

# CHAPTER 1

## Introduction

### 1.1 Background

Obesity is an important problem in many countries around the world. In 2008, the World Health Organization (WHO) (1) reported that more than 1.6 thousand million people were overweight and 400 million people were obese. WHO reported that more than 22 million of under-five children were overweight and obese. It was predicted that the amount of overweight and obese people will be increasing to 2.3 thousand million and 700 million in 2015 (2). The increase trends of overweight and obesity occur globally, both in developed and in-developing countries.

The prevalence of overweight ( $\text{BMI} \geq 25 \text{ kg/m}^2$ ) and obesity ( $\text{BMI} \geq 30 \text{ kg/m}^2$ ) in Thailand was studied by WHO in health survey program in 1991, 1997, 2004, and 2009, respectively. They found that the prevalence of overweight over 18-years-old people was 18.2% in 1991 and increased to 24.1%, 28.1%, and 36.5%, respectively. The prevalence of obesity was 3.5% in 1991 and increased to 5.8%, 6.9%, and 9.0%, respectively. They also found that the prevalence of obesity was higher in women than men and was higher with the increasing age and highest in 45-54 years-old people.

International Health Policy Program (IHPP) studied about the obesity survey in Thailand in 2008-2009. They found that the prevalence of overweight and obesity was increasing exactly, 40.7% of women had  $\text{BMI} \geq 25 \text{ kg/m}^2$ . The increasing prevalence of overweight and obesity is a risk signal which indicated that the health problems were occurred and could be a cause of diseases, such as, Coronary Heart Disease (CHD), hypertension, diabetes, cancer, etc.

According to the problems of obesity, early diagnosis of obesity is very important because there are some limitations of diagnosis with the specialist such as time, cost, or numbers of specialist which results to late treatment. If people can evaluate themselves, they can receive treatment on-time and there will be more efficiency of treatment. Therefore, the simple indicator to evaluate the obesity is a choice of early diagnosis. There are many indicators of obesity which were used to evaluate the nutritional status (3). Body-fat percentage (BF%), which is a direct measurement of fat from a bioelectrical impedance analyzer (Biodynamics BIA 310eTM; Biodynamics Corporation, Seattle, WA), is a gold standard measure of obesity. Although BF% is the most accurate indicator, it is difficult and complicate to measure and its cost is expensive. According to the limitations of BF%, weight-height ratio indicators which are more convenient to measure are popular. Body mass index (BMI) which is relatively unbiased from height because it is the weight-height ratio indicator, is the well-known indicator for evaluating nutritional status in adults (4,5). However, an indicator which is more convenient than BMI was suggested. Pruenglapampoo S (6) studied about the association between Body mass index (BMI) and height weight difference index (HWDI) and suggested that HWDI could be used as a simple and effective index of screening overweight and obesity in adults. HWDI is the simple method to indicate the obesity using the difference of height (cm) and body weight (kg). This indicator had a high correlation and acceptable agreement to BMI and nutritional status classified by BMI (7).

Although HWDI is simple and suggested, both of HWDI and BMI have some limitation of using. First of all, HWDI and BMI do not focus on the source of weight, they cannot be classified the weight of muscularity or body fat. Second, HWDI and BMI cannot indicate the body fat which is the great risk factor for diseases. Finally, interpretation of HWDI and BMI without taking the differences of population, such as age and gender, into consideration might be bias and inaccurate.

According to the limitations of HWDI, we would like to determine concordance and discordance between HWDI and BF%, modify the cut-off for HWDI using different stratification of age and gender to be more accurate for evaluation of

obesity and similar to BF%, and compare the accuracy of using the new cut-off for HWDI with BF% which could be useful in obesity diagnosis and treatments.

## **1.2 Objectives**

1.2.1 To propose a new cut-off of HWDI (New-HWDI) for each age group by gender, considering body-fat percentage (BF%) as gold standard.

1.2.2 To find the relationship between HWDI and BF% and to find a BF% prediction model in relation to age group and gender.

## **1.3 Usefulness of the research**

People can assess their own nutritional status easier and more accurately which helps them to realize their health and avoid the risk of obesity and related diseases.

## **1.4 Definition**

### **1.4.1 Obesity**

Obesity which may impair health is defined as abnormal or excessive fat that accumulates in adipose tissue. Obesity can be result from positive energy balance and weight gain. However, the differences of obese individuals are not only in amount of excess fat but also in its regional distribution fat within the body. The distribution of fat induced by weight gain is associated with the risk of obesity and the kinds of disease (8).

### **1.4.2 Biomarkers related to body composition**

The human body is a complex unit which comprised of multiple compositions (9). Biomarkers (short for biological markers) are biological measures of a biological state. By definition, a biomarker is "a characteristic that is objectively measured and evaluated as an indicator of normal biological processes, pathogenic processes or pharmacological responses to a therapeutic intervention." (10)

There are a number of biomarkers related to body composition that could measure the body composition. However, this research only covers three biomarkers including HWDI, BMI and body-fat percentage which measured by BIA.

#### **1.4.3 Height weight difference index (HWDI)**

HWDI is the difference of height (cm) and body weight (kg).

### **1.5 Thesis outline**

We performed a cross-sectional analysis of baseline data from all adult participants enrolled healthy Thai volunteers by way of invitation at the Faculty of Medicine, Chiang Mai University via public information posters and the hospital web site, between May 2010 and May 2011. Participants were people from the general community. We excluded participants whose age was less than 18 years old. All participants provided written informed consent prior to participation in this study. This study was approved by the Faculty of Medicine, Chiang Mai University Ethics Committee. The final analytical sample was composed by 2,771 participants.

The state of knowledge about obesity, causes and current situation of obesity, assessment of obesity, analytical theory, correlation coefficient, Cohen's kappa statistic for measuring agreement, diagnostic test, regression analysis and other relevant research are described in the Chapter 2

Chapter 3 includes population definition, variables in the analysis, statistical methods, and ethical considerations. Moreover, this chapter explains the methods deployed of this study.

Chapter 4 presents the main results of this study which answer the research objectives about the new criterion of HWDI (New-HWDI) for screening obesity status in Thai adults and the relationship between HWDI and BF%.

Chapter 5 compares our study results with the previous studies and presents the discussion, limitation, and conclusion of this study.