CHAPTER I

INTRODUCTION

Obesity has been recognized as one of the major health problems for decade. People with high body mass index (BMI) are at greater risk for developing obesity-associated diseases such as diabetes mellitus, hypertension, heart disease, and osteoarthritis of the knee (1). The prevalence of obesity is rising globally. As of 1990, over 9.9 million Americans aged 60 and older were classified as obese, representing 23.6% of the elderly population. By 2000, the number of obese elderly Americans has increased to 14.6 million, an estimated of 32 % of the elderly population (2). There has also been a dramatic increase in obese population in Thailand. In 1995, an estimated 40% of Thai adults aged 40 to 49 were considered overweight or obese using a standard of 25 kg/m^2 BMI or greater. The number was twice as much compared to the prevalence of overweight for people at this age range reported ten years ago (approximately 19%). Furthermore, it has been estimated that the number of adults facing obesity problems will continue to rise as the proportion of adults aged 40 and older tends to be larger in the next decades (3).

Several investigators have speculated that gait characteristics of normal weight healthy individuals may differ from those of obese individuals (4-6). During weight bearing task such as walking, gait kinematics of obese individuals have been reported to be different from those of normal weight individuals for both young and adult groups. Hills and Parker (4) and McGraw et al. (5) compared gait patterns of obese children with

those of nonobese children and found that during normal pace walking, obese children walked at slower speed with less steps per minute compared to nonobese children. Similar findings were reported for obese adults. Spyropoulos et al. (6) compared the kinematic parameters during level walking between obese and nonobese men, aged 30-47 years. They found that obese men walked slower with shorter stride length and greater step width than their nonobese counterparts.

An increase prevalence of overweight is parallel by an increase in physical inactivity. In addition, a sedentary lifestyle of working aged people has been identified as a leading factor in the development of obesity. Therefore, in recent years promotion of an active lifestyle of people at all ages has become an important issue. In particular for people who are prone to develop obesity-related diseases, aerobic exercise has become more commonly recommended in order to decrease morbidity and mortality rate of these individuals (7).

Treadmills are frequently used in exercise training. Walking at self-selected pace on a treadmill for obese adults has been found to be an effective method to achieve moderate to vigorous exercise intensity (8), however, little information exists for treadmill walking characteristics of obese adults. Previous investigators have shown that gait characteristics during treadmill walking differ from those during level walking for healthy individuals with normal range BMI. Alton et al. (9) reported greater hip range of motion, greater hip flexion, greater cadence, and lesser stance time in treadmill ambulation compared to overground walking. However, it is not known if healthy obese

individuals will demonstrate any differences in gait characteristics between overground and treadmill walking.

Adjustment of treadmill slope is often used to increase exercise intensity (8). Previous biomechanical research of walking on treadmill of healthy adults has shown that during an uphill walking mode, some kinematic variables are affected. Leroux et al. (10) investigated the postural adaptation to uphill and downhill walking in healthy subjects (aged 25-52 year) on treadmill. Increasing the treadmill slope from 0 to 10% uphill led to an increase in hip, knee and ankle flexion at initial foot contact and an increase in stride length. Nevertheless, no study has examined the effects of slope on gait pattern of obese individuals during treadmill walking.

From literature review, quantitative kinematic parameters of gait patterns of obese individuals especially in middle aged women who are at greater rising of developing obesity related disease remains scarce. Middle aged is the time of human life between youth and old age, usually reported as the years between 40 and 60 (11). Most importantly, understanding the kinematic changes during walking on treadmill may help physical therapists or other healthcare professionals prescribe appropriate exercise routines and prevent any associated injuries, which in turns will ultimately help obese individuals with better weight management. It may be help to improve toe clearance during walking, improve speed of walking and describe appropriate mode of exercise for obese person. Therefore, the purpose of this study is to kinematically describe and compare gait pattern of obese and normal weight women in three walking modes: walking overground at comfortable speed, walking on treadmill at comfortable speed

with 0% inclination, and walking on treadmill at comfortable speed with 10% uphill inclination.

Research Questions and Hypotheses

Research question

Are there any differences in gait kinematics between obese and normal weight women in the three walking modes?

Hypothesis

When compare gait pattern between obese and normal weight women in three modes of walking, there would be differences in:

- Temporospatial variables
  - ✓ Percent of stance cycle
  - ✓ Cadence
  - ✓ Step length
- Joint angles including
  - ✓ Trunk, hip, knee, and ankle angles at initial contact
  - ✓ Maximum trunk, hip, knee, and ankle flexion angles during swing phase
  - ✓ Maximum hip extension angles during stance phase

Purpose

The purpose of this study was to kinematically describe and compare gait pattern of obese and normal weight women in three walking modes: walking overground

at comfortable speed, walking on treadmill at comfortable speed with 0% inclination, and walking on treadmill at comfortable speed with 10% uphill inclination.

Application advantages

1. New information gained from this study may provide more insight into differences in gait kinematics between obese and normal weight women during treadmill walking with and without slope adjustment.

2. The results of the study may help physical therapists and other health related professionals to be able to provide more appropriate exercise prescriptions such as walking on treadmill to client who needs to solve their weight problems.

3. Knowing gait kinematics of obese persons during treadmill walking may help to prevent them from any associated injuries during exercise.