX**	**RPE**
Very light	<20	<35	<10
Light	20-39	35-54	10-11
Moderate	**40-59**	**55-69**	**12-13**
Hard	60-84	70-89	14-16
Very hard	≥85	≥90	17-19
Maximum	100	100	20

Example: If a person is 30 years old, resting HR 60 beats/minute, exercise to reduce fat, use this formula will get the target heart rate 112-138 bpm.

{40-60% x [(220-30)-60]} +60 = (40-60% x130) + 60

= (52-78 bpm)+60

= 112-138 bpm

3.5.5 For the calorie intake during exercise program, participants were encouraged to write down what they consumed on diet diary form given.

3.6 Participants' Health Characteristics

Measured before and after exercise programs

3.6.1 Body composition by using Whole Body Bioelectrical Impedance Analysis Analyzer (Biospace InBody 720 Body Composition Analysis) Measured BP in sitting position with Digital blood pressure.

3.6.2 Body composition included muscle mass, fat mass, water, waist to hip ratio, metabolism with Whole body Bioelectrical Impedance Analysis Analyzer (Biospace InBody 720 Body Composition Analysis) at Mae Fah Luang University Hospital.

3.6.3 Percent body fat by using skinfold measurement caliper (Beta technology, USA).

3.6.4 Lipid profiles by medical technician at Mae Fah Luang University Hospital.

3.6.4.1 Total Cholesterol; using enzymatic method, normal range <200 mg/dL.

3.6.4.2 Triglyceride; using enzymatic method, normal range <150 mg/dL.

3.6.4.3 High-density lipoprotein; using enzymatic colorimetric method, HDL normal range female >65 mg/dL, male >55 mg/dL.

3.6.4.4 Low-density lipoprotein; using enzymatic colorimetric method, normal range LDL<100 mg/dL.

3.7 Collection of the Data

This study compared lipid profiles and percent body fat of the two groups at the first day of the first week prior to the intervention of the exercise programs and the completion of the eight weeks experimental exercise programs. The 50 participants were volunteers, men and women who lived in Bangkok and had their LDL levels of 100 mg/dL or above. These participants were selected by purposive sampling method, and then divided in to two groups of twenty five persons for each group by simple random sampling. There were 25 participants, 3 men and 22 women were assigned to hula hoop

exercise (HHE) group and served as the experimental group for this investigation. The other 25 participants, 4 men and 21 women were assigned to arm swing exercise (ASE) group and served as the control group.

All participants received written and verbal explanations, learned of the objectives and practice by Tell-Show-Do method, were informed about risks, benefits, and the right to withdraw from the study at any time throughout this study before giving informed consent.

Both group performed their assigned exercise programs designed as moderate aerobic exercise, 40-60% Heart Rate Reserve. Both groups regularly participated in a 30-minute moderate aerobic exercise of ASE or HHE per day, 3 days per week. This experimental exercise programs lasted 8 weeks. At the beginning of the program prior to the exercise intervention and after the completion of eight week experimental exercise programs, the participants' physical characteristics were assessed and lipid profiles were tested. They also recorded their food intake for eight weeks on food intake forms.

All procedures were completed within 8 weeks as described in Table 3.2

Table 3.2 Research Plan for Eight Week Exercise Programs

Activities	Wk1	Wk2	Wk3	Wk4	Wk5	Wk6	Wk7	Wk8
Preparation: Invited 50 participants to MFU hospital facility 5-10 persons at a time, instructed them to stop eating and drinking after 24:00 pm the night before their next day appointments at 8:00 am for lipid profile tests and other assessments with the inbody body composition analysis	done							
Oriented the participants of the project, then give them the according forms to read and signed: Project Information Sheets (for them to read & keep. The sheets also had the exercises details), Inform Consent, PAR Q, and Food Intake Form (for them to record throughout 8 wks).								

Table 3.2 (continued)

Activities	Wk1	Wk2	Wk3	Wk4	Wk5	Wk6	Wk7	Wk8
Assigned 50 subjects: 25 to ASE group, 25 to HHE group (by simple random sampling)								
First Evaluation Pretest: Assess, age, weight, height, BMI, percent body fat(with skinfold caliper), BP, pulse, lipid profile	done							
Used Karnoven Formula to calculate each participants HR for moderate aerobic exercise and informed them their appropriate HR during exercise and taught them how to check their HR with the heart rate monitors provided for them								
Made sure that all participants could and understood how to perform ASE or HHE and knew how to monitor their HR during exercises.								
Follow up made a visit and/or telephoned 20 minutes/person. Asked for any difficulty with ASE or HHE. Encourage continuous participation.		done		done		done		
Second Evaluation Posttest: Assess age, weight, height, BMI, percent body fat (with skinfold caliper), lipid profiles								done

Note. Wk represents "Week"

3.8 Statistical Analysis

The data collected include participants' sex, age, body mass index (BMI), lipid profiles, percent body fat, and calories intake. These data then was used to determine the following statistic. Because data within arm swing exercise (ASE) group, data within hula hoop exercise (HHE) group, and data between ASE group and HHE groups are normal

distributed based on Skewness and Kurtosis normal distribution test, t-test and analysis of variance were used in the analysis of the data in this study. An independent samples t-test was utilized to determine if there was a significant different in mean and standard deviation of age, weight, height, body mass index , percent body fat (PBF), total cholesterol, LDL, blood pressure, and pulse at rest of the two groups before the experiment. A paired-samples t-test was utilized to determine if there was a significant difference in lipid profile and percent body fat of the two groups before the exercise programs and after the completion of eight week experimental exercise programs. An independent samples t-test was utilized to determine if there was a significant difference in percentage of lipid profiles and percent body fat of the two groups after the completion of eight week exercise programs. One-way analysis of variance with repeated measurement was utilized to determine if there was a significant difference in mean of calories intake of the two groups during week 1, week 4, and week 8.

Out of 25 participants enrolled in arm swing exercise program, 20 participants completed all required activities assigned to them (one of them had an accident and was unable to perform the exercise, one did not show up for lipid profile test after the 8th week, and three of them had to discontinue due to lack of at least 80% of the exercise completion). At the same time, out of 25 participants enrolled in hula hoop exercise program, 20 participants completed their activities and their data were used in analysis (four of them had to discontinue because they did not complete up to 80% of the exercise requirement, one did not show up for the lipid profile test after the 8th week).

3.8.1 Difference between pretest data of ASE group and HHE group was tested by independent t-test with 0.05 level of significance.

3.8.2 Difference between pretest and posttest data was tested by paired- t-test with 0.05 level of significance.

3.8.3 Difference between the mean of arm swing exercise and the mean of hula hoop exercise was tested by independent samples t-test with 0.05 level of significance.

3.8.4 Differences in calories intake of both arm swing exercise group and hula hoop exercise group were tested by one-way analysis of variance with 0.05 level of significance.

CHAPTER 4

RESULTS

This study was conducted to determine the effects of arm swing exercise (ASE) and hula hoop exercise (HHE) on persons at risk of dyslipidemia disease. Specifically, it sought to compare the effects of both arm swing exercise and hula hoop exercise on lipid profile levels of persons at risk of dyslipidemia disease and find practical ways to control the disease. This study compared lipid profiles and percent body fat of two groups which were arm swing exercise (ASE) group and hula hoop exercise (HHE) group. Data of the two groups were collected before the intervention of the exercise programs and at the completion of eight week experimental exercise programs. The data collected in this investigation consisted of: sex, age, weight, height, cholesterol, high-density lipoprotein (HDL), low-density lipoprotein (LDL), body mass index (BMI), percent body fat (PBF), and pulse rate at rest. The findings of the study were presented in five parts as follows:

1. Showed the mean and standard deviation of age, weight, height, body mass index (BMI), cholesterol, low-density lipoprotein (LDL), blood pressure, and pulse at rest before the intervention. Independent t-test was used to determine the differences between ASE group and HHE group before the exercise programs.

2. Showed the comparisons within ASE group and within HHE group. Paired t-test was used to determine if there was a significant difference in lipid profiles and percent body fat before the exercise programs and after the completion of eight week experimental exercise programs.

3. Showed comparisons between ASE group and HHE group. Independent t-test was used to determine if there was a significant difference in percentage of changes in lipid profiles and percent body fat of the two groups after the completion of eight week exercise programs.

4. Graph showed the mean of lipid profile levels and percent body fat of the two groups before the experiment and after the completion of the eight week exercise

programs. There were also graphs that showed the mean of percentage of changes in lipid profiles and percent body fat of the two groups before the experiment and after the completion of the eight week exercise programs.

5. Showed an analysis of the mean of food intake of participants in ASE group and HHE group. One-way analysis of variance with repeated measurement was used to determine if there was a significant difference in mean of calories intake of the two groups during week1, week 4 and week 8.

4.1 Participants' Characteristics

Selected data related to health characteristics of participants before exercise programs were collected and analyzed. The mean of each characteristics was compared to determine if there was a statistically difference. The results were shown in Table 4.1.

Table 4.1 Comparisons of Characteristics of Participants in ASE Group and HHE Group before Exercise Programs

Characteristics of the Participants	ASE Group (n=20)		HHE Group (n=20)		t	df	p-value
	$\bar{X}$	S.D.	$\bar{X}$	S.D.			
Age (year)	40.72	7.91	37.15	8.46	1.39	38	0.173
Weight (kilogram)	70.71	16.65	63.64	14.74	1.42	38	0.163
Height (centimeter)	161.15	6.80	161.30	6.14	-0.07	38	0.942
BMI (kg/meter^2)	27.22	6.19	24.31	4.50	1.70	38	0.097
Percent Body Fat	37.10	6.67	34.24	3.43	1.71	38	0.096
Total Cholesterol (mg/dL)	217.85	34.66	214.95	25.00	0.30	38	0.763
LDL (mg/dL)	157.90	35.37	144.25	26.38	1.38	38	0.175
Systolic Blood Pressure (mmHg)	126.70	12.05	122.40	12.89	1.09	38	0.283
Diastolic Blood Pressure (mmHg)	86.20	11.04	78.55	11.21	2.17	38	0.036
Pulse at rest (beats/minute)	78.35	9.28	77.35	11.80	0.29	38	0.767

Table 4.1 showed that the mean of arm swing exercise (ASE) participant age was 40.75 years old with standard deviation of 7.91. The mean of their weight was 70.71

kilograms with standard deviation of 16.65. The mean of their height was 161.15 centimeters with standard deviation of 6.80. The mean of their BMI was 27.22 kg/m² with standard deviation of 6.19. The mean of their percent body fat was 37.10 with standard deviation of 6.67. The mean of their total cholesterol was 217.85 with standard deviation of 34.66. The mean of their LDL was 157.90 mg/DL with standard deviation of 35.37. The mean of their systolic blood pressure was 126.70 mmHg with standard deviation of 12.05. The mean of their diastolic blood pressure was 86.20 mmHg with standard deviation 11.04. The mean of their pulse at rest was 78.35 beats/min with standard deviation of 9.28

While the mean of hula hoop exercise (HHE) participant age was 37.15 years old with standard deviation of 8.46. The mean of their weight was 63.64 kilograms with standard deviation of 14.74. The mean of their height was 161.30 centimeters with standard deviation of 6.14. The mean of their BMI was 24.31 kg/m² with standard deviation of 4.50. The mean of their percent body fat was 34.24 with standard deviation of 3.43. The mean of their total cholesterol was 214.95 with standard deviation of 25.00. The mean of their LDL was 144.25 with standard deviation of 26.38. The mean of their systolic blood pressure was 122.40 mmHg with standard deviation of 12.89. The mean of their diastolic blood pressure was 78.55 mmHg with standard deviation of 11.21. And the mean of their pulse at rest was 77.35 beats/min with standard deviation of 11.80.

An independent t-test was conducted to compare the mean of age, weight, height, body mass index, percent body fat, total cholesterol, LDL, systolic blood pressure, diastolic blood pressure, and pulse at rest of participants in ASE group and HHE group before taking exercise programs. There was no a significant difference in each of these characteristics except diastolic blood pressure of participants in these two groups. Participants' diastolic blood pressure level was difference at 0.05 level of significance.

4.2 Average of Lipid Levels

Paired t-test was conducted to compare the levels of total cholesterol, triglyceride, HDL, LDL, and percent body fat of the ASE group before and after eight weeks exercise programs. The HHE group was also tested by the same method. Independent-t-test was conducted to compare these variables between ASE group and HHE group both before and after the eight week exercise programs. Results of comparisons were shown in Table 4.2.

Table 4.2 Lipid Profiles and Percent Body Fat of ASE and HHE Groups before and after Exercise Programs

Variables of lipid profile percent body fat	Pretest		Posttest (at 8th week)		d(S.D.)	t	df	p-value
	$\bar{X}$ (n=20)	S.D. (n=20)	$\bar{X}$ (n=20)	S.D. (n=20)				
Cholesterol (mg/dL)								
ASE Group	217.85	34.66	219.65	23.81	-1.80(32.51)	-0.25	19	0.807
HHE Group	214.95	25.00	210.55	33.13	4.40(19.90)	0.99	19	0.335
t; df: p-value	0.303;38:0.763		0.998; 38:0.325		-0.728; 38:0.471			
Triglyceride (mg/dL)								
ASE Group	14.30	51.38	127.20	58.86	14.10(53.07)	1.19	19	0.249
HHE Group	104.30	36.31	95.25	37.75	9.05(27.71)	1.46	19	0.161
t; df: p-value	2.630;38:0.012		0.043;38:0.048		0.377;38:0.708			
HDL (mg/dL)								
ASE Group	52.70	9.61	53.80	10.94	-1.10(6.21)	-0.79	19	0.438
HHE Group	70.35	14.47	68.45	13.25	1.90(7.97)	1.07	19	0.300
t; df: p-value	-4.543;38:<0.001		-3.813;38:<0.001		-1.329;38:0.192			
LDL (mg/dL)								
ASE Group	157.90	35.37	152.00	23.04	5.90(35.15)	0.75	19	0.462
HHE Group	144.25	26.38	138.60	32.17	5.65(18.98)	1.33	19	0.199
t; df: p-value	1.384;38:0.175		1.515;38:0.138		0.028;38:0.978			
Percent body fat								
ASE Group	37.10	6.67	35.13	6.45	1.97(2.61)	3.38	19	0.003*
HHE Group	34.24	3.43	32.22	3.99	2.02(2.55)	3.55	19	0.002*
t; df: p-value	1.705;38:0.096		1.508;38:0.140		-0.063;38:0.950			

4.2.1 Comparisons within ASE Group and HHE Group

In the comparisons of the lipid profiles and percent body fat before and after eight week exercise programs, it was found that there was no significant difference in the levels of: (1) total cholesterol for ASE group before exercise programs (M=217.85, SD=34.66) and after programs (M=219.65, SD=23.81), t(19)=-0.25, p=0.807, (2) total cholesterol for HHE group before the programs (M=214.95, SD=25.00) and after the program (M=210.55, SD=33.13), t(19)=0.99, p=0.335, (3) triglyceride for ASE group before the programs (M=141.30, SD=51.38) and after the programs, (M=127.20, SD=58.86), t(19)=1.19, p=0.249, (4) triglyceride for HHE group before programs (M=104.30, SD=36.31) and after the program (M=95.25, SD=37.75), t(19)=1.46, p=0.161, (5) HDL for ASE group before the programs (M=52.70, SD=9.61) and after the programs (M=53.80, SD=10.94), t(19)=-0.79, p=.438, (6) HDL for HHE group before the programs (M=70.35, SD=14.47) and after the program (M=68.45, SD=13.25), t(19)=1.07, p=0.300, (7) LDL for ASE group before the programs (M=157.90, SD=35.37) and after the programs (M=152.00, SD=23.04), t(19)=0.75, p=0.462, (8) LDL for HHE group before the programs (M=144.25, SD=26.38) and after the program (M=138.60, SD=32.17); t(19)=1.33, p=0.199.

There was no significant difference in percent body fat for (1) ASE group before the exercise programs (M=37.10, SD=6.67) and after the exercise programs (M=35.13, SD=6.45); t(19)=3.38, p=0.003,* and (2) HHE group before the exercise programs (M =34.24, SD=3.43) and after the exercise programs (M=32.22, SD=3.99), t(19)=3.55, p=0.002.* In the analysis of percent of changes in percent body fat, it was found that ASE group was able to reduce percent body fat by 1.97 or 5.31 percent while HHE group was able to reduce percent body fat by 2.02 or 5.90 percent.

These results suggested that there were no significant changes in total cholesterol, triglyceride, HDL, and LDL. However, a considerable change was found in the percent fat in both groups after the intervention of the exercise programs.

4.2.2 Comparisons between ASE and HHE Groups

Before eight week exercise programs, there was no significant difference in the levels of: (1) total cholesterol for ASE group (M=217.85, SD=34.66) and HHE group (M=214.95, SD =25.00), t(38)=0.303, p=0.763, (2) LDL for ASE group (M=157.90,

SD=35.37) and HHE group (M=144.25, SD =26.38), t(38)=1.384, p=0.175, and (3) percent body fat for ASE group (M=37.10, SD=6.67) and HHE group (M=34.24, SD =3.43), t(38)=1.705, p=0.096.

After eight week exercise programs, there was no significant difference in the levels of: (1) total cholesterol for ASE group (M=219.65, SD=23.81) and HHE group (M=210.55, SD =33.13), t(38)=0.998, p=0.325, (2) LDL for ASE group (M=157.90, SD=35.37) and HHE group (M=144.25, SD =26.38), t(38)=1.384, p=0.175, and (3) percent body fat for ASE group (M=35.13, SD=6.45) and HHE group (M=32.22, SD =3.99), t(38)=1.508, p=0.140.

Before and after eight week exercise programs, there was a significant difference in the levels of triglyceride and HDL. Before the programs, there was a significant difference in the levels of: (1) triglyceride for ASE group (M=140.30, SD=51.38) and HHE group (M=104.30, SD =36.31), t(38)=2.630, p=0.012,* and (2) HDL for ASE group (M=52.70, SD=9.61) and HHE group (M=70.35, SD =14.47), t(38)=-4.543, p<0.001.* After the programs, there was a significant difference in the levels of: (1) triglyceride for ASE group (M=127.20, SD=58.86) and HHE group (M=95.25, SD =37.75), t(38)=2.043, p=0.048,* and (2) HDL for ASE group (M=53.80, SD=10.94) and HHE group (M=68.45, SD =13.25), t(38)=-3.183, p<0.001.*

These results indicated that there were significant differences in triglyceride and HDL levels of ASE group when compared to HHE group before exercise programs. The significant differences at 0.05 levels in triglyceride and HDL were found again at the end of eight week exercise programs.

In order to determine the differences of the lipid profiles and percent body fat between ASE group and HHE group, the mean of the difference was compared. The results indicated that there was no significant difference in the mean of the difference in the levels of: (1) total cholesterol for ASE group (M=-1.80, SD=32.51) and HHE group (M=4.40, SD =19.90), t(38)=0.728, p=0.471, (2) triglyceride for ASE group (M=14.10, SD=53.07) and HHE group (M=9.05, SD =27.71), t(38)=0.377, p=0.708, (3) HDL for ASE group (M=-1.10, SD=6.21) and HHE group (M=1.90, SD =7.97), t(38)=-1.329, p=0.192, (4) LDL for ASE group (M=5.90, SD=35.15) and HHE group (M=5.65, SD =18.98), t(38)=0.028, p=0.978, and (5) percent body fat for ASE group (M=1.97, SD=2.61) and HHE group (M=2.02, SD =2.55), t(38)=0.063, p=0.950. Based on the

analysis of the mean of the difference, the ASE group and the HHE group were not significantly different.

4.3 Percent of Changes

This part showed the comparisons of lipid profile levels and percent body fat of ASE and HHE groups after the completion of the eight week exercise programs. An independent-samples t-test was conducted to compare the percent of changes in cholesterol, triglyceride, HDL, LDL, and percent body fat. The results were shown in Table 4.3.

Table 4.3 Comparisons of Percent of Change from the Baseline between ASE Group and HHE Group after Exercise Programs at 8th Week Visit

Variables of lipid profiles and percent body fat	Percent of Changes at 8th week visit				t	df	p-value
	ASE Group (n=20)		HHE Group (n=20)				
	$\bar{X}$	S.D.	$\bar{X}$	S.D.			
Cholesterol (mg/dL)	2.370	13.37	-1.866	9.29	1.163	38	0.252
Triglyceride (mg/dL)	-6.825	33.86	-7.099	23.58	0.030	38	0.976
HDL (mg/dL)	2.229	11.84	-0.977	8.41	0.987	38	0.330
LDL (mg/dL)	-0.565	19.30	-3.780	13.29	0.613	38	0.543
Percent body fat	-5.181	7.31	-4.736	5.93	-0.211	38	0.834

After performing eight week exercise programs, there was no significant difference in the percent of changes of: (1) total cholesterol for ASE group (M=2.370, SD=13.37) and HHE group (M=-1.866, SD =9.29), t(38)=1.163, p=0.252, (2) triglyceride for ASE group (M=-.825,D=33.86), and HHE group (M=-7.099, SD=23.58), t(38)=0.030, p=0.976, (3) HDL for ASE group (M=2.229, SD=11.84) and HHE group (M=-0.977, SD=8.41), t(38)=0.987, p=0.330, (4) LDL for ASE group (M=-0.565, SD=19.30) and HHE group (M=-3.780, SD=13.29), t(38)=0.613, p=0.543, and (5) percent body fat for ASE group (M=-5.181, SD=7.31) and HHE group (M=-4.736, SD=5.93), t(38)=-0.211, p=0.834. These comparisons indicated that there were no significant statistical differences in the variables of lipid profiles and percent body fat between the group performing arm swing

exercise and the group performing hula hoop exercise after eight week training. However, participants in both groups consistently performed exercises as directed and found that in ASE group total cholesterol increased, triglyceride level decreased, HDL increase, LDL decreased, percent body fat decreased. In HHE group total cholesterol decreased, triglyceride decreased, HDL decreased, LDL decreased, percent body fat decreased.

4.4 Results

In this part, the results of before and after eight weeks exercise programs in both ASE group and HHE group were demonstrated in figures. Figure 4.1 showed the mean of lipid profile of ASE group. Figure 4.2 showed the mean of lipid profile levels of HHE group. Figure 4.3 showed the mean of percent body fat of ASE group and HHE group. Figure 4.4 showed the mean of percent of changes of lipid profile levels and percent body fat.

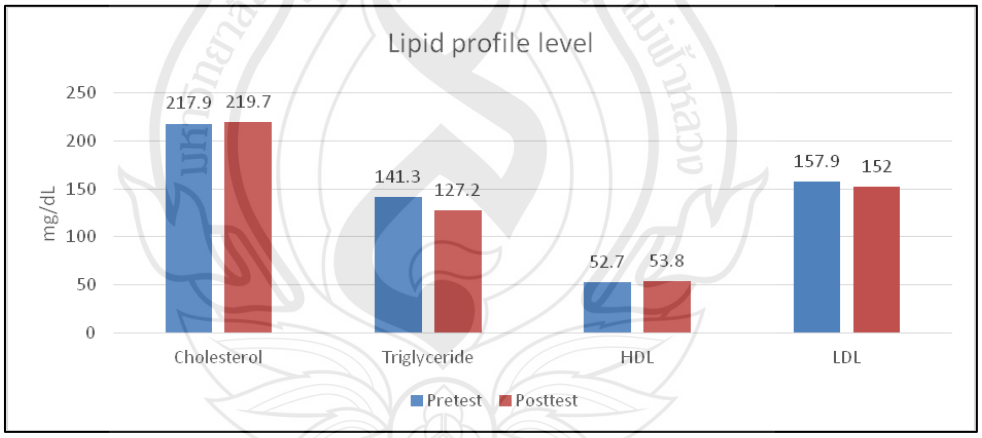


Figure 4.1 Mean of Lipid Profile of ASE Group

After the completion of the eight weeks exercise programs, participants in ASE group had their cholesterol increased from 217.9 to 219.7 mg/dL, triglyceride decreased from 141.3 to 127.2 mg/dL, HDL increased from 52.7 to 53.8 mg/dL, and LDL decreased from 157.9 to 152 mg/dL

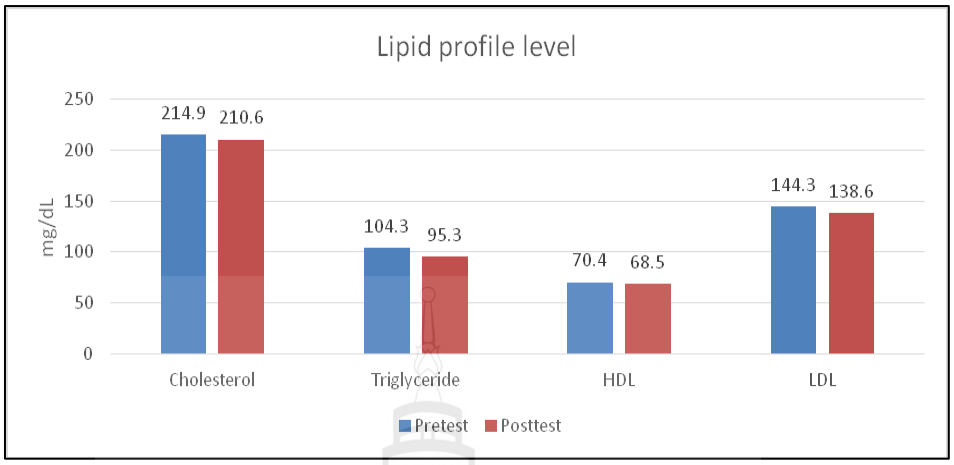


Figure 4.2 Mean of Lipid Profile Levels of HHE Group

After the completion of the eight weeks exercise programs, participants in HHE group had their cholesterol decreased from 214.9 to 210.6 mg/dL, triglyceride decreased from 104.3 to 95.3 mg/dL, HDL decreased from 70.4 to 68.5 mg/dL, and LDL decreased from 144.3 to 138.6 mg/dL

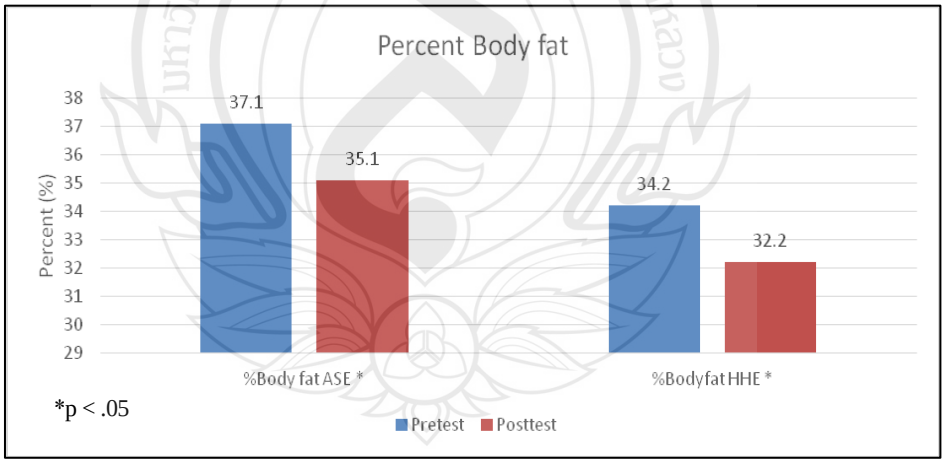


Figure 4.3 Mean of Percent Body Fat of ASE Group and HHE Group

After the completion of the eight weeks exercise programs, participants in ASE group had their percent body fat decreased from 37.1 to 35.1%. The mean difference was statistically significant at 0.05 level. The participants in HHE group had their percent

body fat decreased from 34.2 to 32.2%, and the mean difference was also significant at 0.05 level.

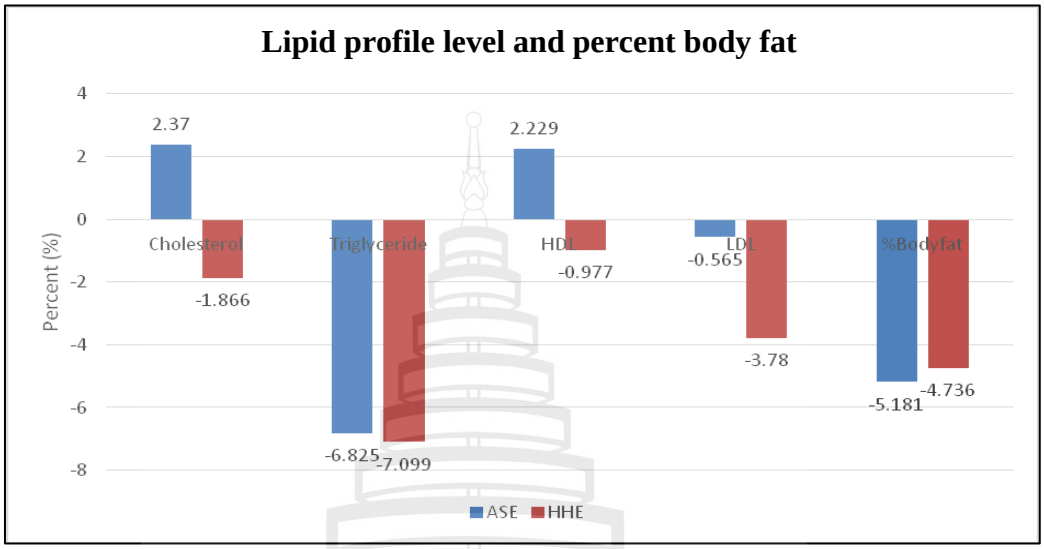


Figure 4.4 Mean of Percent of Change in Lipid Profile Levels and Percent Body Fat

Participants in ASE group had a mean of 2.370 % change in cholesterol, -6.825% change in triglyceride, 2.229% change in HDL, -0.565% change in LDL, and -5.181% change in percent body fat while participants in HHE group had a mean of -1.866 % change in cholesterol, -7.099% change in triglyceride, -0.977% change in HDL, -3.780% change in LDL, and -4.736% change in percent body fat. The means of the percent of these changes were not statistically significant at 0.05 level when compared between ASE group and HHE group.

4.5 Analysis of Participants' Calories Intake

Journals of food intake of participants in both ASE and HHE groups were collected and analyzed to determine the effects of calories taken in the period of eight weeks exercise programs. Three periods of food intake were compared: week 1, week 4, and week 8. A one-way analysis of variance with repeated measurement was conducted

to compare the changes in calories of each group during these periods. Results of comparisons were shown in Table 4.4.

Table 4.4 Analysis of Food Intake of Participants in ASE Group and HHE Group

Sample Groups	Week 1 (kcal)		Week 4 (kcal)		Week 8 (kcal)		F	df	p-value
	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.			
ASE Group (n=20)	203.2	226.4	1,991.0	223.8	1,997.9	203.7	2.797	(2,38)	0.063
HHE Group (n=20)	1,973.7	158.5	1,950.7	192.2	1,978.7	149.4	0.825	(2,38)	0.446

Participants in ASE group had the mean of kilo calories intake of 2032.2 with standard deviation of 226.4 in Week 1, 1991.0 with standard deviation of 223.8 in Week 4, and 1997.9 with standard deviation of 203.7 in Week 8. There was no significant difference at 0.05 level of calories intake in these three periods, $F(2,38)= 2.979$, $p=0.063$. Participants in HHE group had the mean of kilo calories intake of 1973.7 with standard deviation of 158.5 in Week 1, 1950.7 with standard deviation of 192.2 in Week 4, and 1978.7 with standard deviation of 149.4 in Week 8. There was no significant difference at 0.05 level of calories intake in these three periods, $F(2,38)=0.825$, $p=0.446$. These results suggested that calories intake had no effect on changes in lipid profiles and percent body fat during eight week exercise programs.

CHAPTER 5

CONCLUSIONS, DISCUSSION AND RECOMMENDATIONS

This chapter presents a summary of the results of the study, conclusions, and recommendations drawn from the study for further research.

5.1 Summary

The purpose of this study was to analyze whether arm swing exercise could improve lipid profiles better than hula hoop exercise in persons at risk of dyslipidemia disease. The study compared the effects of arm swing exercise and hula hoop exercise on lipid profiles of two groups of participants after the completion of the eight week exercise programs.

The procedure used in this study was a quasi-experimental design. Fifty participants were assigned to 2 groups: 25 for arm swing exercise group and 25 for hula hoop exercise group. These two groups performed their assigned exercise programs for eight weeks. Pre-test and posttest were conducted to compare the means of lipid profile levels and percent body fat between these two groups and used to compare the mean before and after intervention of an exercise program in each group. Based on Skewness and Kurtosis normal distribution test, data collected were normally distributed. T-test and one-way analysis of variance were employed in the analysis of the data.

The findings of the study were as follows:

5.1.1 Comparisons between ASE Group and HHE Group

5.1.1.1 The differences at a significance level of 0.05 were not found in the average of age, body mass index, percent body fat, cholesterol, low-density lipoprotein, systolic blood pressure, pulse at rest between ASE group and HHE group before exercise programs.

5.1.1.2 The difference at a significance level of 0.05 was found in the average of diastolic blood pressure between ASE group and HHE group before exercise programs.

5.1.1.3 The difference at a significance level of 0.05 was found in the average of triglyceride between ASE group and HHE group before exercise programs.

5.1.1.4 The difference at a significance level of 0.05 was found in the average of high-density lipoprotein between ASE group and HHE group before exercise programs.

5.1.1.5 The difference at a significance level of 0.05 was found in the average of triglyceride between ASE group and HHE group after exercise programs.

5.1.1.6 The difference at a significance level of 0.05 was found in the average of high-density lipoprotein between ASE group and HHE group after exercise programs.

5.1.1.7 The differences at a significance level of 0.05 were not found in the percent of changes of cholesterol, triglyceride, high-density lipoprotein, and percent body fat between ASE group and HHE group after the completion of eight week exercise programs.

5.1.2 Comparisons within Group

5.1.2.1 The differences at a significance level of 0.05 were not found in the levels of cholesterol, triglyceride, high-density lipoprotein, and low-density lipoprotein of ASE group before and after eight week exercise programs.

5.1.2.2 The difference at a significance level of .05 was found in percent body fat of ASE group before and after eight week exercise programs. The percent body fat was lower at the end of the programs.

5.1.2.3 The differences at a significance level of 0.05 were not found in the levels of cholesterol, triglyceride, high-density lipoprotein, and low-density lipoprotein of HHE group before and after eight week exercise programs.

5.1.2.4 The difference at a significance level of .05 was found in percent body fat of HHE group before and after eight week exercise programs. The percent body fat was lower at the end of the programs.

5.1.2.5 The differences at a significance level of 0.05 were not found in calories intake of ASE group during Week 1, Week 4, and Week 8.

5.1.2.6 The differences at a significance level of 0.05 were not found in calories intake of HHE group during Week 1, Week 4, and Week 8.

5.2 Conclusions and Discussion

From the findings of the study, there were significant differences at 0.05 level of triglyceride and high-density lipoprotein between ASE group and HHE group after eight week exercise programs. These differences were the results of the differences before the exercise programs which the average of triglyceride was 141.30 mg/dL for ASE group and 104.30 mg/dL for HHE group, and average of high-density lipoprotein was 52.70 mg/dL for ASE group and 70.35 mg/dL for HHE group.

According to the hypothesis of this study, arm swing exercise could improve lipid profiles in persons at risk of dyslipidemia disease better than hula hoop exercise. In the analysis of the percent of changes, the results of the study indicated that there were insufficient evidences to support the hypothesis. There were no significant differences at 0.05 level in total cholesterol, triglyceride, HDL, and LDL for both groups after the completion of eight week experimental exercise programs. In comparing changes within each group, there were significant differences at 0.05 level in percent body fat in both groups after the intervention of exercise programs. The calories intake during eight week exercise programs had no effects on changes in lipid profiles and percent body fat.

Eckel and Jakicic (2014) studied aerobic exercise training and lipids. The results of the study provided an evidence that LDL level was reduced 3-6 mg/dL on average. The present study was one type of aerobic exercise training and LDL was reduced 5.9 mg/dL on average for ASE group and 5.65 mg/dL for HHE group. Change as a result of the exercise in this study was from a moderate exercise program. The vigorous aerobic exercise as suggested by Kraus et al (2002) could also lower cholesterol level.

Miller, et al. (2011) summarized research findings on physical exercises and triglycerides. Overall, exercise was most effective in lowering triglycerides (20% to 30%) when baseline levels were elevated (greater than 150 mg/dL). The present study found

that triglyceride was reduced by 10% from 141.30 mg/dL to 127.20 mg/dL for ASE group, and was reduced by 8% from 104.30 mg/dL to 95.25 mg/dL for HHE group.

The findings of this study supported the study conducted by Leeyanuwat (2006) which investigated the effects of arm exercise on high blood glucose and high density lipoprotein (HDL) concentrations and insulin resistance in T2DM patients. The study indicated that arm swing exercise reduce glycated hemoglobin (HbA1c) concentration after exercise training than the baseline. The study suggested that 30 minutes arm swing per day for 8 weeks contributed to a reduction in blood HbA1c concentrations in T2DM patients. HbA1c concentration is a major biomarkers for cardiovascular risks. According to Leeyanuwat's research results, there was no significant different in lipid profiles, insulin sensitivity, high sensitive c reactive protein, and anthropometric parameter between any period. The present study similar to Leeyanuwat's results on no significant changes in lipid profile, but was different in the percent body fat. In the present study, there was a significant reduction on percent body fat at 8 week exercise than the baseline.

The result of this study was also similar to the study conducted by Rungudom and Suksom (2012) which sought to determine the effects of hula hoop exercise on overweight women. The researchers found that hula hoop exercise program had a favorable effect to reduce waist circumference and subcutaneous fat in specific body parts. Rungudom and Suksom's study results suggested improve in muscle strength, no change in body weight, percent body fat, or lipid profile. There was also a different result in this study which was the significant reduction in percent body fat. This present study also had no significant change in lipid profile like Rungudom and Suksom's result. The difference was that this study had significant reduction in percent body fat. In the analysis of the changes, it was found that ASE group reduced percent body fat by 5.31 percent while HHE group reduced by 5.90 percent.

Tunkamnerdthai, et al. (2015) investigated the effects of arm swing exercise on lung function and obesity in overweight T2DM patients. After arm swing training period, the tests revealed that the force vital capacity, forced expiratory volume in the first second of expiration, and maximal voluntary ventilation were increased when compared with after the control period. HbA1c, LDL level and the percent body fat were significantly better improved. The decrease in body fat in their study may be due to increased fat oxidation during the exercise which is similar to this study. The difference was that in

their study there was also a decrease in LDL level, but in this study there was no significant difference in lipid profile. Van Aggel, et al (2002) also found that low-intensity exercise contributed to increase fat oxidation during exercise in obese subjects. ASE was considered a low-intensity exercise, but in this experiment, ASE was designed to be a moderate aerobic exercise, therefore more fat oxidation should be used. More importantly, the calories intake during eight week exercise programs had no effect on changes in lipid profile and percent body fat. Then the significant decrease in body fat of both ASE and HHE was mainly from the practices in the exercise programs.

This study has demonstrated the benefits of arm swing exercise and hula hoop exercise to health. The experimental exercise programs used in the study can be applied and adapted to the needs of individual. It is imperative that male and female in their adult life should consistently engage in an exercise in order to have a healthy living. Good health means less healthcare cost and good health also promotes economic growth of individual and country.

5.3 Recommendations

Based on the findings of this study, it is recommended that:

5.3.1 A similar investigation should be conducted for longer period of time to evaluate the subjects.

5.3.2 A modified investigation similar to this one should be conducted with persons who already had diseases such as metabolic syndromes diseases.

5.3.3 A modified investigation similar to this one should be conducted and study the effect of exercise on visceral fat that cause diseases.

5.3.4 To improve data collection and conduction of the research, all participants should all be in the same facility.

5.3.5 Participant who has liver disease (eg, hepatitis) or hypothyroid should be excluded from the experiment because the results of lipid profile could greatly be effected by the diseases. Participant who has a spine injury should also be excluded from the experiment for their safety.

Avoid data collection during long holidays period (such as Songkran) because participants might have hard times with compliance to the program requirements, especially with exercise and diet.

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APPENDICES

APPENDIX A

LETTER OF APPROVAL FROM THE ETHIC COMMITTEE

เอกสารเลขที่ ๐๐๒/๒๕๕๙

มหาวิทยาลัยแม่ฟ้าหลวง
คณะกรรมการจริยธรรมการวิจัยในมนุษย์
ขอรับรองว่า

ชื่อวิทยานิพนธ์ : การศึกษาผลของการออกกำลังกายโดยการแกว่งแขน และการออกกำลังกายโดยใช้ฮูลาฮูปที่มีต่อผู้มีภาวะเสี่ยงต่อโรคไขมันในเลือดสูง

(A STUDY TO DETERMINE THE EFFECTS OF ARM SWING EXERCISE AND HULA HOOP EXERCISE ON PERSONS AT RISK OF DYSLIPIDEMIA DISEASE)

โครงการเลขที่ : REH-๕๙๐๐๒
ชื่อบัณฑิตศึกษา : นางสาวชลิดา เถาว์ชาลี
สังกัด : สำนักวิชาเวชศาสตร์ชะลอวัยและฟื้นฟูสุขภาพ

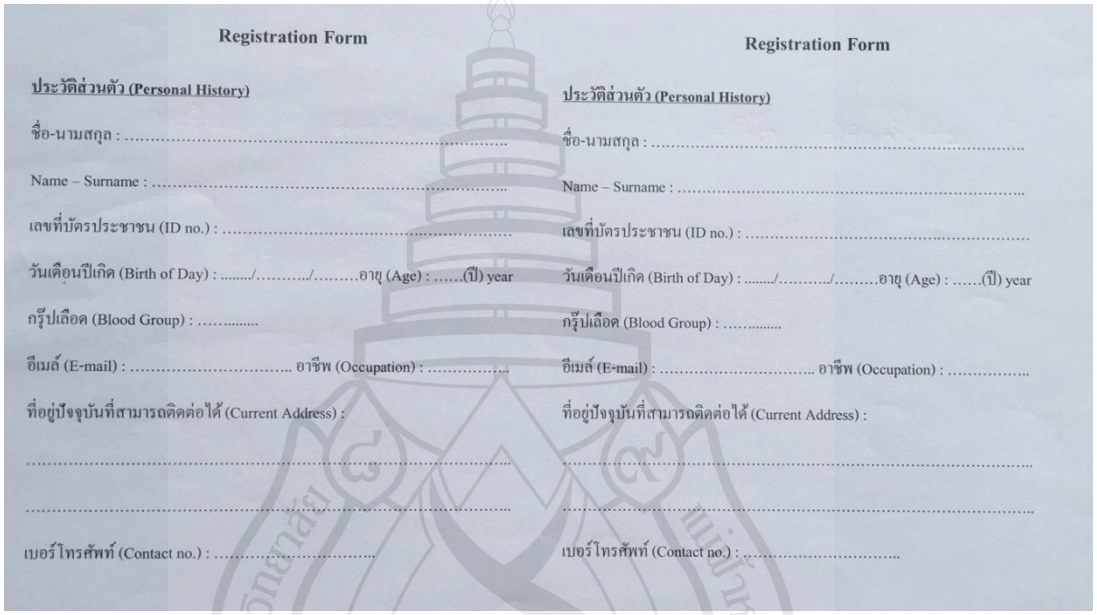
เป็นวิทยานิพนธ์ที่ไม่ขัดต่อหลักจริยธรรมสากลตามคำปฏิญญาเฮลซิงกิ (The Declaration of Helsinki) และแนวทางจริยธรรมการวิจัยในคนแห่งชาติ พ.ศ. ๒๕๔๕

จึงเห็นสมควรให้ดำเนินการวิจัยในขอบข่ายของวิทยานิพนธ์ที่เสนอต่อคณะกรรมการจริยธรรมการวิจัยในมนุษย์ มหาวิทยาลัยแม่ฟ้าหลวงได้ ณ วันที่ ๒๙ เดือน ธันวาคม พ.ศ. ๒๕๕๘

ลงชื่อ.....
(รองศาสตราจารย์ ดร.ปรีชา อุปโยคิน)
รองประธานคณะกรรมการจริยธรรมการวิจัยในมนุษย์
ปฏิบัติการแทนประธานคณะกรรมการจริยธรรมการวิจัยในมนุษย์
มหาวิทยาลัยแม่ฟ้าหลวง
วันที่ ๔ มกราคม ๒๕๕๙

APPENDIX B

REGISTRATION FORM



Registration Form

ประวัติส่วนตัว (Personal History)

ชื่อ-นามสกุล : .....

Name – Surname : .....

เลขที่บัตรประชาชน (ID no.) : .....

วันเดือนปีเกิด (Birth of Day) : ...../...../.....อายุ (Age) : .....(ปี) year

กรุ๊ปเลือด (Blood Group) : .....

อีเมล์ (E-mail) : ..... อาชีพ (Occupation) : .....

ที่อยู่ปัจจุบันที่สามารถติดต่อได้ (Current Address) :

.....

.....

เบอร์โทรศัพท์ (Contact no.) : .....

Registration Form

ประวัติส่วนตัว (Personal History)

ชื่อ-นามสกุล : .....

Name – Surname : .....

เลขที่บัตรประชาชน (ID no.) : .....

วันเดือนปีเกิด (Birth of Day) : ...../...../.....อายุ (Age) : .....(ปี) year

กรุ๊ปเลือด (Blood Group) : .....

อีเมล์ (E-mail) : ..... อาชีพ (Occupation) : .....

ที่อยู่ปัจจุบันที่สามารถติดต่อได้ (Current Address) :

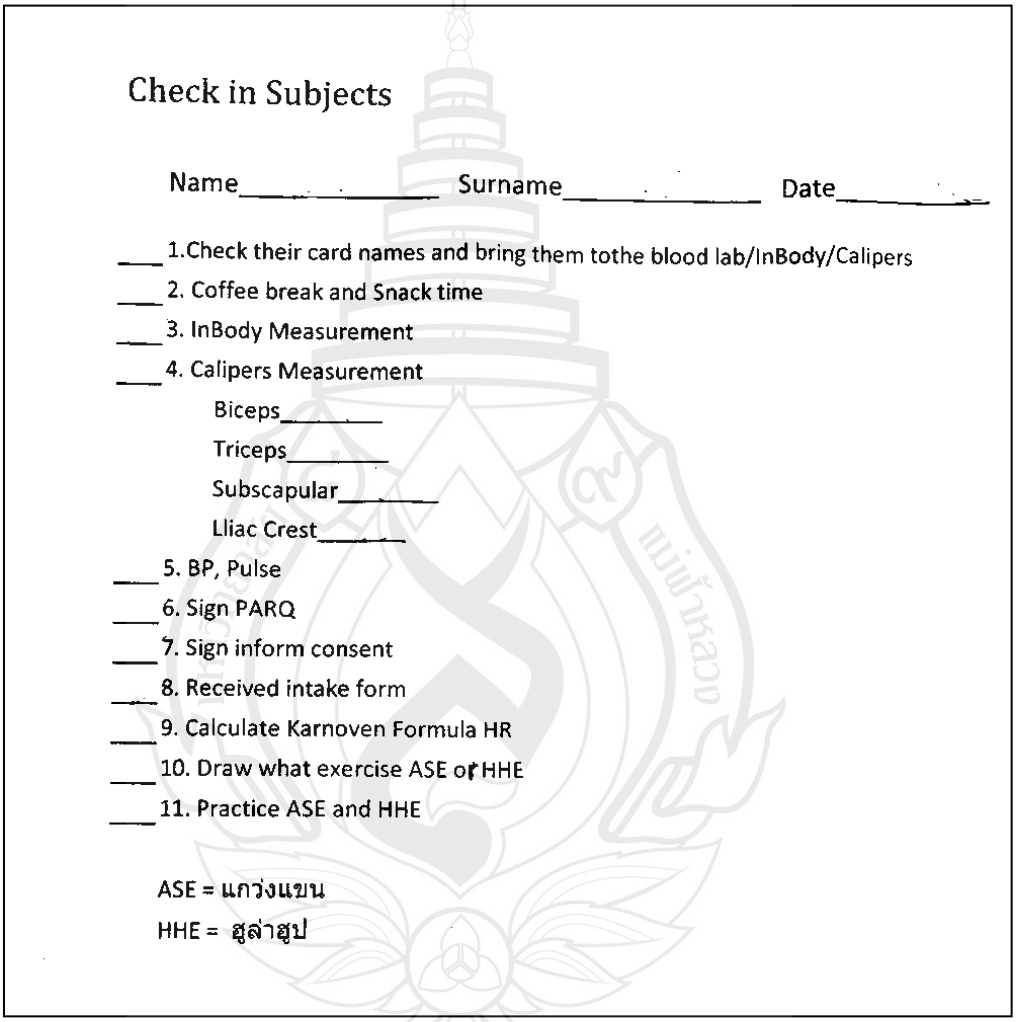
.....

.....

เบอร์โทรศัพท์ (Contact no.) : .....

APPENDIX C

PARTICIPANT CHECK LISTS



Check in Subjects

Name_____ Surname_____ Date_____

___1.Check their card names and bring them tothe blood lab/InBody/Calipers
___2. Coffee break and Snack time
___3. InBody Measurement
___4. Calipers Measurement
Biceps_____
Triceps_____
Subscapular_____
Lliac Crest_____
___5. BP, Pulse
___6. Sign PARQ
___7. Sign inform consent
___8. Received intake form
___9. Calculate Karnoven Formula HR
___10. Draw what exercise ASE or HHE
___11. Practice ASE and HHE

ASE = แกว่งแขน
HHE = ฮูล่าฮูป

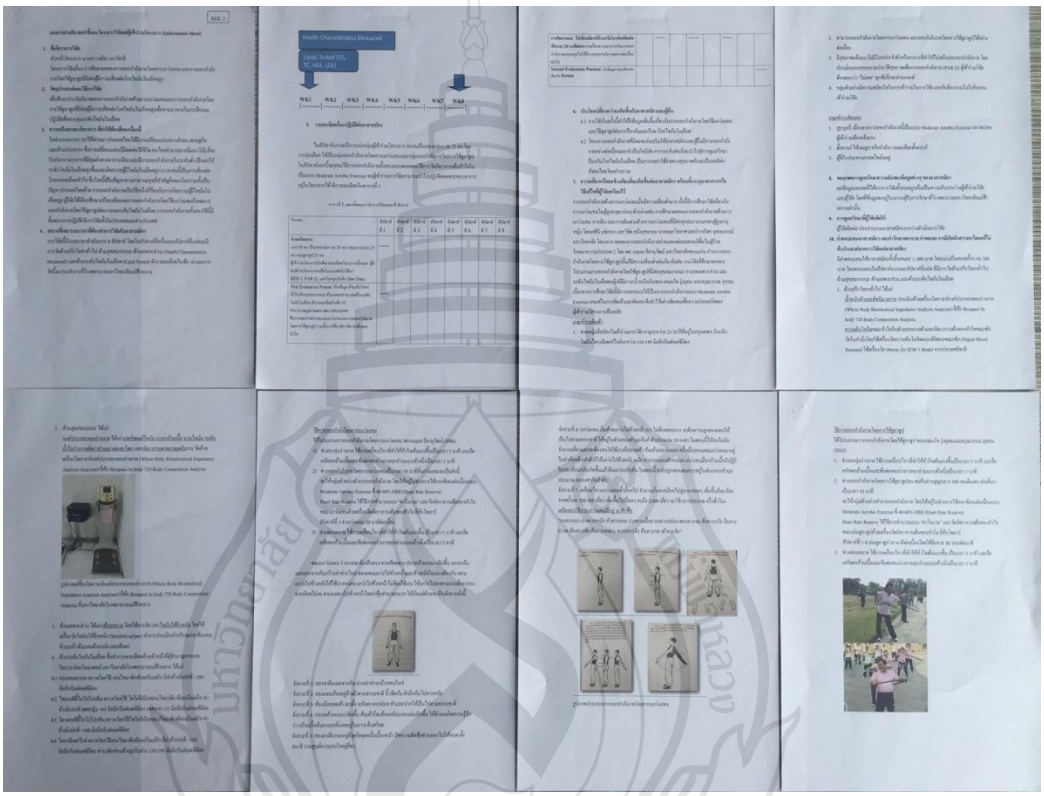
APPENDIX D

FOOD INTAKE FORM

Food Intake Form ไดอารี่อาหาร	**Food Intake Form ไดอารี่อาหาร**
วันที่.....	วันที่.....
อาหารเช้า.....	อาหารเช้า.....
อาหารกลางวัน.....	อาหารกลางวัน.....
อาหารเย็น.....	อาหารเย็น.....
ของว่าง.....	ของว่าง.....
ขนม.....	ขนม.....
เครื่องดื่ม	เครื่องดื่ม
น้ำเปล่า.....แก้วต่อวัน	น้ำเปล่า.....แก้วต่อวัน
กาแฟ.....แก้วต่อวัน	กาแฟ.....แก้วต่อวัน
น้ำอัดลม.....แก้วต่อวัน	น้ำอัดลม.....แก้วต่อวัน
ชนิด.....	ชนิด.....
ชา.....แก้วต่อวัน	ชา.....แก้วต่อวัน
น้ำผลไม้.....แก้วต่อวัน	น้ำผลไม้.....แก้วต่อวัน
แอลกอฮอล์.....แก้วต่อวัน	แอลกอฮอล์.....แก้วต่อวัน

APPENDIX E

PARTICIPANTS INFORMATION SHEET



APPENDIX F

INFORM CONSENT

REH 3

หนังสือยินยอมเข้าร่วมโครงการวิจัย (Informed Consent Form)

วันที่.....เดือน..... พ.ศ.....

ข้าพเจ้า (นาย/นาง/นางสาว)..... อายุ.....ปี อยู่บ้านเลขที่..... หมู่ที่.....ถนน.....ตำบล.....อำเภอ..... จังหวัด..... รหัสไปรษณีย์.....ขอทำหนังสือแสดงความยินยอมเข้าร่วมโครงการวิจัยเพื่อเป็นหลักฐานแสดงว่าข้าพเจ้ายินยอมเข้าร่วมโครงการวิจัยของ นางสาว ชลิดา เถาว์ชาลี เรื่อง การศึกษาผลของการออกกำลังกายโดยการแกว่งแขน และการออกกำลังกายโดยใช้ฮูลาฮูปที่มีต่อผู้มีภาวะเสี่ยงต่อโรคไขมันในเลือดสูง (A STUDY TO DETERMINE THE EFFECTS OF ARM SWING EXERCISE AND HULA HOOP EXERCISE ON RPESONS AT RISK OF DYSLIPIDEMIA DISEASE) ด้วยความสมัครใจ โดยมิได้มีการบังคับ หลอกลวงแต่ประการใด และพร้อมจะให้ความร่วมมือในการวิจัย

2. ข้าพเจ้าได้รับการอธิบายและตอบข้อสงสัยจากผู้วิจัยเกี่ยวกับวัตถุประสงค์การวิจัย วิธีการวิจัย ความปลอดภัย อาการ หรืออันตรายที่อาจเกิดขึ้น รวมทั้งประโยชน์ที่จะได้รับจากการวิจัย โดยละเอียดแล้วตามเอกสารชี้แจงผู้เข้าร่วมการวิจัยแนบท้าย

3. ข้าพเจ้าได้รับการรับรองจากผู้วิจัยว่าจะเก็บข้อมูลส่วนตัวของข้าพเจ้าเป็นความลับ จะเปิดเผยได้เฉพาะในรูปแบบของการสรุปผลการวิจัยเท่านั้น

4. ข้าพเจ้าได้รับทราบจากผู้วิจัยแล้วว่า หากเกิดอันตรายใดๆ จากการวิจัย ผู้วิจัยจะรับผิดชอบค่ารักษาพยาบาลที่เป็นผลสืบเนื่องจากการวิจัยนี้

5. ข้าพเจ้าได้รับทราบว่า ข้าพเจ้ามีสิทธิที่จะถอนตัวออกจากการวิจัยครั้งนี้เมื่อใดก็ได้ โดยไม่มีผลกระทบใดๆ ต่อการรักษาพยาบาลตามสิทธิ์ที่ข้าพเจ้าควรได้รับ

ข้าพเจ้าได้อ่านและเข้าใจข้อความตามหนังสือนี้แล้ว จึงได้ลงลายมือชื่อไว้เป็นสำคัญ พร้อมกับหัวหน้าโครงการวิจัยและพยาน

ลงชื่อ..... ผู้ยินยอม/ผู้ปกครอง
(.....)

ลงชื่อ..... หัวหน้าโครงการ
(.....)

ลงชื่อ..... พยาน
(.....)

ลงชื่อ..... พยาน
(.....)

APPENDIX G

PHYSICAL ACTIVITY READINESS QUESTIONAIRE (PAR-Q)

NASM™
NATIONAL ACADEMY OF SPORTS MEDICINE

Data Collection Sheet

NAME:_____ DATE:_____

HEIGHT:_____in. WEIGHT:_____lbs. AGE:_____

PHYSICIANS NAME:_____ PHONE:_____

PHYSICAL ACTIVITY READINESS QUESTIONNAIRE (PAR-Q)

	Questions	Yes	No
1	Has your doctor ever said that you have a heart condition and that you should only perform physical activity recommended by a doctor?		
2	Do you feel pain in your chest when you perform physical activity?		
3	In the past month, have you had chest pain when you were not performing any physical activity?		
4	Do you lose your balance because of dizziness or do you ever lose consciousness?		
5	Do you have a bone or joint problem that could be made worse by a change in your physical activity?		
6	Is your doctor currently prescribing any medication for your blood pressure or for a heart condition?		
7	Do you know of any other reason why you should not engage in physical activity?		

If you have answered "Yes" to one or more of the above questions, consult your physician before engaging in physical activity. Tell your physician which questions you answered "Yes" to. After a medical evaluation, seek advice from your physician on what type of activity is suitable for your current condition.

NASM
NATIONAL ACADEMY OF SPORTS MEDICINE

GENERAL & MEDICAL QUESTIONNAIRE

	Occupational Questions	Yes	No
1	What is your current occupation?		
2	Does your occupation require extended periods of sitting?		
3	Does your occupation require extended periods of repetitive movements? (If yes, please explain.)		
4	Does your occupation require you to wear shoes with a heel (dress shoes)?		
5	Does your occupation cause you anxiety (mental stress)?		
	Recreational Questions	**Yes**	**No**
6	Do you partake in any recreational activities (golf, tennis, skiing, etc.)? (If yes, please explain.)		
7	Do you have any hobbies (reading, gardening, working on cars, exploring the Internet, etc.)? (If yes, please explain.)		
	Medical Questions	**Yes**	**No**
8	Have you ever had any pain or injuries (ankle, knee, hip, back, shoulder, etc.)? (If yes, please explain.)		
9	Have you ever had any surgeries? (If yes, please explain.)		
10	Has a medical doctor ever diagnosed you with a chronic disease, such as coronary heart disease, coronary artery disease, hypertension (high blood pressure), high cholesterol or diabetes? (If yes, please explain.)		
11	Are you currently taking any medication? (If yes, please list.)		

PHYSICAL ACTIVITY READINESS QUESTIONNAIRE (PAR-Q)

แบบประเมินสุขภาพเพื่อการออกกำลังกาย

ชื่อ-นามสกุล_____วันที่_____

ความสูง_____น้ำหนัก_____อายุ_____

ชื่อแพทย์ผู้ดูแล_____เบอร์โทรศัพท์_____

	คำถาม	ใช่	ไม่ใช่
1	เคยมีแพทย์บอกคุณ ไหมว่าสภาพหัวใจของคุณนั้นต้องการคำแนะนำจากแพทย์ในการออกกำลังกายเท่านั้น		
2	คุณมีอาการเจ็บหน้าอกไหมเมื่อมีการออกแรง?		
3	ในเดือนที่ผ่านมา คุณเคยมีอาการเจ็บหน้าอก ทั้งๆ ที่ยังไม่ได้ออกแรงหรือไม่?		
4	คุณเสียการทรงตัวเพราะรู้สึกหน้ามืดหรือหมดสติหรือไม่?		
5	คุณมีปัญหาเกี่ยวกับกระดูกหรือข้อต่อที่อาจมีอาการแย่ลงหากมีการออกกำลังหรือไม่?		
6	แพทย์ของคุณเพิ่งจะจ่ายยาเพื่อลดความดันโลหิต หรือช่วยสภาพหัวใจของคุณ หรือไม่?		
7	คุณมีเหตุผลใดๆ หรือไม่ ที่ควรจะหลีกเลี่ยงการออกกำลังกาย?		

ถ้าหากว่าคำตอบของคุณคือ "ใช่" มากกว่าหนึ่งข้อ คุณควรปรึกษาแพทย์ประจำตัวของคุณก่อนการออกกำลังกาย บอกแพทย์ของคุณว่าคุณตอบ "ใช่" ในข้อใด หลังจากที่แพทย์ทำการประเมินสถานะทางสุขภาพของคุณ ถามด้วยว่ากิจกรรมประเภทใดที่เหมาะสมกับคุณในขณะนี้

APPENDIX H

RESEARCH POSTER

APPENDIX I

POMO 37

APPENDIX J

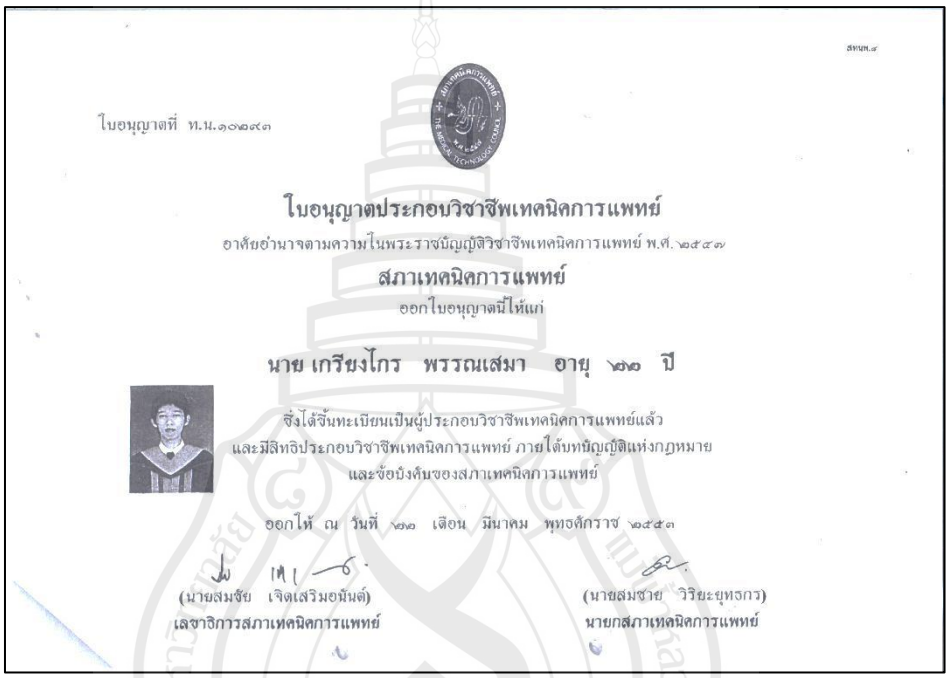
BIOSPACE INBODY 720 BODY COMPOSITION ANALYSIS

APPENDIX K

HULA HOOP

APPENDIX L

MEDICAL TECHNICIAN CERTIFICATION



ใบอนุญาตที่ ท.น.๑๑๒๙๓

ใบอนุญาตประกอบวิชาชีพเทคนิคการแพทย์

อาศัยอำนาจตามความในพระราชบัญญัติวิชาชีพเทคนิคการแพทย์ พ.ศ. ๒๕๔๗

สภาเทคนิคการแพทย์

ออกใบอนุญาตนี้ให้แก่

นาย เกรียงไกร พรรณเสมา อายุ ๒๒ ปี

ซึ่งได้ขึ้นทะเบียนเป็นผู้ประกอบวิชาชีพเทคนิคการแพทย์แล้ว
และมีสิทธิประกอบวิชาชีพเทคนิคการแพทย์ ภายใต้บทบัญญัติแห่งกฎหมาย
และข้อบังคับของสภาเทคนิคการแพทย์

ออกให้ ณ วันที่ ๒๑ เดือน มีนาคม พุทธศักราช ๒๕๕๓

(นายสมชัย เจิดเสริมพันธ์)
เลขาธิการสภาเทคนิคการแพทย์

(นายสมชาย วิริยะยุทธกร)
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EDUCATIONAL BACKGROUND

2016	Certificate of Completion Helping the Obese Patient Find Success, Western Schools, USA
1996-1997	Bachelor of Science in Nursing, Aurora University, Aurora, Illinois, USA
1994-1995	Studied Pre-nursing, University of Illinois, Chicago, Illinois, USA

WORK EXPERIENCE

2015-Present	Owner and Host of Television Program to promote Anti-Aging Lifestyle “Health Society” Channel 13 www.health-society.com
2006-2015	Owner and Host of Television Program to promote Healthy Lifestyle “Living in Shape” Channel 3 www.livinginshape.net
2010	Author of “10 Steps to Change Yourself”
2007	Author of “Ageless Formulas”
2005	Author of “Diet Secret”
1998	Miss Thailand 1998. Represented Thailand in Miss Universe Pageant 1998, Honolulu, Hawaii, USA