Chapter 1

Introduction

Diabetes mellitus (DM) is one of the most common chronic diseases worldwide. The number of people with diabetes is increasing due to population growth, urbanization and increasing prevalence of obesity (Wild et al., 2004). Prevalence of diabetes in adults worldwide will rise from 135 million in 1995 to 300 million in the year 2025 (King et al., 1998). It is higher in developed than in developing countries. However, the proportional increase will be greater in the developing countries (King et al., 1998). In Thailand, the International Collaborative Study of Cardiovascular in Asia (Inter ASIA) estimated the prevalence of diabetes in Thai adults aged more than 35 years to be 9.6 percent (2.4 million) in 2000 as compared with 5.7 percent in 1991 (Aekplakorn et al., 2003). It was estimated that the number of people with diabetes in adults aged 20 years and over in Thailand will increase from 1,017,000 in 2000 to 1,923,000 in 2025 (King et al.,1998). WHO predicted a doubling number of diabetes patients in the next twenty years, especially the developing countries in Asia.

Cause of death in diabetic patients was due to complication of diabetes, such as coronary artery and peripheral vascular disease, stroke, and renal failure. The motality of cardiovascular disease (CVD) is at least 2-fold higher in diabetes than in non-diabetic subjects (Mooradian, 2003). This is the additional risk factors for CVD in diabetes on top of the other risk factors generally found in the non-diabetes population (Adlerberty et al., 1998). Thailand Diabetes Registry (TDR) Project identified the characteristics of Thai diabetes patient from diabetes clinics of eleven tertiary centers. The project reported 9,419 diabetes patient registered and 94.6 percent were type-2 diabetes. Prevalence of dyslipidemia found in this population was 73.7 percent, hypertension was 63.3 percent and obesity (BMI>25 Kg/m^2) was 52.6 percent. Diabetic nephropathy was the most common complication accounting for 43.9 percent followed by retinopathy 30.7 percent. Expenses of medical service on diabetic complications are enormous and pose a high impact on health economic of

the nation. International Diabetes Federation (IDF) predicted direct healthcare costs for diabetes worldwide to be 286 billions dollars or even more.

Metabolic syndrome is also known as syndrome X or, presumably mentioned by some authors, the insulin resistance syndrome. The constellation of metabolic abnormalities includes abnormal glucose homeostasis, abdominal obesity, dyslipidemia and hypertension. The abnormal glucose homeostasis is either overt type 2 diabetes, impaired glucose tolerance (IGT) or impaired fasting blood glucose (IFG). Obesity and metabolic syndrome do not always cause diabetes but they are harbinger of diabetes because they constitute characteristics of pre-diabetes by definition of WHO/IDF Consultation, 2006 and ADA, 2002 which further develop into diabetes. Thus, metabolic syndrome is virtually a fair pre-diabetes model. Attempts in the prevention of the disease are generally believed to be the effective measure to solve the public health problem nowadays. It is the opportunity, therefore, to explore the etiology of diabetes in detailed and find the possible means to prevent diabetes using the pre-diabetic model in abdominal obesity.

Thailand is an agricultural country and rice agriculture is considered the largest industry of the country. Rice bran is the by-product of the rice milling process. Rice bran and its oil have been known to have health benefits and help in disease prevention. Apart from dietary fiber rice bran contains certain quantities of starch, protein, vitamins and minerals as well. Rice bran is particularly rich in bioactive compounds including phytosterols, tocotrienols, tocopherols and γ-oryzanol (Prakash, 1996; Weststrate & Meijer,1998). Several study reported that rice bran and rice bran oil have some kinds of property to improve the plasma lipid in rodent, monkey and human. They were shown to decrease plasma cholesterol and triglyceride but increase high density lipoprotein cholesterol level (Kahlon et al., 1992; Sharma et al.,1986; Nicolosi, 1991; Lichtenstein et al., 1994; Sugano &Tsuji, 1997). In addition, there was a report indicating the role of rice-bran water extract in the reduction of glucose and insulin level in both type 1 and 2 diabetes mellitus (Qureshi et al., 2002).

Although rice is the staple food among Thai, but most of rice eaten by Thai people is the polished rice. Rice bran is used by oil industry and pet food. It is unwise, therefore, if benefits from rice bran are continuing neglected. In particular, the benefit of rice bran in preventing diabetes among those who are diagnosed as

metabolic syndrome should be studied. The study will not only give benefit to human health, but also to restore and conserve Thai folk wisdom on traditional medicine.

The aim of this research is to investigate effect of rice bran on insulin resistance found in normal rats those are fed with high-fat diet (65 % of total kcal is derived from fat). The water-extracted fraction of rice bran will be used in this study.

The objective of study

1. To study method of induction of normal rats into obese rats with high fat diet
2. To study the effect of high fat diet on insulin resistance in rats
3. To study the effect of rice bran extract on insulin resistance in diet- induced obese rats

Definition

Rice: is *Oryza sativa* (Khao Dawk Mali 105)

Rice bran: The second step is polishing the kernel which the process of polishing removes the bran and germ of Oryza sativa seeds.

High fat diet: The diet containing 65% kcal fat from pork belly**,** magarine.

Insulin resistance: refer to pre-diabetes or impaired fasting blood glucose (IFG) or impaired glucose tolerance (IGT). When fasting glucose levels ≥110 but <126 mg/dl

HOMA index: is used to estimate of insulin sensitivity and β-cell function from fasting plasma insulin and glucose concentrations