

## **CHAPTER 1**

### **INTRODUCTION**

This chapter presents the background and significance of the research problem, objectives of the study, hypotheses, scope of the study, and definition of terms.

#### **Background and Significance of the Research Problem**

Metabolic syndrome is a chronic condition consisting of a number of disorders such as abdominal obesity, high blood sugar, high triglyceride, low high density lipoprotein cholesterol, and elevated blood pressure that occur together in individuals. It is a constellation of interrelated risk factors linked to an increased risk of developing cardiovascular disease. Metabolic Syndrome has emerged a major clinical and public health problem. It contributes to doubling the incidence risk of cardiovascular disease within five to ten years (Mottillo et al, 2010), a major cause of death, not only in developed countries, but also in developing countries, including Thailand. Metabolic syndrome is also associated with health consequences, quality of life, and expenditure of health care. It is associated with a decrease functional status, quality of life and well-being of patients with the disease.

Nowadays, the prevalence of metabolic syndrome is increasing worldwide. It is estimated that around 20%-25% of the world adult population have metabolic syndrome (Alberti, Zimmet, & Shaw, 2006). One study in Europe found that the

prevalence of International Diabetes Federation defined metabolic syndrome was 29.6%, compared to 25.9% using the 2005 Adult Treatment Panel (ATP) III criteria (Hildrum, Mykletum, Hole, Midthjell, & Dahl, 2007). In North America and Australia, the prevalence of metabolic syndrome is approximately between 12% and 25%, whereas in Asia, the prevalence 10% to 30% (Nestel et al., 2007). In the United States, data from the National Health Statistics Reports showed approximately 34% of the population age 20 years and over met the criteria for metabolic syndrome (Ervin, 2009).

In Thailand, the prevalence of metabolic syndrome in women was higher than that in men. At the age of 50 years and over, the prevalence of metabolic syndrome from 2003-2004 increased from 9.5% to 24.7% and from 7% to 29.5% among women (Pongchaiyakul, Nguyen, Wanothayaroj, Karusan, & Klungboonkrong, 2007). A study among the employees of the Electricity Generating Authority of Thailand (EGAT) revealed that the prevalence of metabolic syndrome based on the ATP III criteria was 19.3% in men and 11.8% in women (Tanomsup et al., 2007). Also studies focused in central Thailand revealed that the overall prevalence of MetS was 11% with 13.9% prevalence among men and 8.8% women (Kongsomboon & Loetthiraphan, 2010).

The high prevalence of metabolic syndrome was associated with high prevalence of metabolic risk factors (Grundy et al., 2005). These risk factors include abdominal obesity, high blood pressure, high fasting blood sugar level, high triglyceride level and low HDL cholesterol level. Mottillo et al. (2010) did a systematic review and meta-analysis of metabolic syndrome and found that high fasting plasma glucose, high plasma triglyceride, low HDL cholesterol, hypertension

and central obesity were highly associated with the metabolic syndrome. Reynolds and Wildman (2009) reported that individuals with hypertension have greater than a two-fold increase in risk for having the metabolic syndrome, when compared to individual with normal blood pressure. Wood and Fernandez (2009) demonstrated that glycemic management in people with metabolic syndrome reduced the propensity of cardiovascular events. Thus, metabolic risk factor control was expected to decrease the prevalence of metabolic syndrome.

The goal of metabolic syndrome treatment is to control its components including waist circumference  $\leq 80$  cm in women or  $\leq 90$  cm in men, reduced systolic and diastolic blood pressure  $\leq 130/85$  mmHg, reduced fasting plasma glucose  $\leq 100$  mg/dl, reduced plasma triglyceride level  $\leq 150$  mg/dl and raised HDL cholesterol level  $\geq 50$  mg/dl in women or  $\geq 40$  mg/dl in men. These metabolic control components are specified by the modified Nutritional Cholesterol Education Panel III for Asia (Tan, Ma, Wai, Chew, & Tai, 2004). Although metabolic control is important to reduce metabolic syndrome, treatment goals are not reached for adequate risk factor reduction in patients with metabolic syndrome (Fruchart et al., 2008). A national study in United States has shown that less than 10% of people with diabetes attain recommended goals of metabolic syndrome control criteria for all three risk factors (Malik, Lopez, Chen, Wu, & Wong, 2007). A study in Spain regarding control of metabolic risk factors in people with type 2 diabetes found that only 7.8% of the samples reached the blood pressure target ( $< 130/80$  mmHg). Regarding treatments for dyslipidemia, only 5.6% patients attained the target (Orozco-Beltrán et al., 2007). In Thailand, data from the Thailand National Health Examination Survey IV during 2008 and 2009 revealed that 20.9 % of the patients had blood pressure

controlled and 28.5% reached the target of blood sugar control (FBS < 126 mg/dl). About 46.6 % had lower level of HDL cholesterol than the recommended. Only 36.5% of individuals had triglyceride level above 150 mg/dl. Abdominal obesity was highest in people aged 45-69 years (National Health Examination Survey [NHES] IV Study Group, 2010). Thus, many Thai people have multiple risk factors related to metabolic syndrome.

Additionally, dietary factors and sedentary lifestyle are known to contribute to the high prevalence of metabolic syndrome (Hu et al., 2008). Excess carbohydrate consumption has been a critical factor blamed for weight gain, abdominal obesity, increased blood sugar levels and increased plasma triglyceride (Honors, Davenport, & Kinzig, 2009; Johnson et al., 2009). A 1.3 g/day higher lifetime sodium intake translates into an approximately 5 mm Hg smaller rise in systolic blood pressure (Dickinson, & Havas, 2007). The National Health and Nutrition Examination Survey in United States conducted during 2003 to 2006 found that the prevalence of metabolic syndrome was higher among those who spend an increased amount of time engaged in sedentary activities such as watching television or videos or using a computer (Ervin, 2009). Healy et al. (2008) reported that time spent occupied with sedentary and light intensity activity were associated with increased waist circumference, increased systolic and diastolic blood pressure, increased fasting plasma glucose, increased triglyceride and decreased HDL cholesterol. Therefore, dietary factors and sedentary activity are associated with high waist circumference, high blood pressure level, high fasting plasma glucose, high triglyceride level and reduced HDL cholesterol.

Currently, modification of eating behavior and physical activity are recommended as primary therapy for metabolic syndrome management (Grundy et al., 2005). Complex carbohydrates (such as potatoes, bread, corn, etc) are associated with decreased events of weight gain, obesity and diabetes. High fiber diets are associated with a decreased incidence of hypertension, diabetes and obesity. The consumption of unsaturated fats, derived from vegetable oils such as sunflower, corn, olive and soybean, may be able to prevent metabolic syndrome (Pitsavos, Panagiotakos, Weinem, & Stefanadis, 2006). Dietary intakes rich in whole grain foods (Sahyoun, Jacques, Zhang, Juan, & McKeown, 2006) and greater intakes of fruit and vegetables have been associated with lower prevalence of metabolic syndrome (Esmailzadeh et al., 2006). Furthermore, evidence suggested that regular, moderate-intensity physical activity, five days per week is associated with reduced prevalence of metabolic syndrome (Grundy et al., 2005). Meta-analysis of randomized controlled trials showed that regular aerobic exercise increased an average in HDL-C levels, and a reduction in triglycerides, total cholesterol, and LDL-C (Kelly & Kelly, 2006), reduced systolic blood pressure by 4 mmHg and diastolic blood pressure by 3 mm Hg (Calhoun et al., 2008), as well as glycemic control (Sacco, Malone, Morrison, Friedman, & Welly, 2009). The results of those studies reflected that healthy eating behaviors and increased physical activity helped in treating and controlling the metabolic syndrome.

Although the beneficial effects of physical activity and healthy eating behavior are related to health status, people with hypertension, diabetes, or hypercholesterolemia have low levels of physical activity and/or exhibit unhealthy eating behaviors. American people with metabolic syndrome are more likely to spend

less time engaged in moderate or vigorous physical activity and to spend more hours watching television or videos or using a computer (Ervin, 2009). A descriptive cross-sectional survey showed that 80% of adults with hypertension, diabetes mellitus, dyslipidemia, and/or abdominal obesity were not engaging in regular exercise (Oh et al., 2007). Similarly, the Thailand National Health Examination Survey (NHES) IV found that 35.6% of Thai people aged over 15 years had insufficient physical activity (< 3 times/wk, low intensity) and daily consumed low amount of vegetables and fruit (3serving/day, < 400 g/day ) (NHES IV Study Group, 2010). Thus, changing eating behavior and improving physical activity are needed for controlling metabolic syndrome.

Enhancing physical activity and healthy eating behavior requires strategies. Lifestyle interventions presently have been implemented mostly in the field of obesity, diabetes, hypertension, and dyslipidemia. However, a few studies have been conducted in people with metabolic syndrome. A review of the literature reveals that lifestyle modifications have been mostly facilitated by recommendations of lifestyle change, general lifestyle advice, counseling, prescribing dietary or/and exercise regimens, education, dissemination of education materials, and monitoring of the components of metabolic syndrome. Bo et al. (2007) reported the use of detailed and individualized dietary and exercise counseling by trained professionals to people with metabolic syndrome. Nurse-led lifestyle counseling regarding lifestyle change was also found to improve indicators of metabolic syndrome including waist circumference and triglyceride concentrations (Tonstad, Alm, & Sandvik, 2007). However, those programs were mainly designed from a healthcare provider's agenda rather than people's needs.

With the complexity of metabolic risk factors in people with metabolic syndrome, it is rather difficult to change the risk behaviors. There are many barriers to changing eating behaviors and physical activity, including personal, cultural, environmental, and societal factors (Kohinor, Stronks, Nicolaou, & Halkens, 2010). Changing people's behaviors by providing traditional health education or simple approaches such as information transference, general advice, and prescribing dietary or/and exercise regimens is less likely to be successful (Hardcastle, Taylor, Bailey, & Castle, 2008). As traditional health education usually focuses on teaching disease-specific skills and compliance to prescribed advice from health care providers (Coleman, & Newton, 2005), the provision of information and skills is mainly based on health care providers' agendas rather than people's needs. Furthermore, the focus of traditional health education is often not based on problem-solving behavioral change issues. When patients encounter problems and obstacles, they neither solve them nor maintain new behaviors. Therefore, nonadherence to medical regimen is evidenced in many chronically ill persons attempting to achieve the goal of treatment and care, a new approach is needed for changing unhealthy behaviors should focus on the person's need and their problem-solving skills.

Self-management support is one approach that offers a systematic provision of education and supportive interventions by health care providers. The intervention aim to increase patients' skills and confidence to manage their health problems and enhance behavioral change such as developing patient problem-solving skills, improving self-confidence, and supporting application of knowledge in real-life situations (Glasgow et al., 2002). Health care providers will serve as transition

coaches to teach individuals about their conditions and enhance their skills on illness management (Green & Glasgow, 2006).

Russell Glasgow and colleagues (2002) developed self-management support with the 5As framework with clear processes and sequences for training activities meant to enhance patients' confidence for changing their behaviors. This approach includes treatment processes involving active participation, flexible activities in real life situations, and supporting patients during the behavior change process. The program has been found to be effective in smoking-cessation (Lawson, Flocke, & Casucci, 2009), heart failure management (Peters-Klimm et al., 2010), diabetes self-management behaviors (King et al., 2010), and chronic illness self-management (Glasgow, Davis, Funnell, & Beck, 2003). However, a study of self-management for people with metabolic syndrome was not found.

From the literature review, although people with metabolic syndrome receive knowledge of disease control, the treatment goals are not reached for adequate risk factor control (Fruchart et al., 2008). Obviously, the current method of knowledge dissemination is not sufficient to help patients control their disease. So, it is necessary to find the better way to educate the patients. According to self-management education has been reported as the effective strategy to control many chronic diseases, it should be tested in people with metabolic syndrome. Particularly in Thailand, little is known about the effectiveness of self-management intervention for enhancing eating behaviors and physical activity in Thai people with metabolic syndrome. Therefore, this study aims to examine the effects of a self-management support program developed by the researcher based on the Glasgow et al.'s framework on eating behaviors, physical activity, and metabolic control among

people with metabolic syndrome. The study results will provide a knowledge base for nurses that can be further used for disease control and enhancing quality of life.

### **Objectives of the Study**

The purpose of this study is to examine the effects of a self-management support program on eating behaviors, physical activity, and metabolic control among people with metabolic syndrome.

Research objectives are:

1. To compare eating behaviors, physical activity, and metabolic control of people with metabolic syndrome before and the end of the program and three months after the end of the program.
2. To compare eating behaviors, physical activity, and metabolic control between people with metabolic syndrome who received a self-management support program and those who received usual care.

### **Hypotheses**

1. People with metabolic syndrome receiving a self-management support program will have better eating behaviors than before receiving the program.
2. People with metabolic syndrome receiving a self-management support program will have higher physical activity level than before receiving the program.
3. People with metabolic syndrome receiving a self-management support program will have better metabolic control: smaller waist circumference, lower

systolic and diastolic blood pressure, lower blood sugar level, lower triglyceride level, and higher HDL cholesterol level than before receiving the program.

4. People with metabolic syndrome receiving a self-management support program will have better eating behaviors than those receiving usual care, at the end of the program and three months after the end of the program.

5. People with metabolic syndrome receiving a self-management support program will have higher physical activity score than those receiving usual care, at the end of the program and three months after the end of the program.

6. People with metabolic syndrome receiving a self-management support program will have better metabolic control: smaller waist circumference, lower systolic and diastolic blood pressure, lower blood sugar level, lower triglyceride level, and higher HDL cholesterol level than those receiving usual care, at the end of the program and three months after the end of the program.

### **Definition of Terms**

**A self-management support program for people with metabolic syndrome.** A self-management support program for people with metabolic syndrome refers to action and activities that enable people with metabolic syndrome to manage their eating behaviors, physical activity, and metabolic control. This program consists of educational and supportive group sessions of three months duration which call for a two hour session every one week for the first four weeks and monthly sessions for months two and three. It focuses on supporting people with metabolic syndrome in goal achievement to control metabolic risk components through eating behaviors and physical activity. Support includes goal setting and goal achievement, confidence in

the ability to produce behavioral change, action to change behavior and control metabolic risks, monitoring progress, problem solving for personal self-management plans, offering social and environment support, encouragement through ongoing contact and maintenance behaviors based on a self-management with the 5A's model of Glasgow et al. (2002).

**Eating behaviors.** Eating behaviors refers to the consumption of daily nutrients including carbohydrate, protein, fat, cholesterol, fiber, sodium, and sugar. The portion sizes of nutrient daily intake are weighted in cups, tablespoons, teaspoons, grams, and pieces. The nutrient intake is calculated using the INMUCAL-Nutrients program software developed by Institute of Nutrition, Mahidol University (2007).

**Physical activity.** Physical activity refers to the metabolic equivalents that person spent their energy on daily activities including occupational activity, household, transportation, and leisure-time activities. The lists of activities are calculated as the daily metabolic equivalents (MET) value based on the Community Healthy Activities Model Program for Seniors (CHAMPS) developed by Stewart et al. (2000).

**Metabolic control.** Metabolic control refers to the control of metabolic risk factors within designated criteria including waist circumference, systolic blood pressure, diastolic blood pressure, fasting blood sugar, plasma triglyceride, and plasma HDL cholesterol.

**Waist circumference.** Waist circumference refers to a numerical measurement of waist size by placing a measuring tape horizontally around the participant's iliac crest (hipbones).

**Blood pressure.** Blood pressure refers to systolic and diastolic blood pressure. Systolic blood pressure is the maximum pressure exerted on the arteries occurring during each heart beat while diastolic blood pressure is the minimum pressure in the arteries. The instrument used to measure blood pressure is the OMRON IA2 Automatic Blood Pressure Monitor.

**Fasting blood sugar.** Fasting blood sugar refers to measure blood sugar level at least 8 hours without eating.

**Plasma triglyceride.** Plasma triglyceride refers to the level of triglyceride in plasma after at least 10 hours without eating.

**Plasma high-density lipoprotein (HDL).** Plasma high-density lipoprotein refers to the level of HDL in plasma after at least 10 hours without eating.

**A person with metabolic syndrome.** A person with metabolic syndrome refers to the individual who meets at least three of five criteria of metabolic syndrome following the modified National Cholesterol Education Program Adult Treatment Panel III criteria (2005). The five criteria are high waist circumference ( $> 90$  cm in men,  $> 80$  cm in women), high blood pressure level ( $\geq 130/85$  mmHg or use of antihypertensive medication), high fasting plasma glucose level ( $\geq 100$  mg/dL or treatment of diabetes mellitus), high plasma triglyceride levels (TG  $> 150$  mg/L), and low high-density lipoprotein cholesterol levels (HDL  $< 40$  mg/dL in men,  $< 50$  mg/dL in women).

**Usual care.** Usual care refers to treatment based on the 2010 Clinical Practice Guidelines in Diabetes, Hypertension, and Dyslipidemia Control of the Ministry of Public Health Thailand (Bureau of Policy and Strategy, 2010), including

health assessments, giving advice about their conditions, and treatment advice.

Registered nurses who work in diabetes/hypertension clinic provide health education.