

**FACTORS ASSOCIATED WITH GLYCEMIC CONTROL  
IN TYPE 2 DIABETES MELLITUS PATIENTS  
IN PATTANANIKOM HOSPITAL**



**A THESIS SUBMITTED IN PARTIAL FULFILLMENT  
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Thesis  
Entitled

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IN TYPE 2 DIABETES MELLITUS PATIENTS  
IN PATTANANIKOM HOSPITAL**



*Varataya Pintong*  
.....  
Miss Varataya Pintong  
Candidate

*Prasert Assantachai*  
.....  
Assoc. Prof. Prasert Assantachai,  
M.D. (Hons), F.R.C.P. (London)  
Major-Advisor

*Vongsvat Kosulwat*  
.....  
Asst. Prof. Vongsvat Kosulwat  
Ph.D. (Nutritional Epidemiology)  
Co-advisor

*N. Plengvidhya*  
.....  
Lect. Nattachet Plengvidhya,  
M.D., Dip Thai Brd Int Med  
Co-advisor

*Kamol Udol*  
.....  
Asst. Prof. Kamol Udol,  
M.D. (Hons), M.Sc. (Clin Epidemiol)  
Co-advisor

*Rassmidara Hoonsawat*  
.....  
Assoc. Prof. Rassmidara Hoonsawat,  
Ph.D.  
Dean  
Faculty of Graduate Studies

*Prasert Assantachai*  
.....  
Assoc. Prof. Prasert Assantachai,  
M.D. (Hons), F.R.C.P. (London)  
Chair  
Master of Science Programme  
in Epidemiology  
Faculty of Medicine, Siriraj Hospital

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Entitled

**FACTORS ASSOCIATED WITH GLYCEMIC CONTROL  
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For the degree Master of Science (Epidemiology)

On  
20 May 2005

*Varataya Pintong*

Miss. Varataya Pintong  
Candidate

*Prasert Assantachai*

Assoc. Prof. Prasert Assantachai,  
M.D. (Hons), F.R.C.P. (London)  
Chair

*Kamol Udol*

Asst. Kamol Udol,  
M.D. (Hons), M.Sc. (Clin Epidemiol)  
Member

*Sunanta Chobtangsilp*

Lect. Sunanta Chobtangsilp  
M.D., Dip Thai Brd Int Med  
Member

*N. Plengvidhya*

Lect. Nattachet Plengvidhya,  
M.D., Dip Thai Brd Int Med  
Member

*Rassmidara Hoonsawat*

Assoc. Prof. Rassmidara Hoonsawat,  
Ph.D.  
Dean  
Faculty of Graduate Studies  
Mahidol University

*Piyasakol Sakolsatayadorn*

Prof. Piyasakol Sakolsatayadorn,  
M.D., F.R.C.S.T  
Dean  
Faculty of Medicine, Siriraj Hospital  
Mahidol University

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Varataya Pintong

FACTORS ASSOCIATED WITH GLYCEMIC CONTROL IN TYPE 2  
DIABETES MELLITUS PATIENTS IN PATTANANIKOM HOSPITAL

VARATAYA PINTONG 4536932 SIEP / M

M.Sc. (EPIDEMIOLOGY)

THESIS ADVISORS: PRASERT ASSANTACHAI, M.D. (Hons), F.R.C.P.  
(London), VONGSVAT KOSULWAT, Ph.D.(Nutritional Epidemiology), KAMOL  
UDOL, M.D. (Hons), M.Sc. (Clin Epidemiol), NATTACHET PLENGVIDHYA,  
M.D.,Dip Thai Brd Int Med

ABSTRACT

The study was a cross-sectional analytic study. The purpose of this study was to determine the factors associated with glyceemic control in type 2 diabetes mellitus patients who were treated at the diabetic clinic in Pattananikom Hospital in Lopburi province from April 22 to June 10, 2004. The total number of subjects was 148. Data were analyzed by descriptive statistics; univariate analysis by chi-square and multivariate analysis by forward stepwise and logistic regression, with a 95% confidence interval, all of which were done by the SPSS program.

Results showed that only 68.2 % of the subjects had an uncontrollable plasma glucose level. Multiple logistic regression was applied to calculate adjusted odd ratios ( $OR_{adj}$ ). Factors associated with glyceemic control in type 2 diabetes mellitus patients were gender ( $OR_{adj} = 3.12$ , 95%CI = 1.25-7.79,  $p$ -value = 0.015), dietary habit ( $OR_{adj} = 11.23$ , 95%CI = 3.69-34.18,  $p$ -value < 0.001 for poor dietary habit and  $OR_{adj} = 7.95$ , 95%CI = 2.85-22.17,  $p$ -value < 0.001 for fair dietary habit) and low drug compliance ( $OR_{adj} = 3.67$ , 95%CI = 1.16-13.65,  $p$ -value = 0.029)

The findings of this research showed some significant risk factors associated with glyceemic control in type 2 diabetes mellitus patients. Health teams should provide health education in a participatory manner focusing on physical health care, dietary habit, and drug compliance in order to increase effectiveness of prevention, and control of diabetes mellitus.

KEY WORDS: RISK FACTORS / GLYCEMIC CONTROL

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ปัจจัยที่มีความสัมพันธ์ต่อระดับน้ำตาลในเลือดของผู้ป่วยเบาหวานชนิดที่ 2 ในโรงพยาบาลพัฒนานิคม  
(FACTORS ASSOCIATED WITH GLYCEMIC CONTROL IN TYPE 2 DIABETES  
MELLITUS PATIENTS IN PATTANANIKOM HOSPITAL)

วรัทยา ปิ่นทอง 4536932 SIEP / M

วท.ม. (วิทยาการระบาด)

คณะกรรมการควบคุมวิทยานิพนธ์ : ประเสริฐ อัสสันตชัย, (Hons), F.R.C.P.(London),  
วงสาวท โกศลวัฒน์, Ph.D.(Nutritional Epidemiology), กมล อุดล, M.D.(Hons), M.Sc. (Clin  
Epidemiol.), ณัฐเชษฐ์ เปล่งวิทยา, M.D., Dip Thai Brd Int Med

บทคัดย่อ

การศึกษานี้เป็น cross-sectional analytic study ครั้งนี้มีวัตถุประสงค์เพื่อศึกษาปัจจัยที่มีความสัมพันธ์ต่อการควบคุมระดับน้ำตาลในเลือดของผู้ป่วยเบาหวานชนิดที่ 2 ที่คลินิกเบาหวานแผนกผู้ป่วยนอก โรงพยาบาลพัฒนานิคม จังหวัดลพบุรี ระหว่างวันที่ 22 เมษายน ถึงวันที่ 10 มิถุนายน 2547 กลุ่มตัวอย่างที่ศึกษาคือผู้ป่วยเบาหวาน จำนวน 148 ราย วิเคราะห์ข้อมูลโดยใช้สถิติเชิงพรรณนา ทดสอบความสัมพันธ์ โดยใช้สถิติไคสแควร์ และวิเคราะห์ตัวแปรเชิงซ้อน โดยการใช้ Multiple logistic regression เพื่อทดสอบขนาดและทิศทางความสัมพันธ์โดยการคำนวณหาค่าอัตราความเสี่ยงสัมพัทธ์ และดูนัยสำคัญทางสถิติ โดยใช้ค่าความเชื่อมั่น 95 เปอร์เซ็นต์ (95% confidence interval) ใช้โปรแกรมสำเร็จรูป SPSS ในการวิเคราะห์ข้อมูล

ผลการศึกษา พบว่า ร้อยละ 68 ไม่สามารถควบคุมระดับน้ำตาลในเลือดได้ เมื่อวิเคราะห์ตัวแปรเชิงซ้อน โดยควบคุมอิทธิพลตัวแปรอื่นๆ พบว่า ปัจจัยที่มีความสัมพันธ์ต่อการควบคุมระดับน้ำตาลในเลือด ของผู้ป่วยเบาหวานชนิดที่ 2 คือ เพศ ( $OR_{adj} = 3.12, 95\%CI = 1.25-7.79, p-value = 0.015$ ), นิสัยการรับประทานอาหาร ( $OR_{adj} = 11.23, 95\% CI = 3.69-34.18, p-value < 0.001$  for poor dietary habit and  $OR_{adj} = 7.95, 95\% CI = 2.85-22.17, p-value < 0.001$  for fair dietary habit) และการให้ความร่วมมือน้อย ในการรับประทานยา ( $OR_{adj} = 3.67, 95\% CI = 1.16-13.65, p-value = 0.029$ )

จากการศึกษาครั้งนี้แสดงให้เห็นถึงปัจจัยที่มีความสัมพันธ์ต่อการควบคุมระดับน้ำตาลในเลือด ของผู้ป่วยเบาหวานชนิดที่ 2 ดังนั้นบุคลากรทางการแพทย์ควรมีตระวังในปัจจัยดังกล่าวและควรให้ความรู้แก่ผู้ป่วย ที่มารับบริการ โดยเน้นในเรื่องอาหารที่ควรรับประทาน และความร่วมมือในการรับประทานยา เพื่อเพิ่มประสิทธิภาพในการป้องกันและควบคุมโรคเบาหวานต่อไป

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## CHARPTED I

### INTRODUCTION

#### Background

Diabetes mellitus is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both. The two main classes of diabetes mellitus are insulin – dependent (IDDM) or type 1 diabetes mellitus and non–insulin–dependent (NIDDM) or type 2 diabetes mellitus (1).

Type 2 diabetes mellitus accounts for 85 % of cases of diabetes in Caucasian populations and virtually all in certain non – Caucasian ethnic groups. Current estimates almost certainly conservative are that at least 150 million people worldwide have diabetes, of whom two – thirds live in developing countries. The total number of people with diabetes is predicted to rise to about 300 million by 2025 (2). In Europe and America, type 2 diabetes mellitus was found in 85 % of all diabetic patients, and in Asian countries including Thailand , the most common type of diabetes is the type 2 ,which is found in 95 % of the cases (3). In Thailand, prevalence in 1991 was 3.26 % among persons age > 30 years. Annual report from the Ministry of Public Health revealed that morbidity rate of diabetes mellitus was 218.8, 267.7 and 277.7 per 100,000 population respectively in 1999 to 2001. The mortality rate of diabetes mellitus was 7.6, 7.9, 11.4 and 12.2 per 100,000 population respectively in 1997 to 2000(4). In 2000, The National Survey of Population found that diabetes prevalence in Thai adults was 9.6% (2.4 million people) (5). The global database collected by WHO with demographic estimates and projections issued by the United Nations to estimate the number of people with diabetes in Thailand in the year 1995, 2000, and 2025 was shown in Table 1. In addition, the data have been analyzed in terms of certain additional parameters, such as sex ratio, urban-rural ratio, and the age structure of the diabetic population. The prevalence of diabetes in Thailand was increasing in rural more than in urban areas during the year 1995 and 2000, but prevalence in 2025 was increasing in urban more than in rural areas. This trend could also be seen especially in the age group of 45-64 years old in the year 2025.(Table 1)(6)

**Table 1** : Estimated numbers of diabetes mellitus patients in Thailand in 1995 – 2025.

Year	Number of people recruited	Prevalence (per 100)	Number of diabetic cases				
			Area		Age group		
			Rural	Urban	20-44	45-64	≥ 65
1995	36,088	2.4	514	349	368	389	106
2000	39,981	2.5	563	454	422	465	130
2025	52,660	3.7	674	1,248	494	1,084	345

Epidemiological data show that diabetes is still a significant health problem and its prevalence might increase in the future. Sequentially, the problems of hypoglycemia, hyperglycemia, complications of diabetes such as hypertension, renal failure, blindness, amputation, myocardial infarction, etc. are certainly increasing. All of these complications affect somatic, psychological and socioeconomic status of individual, family and society. The most important issue in patient management is the ability to maintain their blood glucose at a normal level. Patients have to change their health behaviors by controlling their diet and increasing exercise. Knowledge regarding factors associated with blood glucose control will help diabetic patients to have appropriate intervention in controlling the disease and preventing complications.

In Lopburi province, the number of diabetic patients increases every year. Pattananikom hospital is a community hospital with 60 beds in Lopburi province and provides services for diabetic patients every Thursday. From the diabetic clinic records, the numbers of diabetic patients are increasing each year. In 1999 to 2001, there were 468, 546 and 604 diabetic patients attending the clinic respectively. Most of the patients were type 2 diabetes mellitus patients and 70 % of diabetic patients could not control the blood glucose to the normal level. In 2003, there were 1,401 diabetic patients and 53% of them could not control their blood glucose. It is interesting to study what factors associated with glycemic control in type 2 diabetes mellitus patients in Pattananikom hospital. The research results will provide the plan and proper management for diabetic patients.

## **Objective**

### **General Objective**

To determine the factors associated with glycemc control in type 2 diabetes mellitus patients.

### **Specific Objective**

1. To determine the association between demographic characteristics and glycemc control in type 2 diabetes mellitus patients.
2. To determine the association between knowledge of type 2 diabetes mellitus and glycemc control in type 2 diabetes mellitus patients.
3. To determine the association between health behavior (dietary habit, physical activity and drug compliance) and glycemc control in type 2 diabetes mellitus patients.
4. To determine the association between psychosocial characteristics (mental stress, family support) and glycemc control in type 2 diabetes mellitus patients.

### **Hypothesis**

1. Demographic characteristics are associated with glycemc control.
2. Knowledge of type 2 diabetes mellitus is associated with glycemc control.
3. Health behavior factors (dietary habit, physical activity and drug compliance) are associated with glycemc control.
4. Psychosocial characteristics (mental stress, family support) are associated with glycemc control.

### **Advantage of study**

The results would provide a guide for improvement of diabetic clinic management and glycemc control in type 2 diabetes mellitus patients.

## Variables

### 1. Independent variables

#### 1.1 Demographic characteristics

- Age
- Gender
- Marital status
- Education
- Occupation
- Family Income
- Duration of diabetes mellitus
- Body mass index

#### 1.2 Knowledge of diabetes

- Pathogenesis
- Signs and symptoms
- Complications
- Treatment and self - care

#### 1.3 Health behaviors

- Dietary habit
- Physical activity
- Drug compliance

#### 1.4 Psychosocial characteristics

- Mental stress
- Family support

### 2. Dependent Variable

- Glycemic control (uncontrolled group)

## Definition

1. Age: a full year of age of diabetic patients are starting from the date of birth to the date of the study. If it was 6 months or more, the age would be added up to 1 year.

2. Duration of disease: a full year of disease, starting from the date that the physician diagnosed the patients with diabetes until the date of the study. If it was 6 months or more, the duration would be added up to 1 year.

3. Type 2 diabetic patients: diabetic patients who had been diagnosed by a physician to have type 2 diabetes mellitus and who received treatment by oral glycemic medication at diabetic clinic of Pattananikom hospital. The patient profile had to be fit in inclusion criteria.

4. Glycemic control: HbA<sub>1c</sub> levels was used to determine glycemic control. Hemoglobin, a protein molecule found in red blood cell, becomes modified by having glucose bound to it. Measuring glycosylated hemoglobin is useful for predicting complication in patients with existing diabetes. HbA<sub>1c</sub> could indicate diabetes control between 1 – 2 months period. HbA<sub>1c</sub> equals or less than 7% are considered as good glycemic control, whereas HbA<sub>1c</sub> more than 7% indicates poor control(7).

5. Knowledge of diabetes mellitus: patient's knowledge of the general information about pathogenesis, signs and symptoms, complications, treatment, prevention of complication and self-care.

6. Body Mass Index : the measurement indicating the proper weight calculated by weight (kilogram) / height (meter)<sup>2</sup> on the interview day and can be interpreted as follows (8) :

- Underweight was defined as body mass index of < 18.5 kg/m<sup>2</sup>
- Normal range was defined as body mass index of 18.5-22.9 kg/m<sup>2</sup>
- Overweight at risk was defined as body mass index of 23-24.9 kg/m<sup>2</sup>
- Obese I was defined as body mass index of 25-29.9 kg/m<sup>2</sup>
- Obese II was defined as body mass index of ≥ 30 kg/m<sup>2</sup>

7. Health behaviors: behaviors or practices in daily life associate with glycemic control in type 2 diabetes mellitus patients, which is divided into 3 components including dietary habit, physical activity and drug compliance.

8. Dietary: food consumption behaviors in daily life of diabetic patients including healthy food (such as lean meat, vegetables, low fat milk, etc.) , unhealthy food (such as fatty/oily foods, water mixed of sugar, dessert, luscious fruits, etc) and frequency of food consumption.

9. Physical activity: all activities during everyday life including working, recreation, exercise and sport activities.

10. Vigorous physical activities: activities that take hard physical effort and make the patients breathe much harder than normal.

11. Moderate activities: activities that take moderate physical effort and make the patients breathe some what harder than normal.

12. Drug compliance: pattern of which diabetic patients follow prescriptive order.

13. Family support: some supports that diabetic patients may receive from their family members such as taking care, financial support, etc.

14. Stress: responses of the body or the mind to harmful, threatening, or challenging events. The emotional responses to stress include anxiety, irritability, anger, embarrassment, depression, and hostility.

## CHAPTER II

### LITERATURE REVIEW

Theory and researches have been reviewed as follows :

1. Knowledge of type 2 diabetes mellitus
2. Health behaviors
3. Factors associated with glycemic control in diabetic patients.

#### **1. Knowledge of type 2 diabetes mellitus**

##### **1.1 Definition**

Diabetes mellitus is characterized by hyperglycemia and disturbances of carbohydrate, fat and protein metabolism that are associated with absolute or relative deficiencies in insulin action and / or insulin secretion. Therefore, although diabetes is an endocrine disease in origin, its major manifestations are those of a metabolic disease(9). Diabetes mellitus may be suspected or recognized clinically by the presence of characteristic symptoms such as excessive thirst, polyuria, pruritus, unexplained weight loss, or one or more of the many complications associated with or attributable to the disease(10).

##### **1.2 Classification (7)**

According to the American Diabetic Association (ADA) and the World Health Organization (WHO), the new classification bases on the etiology of diabetes mellitus as follows :

##### **Type 1**

Type 1 diabetes most often results from cellular mediated autoimmune destruction of the beta cells of the pancreas. Patients with this form of diabetes are dependent upon insulin for survival and are at risk of ketoacidosis. Type 1 commonly occurs in childhood and adolescence but may occur at any ages.

## **Type 2**

Individuals with type 2 diabetes have insulin resistance and relative, rather than absolute, insulin deficiency. Primary treatment centres on weight loss, improved nutrition, and increased age-appropriate physical activity. Oral agents may become necessary if the initial treatment is unsuccessful. These patients do not need insulin to survive but may require insulin over time for optimal management, especially if oral agents become ineffective. Type 2 diabetes commonly goes undiagnosed for years because it is often asymptomatic in its early stages. Individuals with undiagnosed type 2 diabetes are at increased risk for developing macro/microvascular complications.

### **Other types**

Other types of diabetes mellitus are an abnormal heredity of beta cell function, genetic defects in insulin action, diseases of the exocrine pancreas, endocrinopathies, drug or chemical – induced, infections, uncommon but specific forms of immune – mediated diabetes mellitus and other genetic syndromes sometimes associated with diabetes .

### **Gestational Diabetes Mellitus (GDM)**

Gestational Diabetes Mellitus (GDM) is defined as any degree of glucose intolerance with onset or first recognition during pregnancy. The definition applies regardless of whether insulin or only dietary modification is used for treatment. GDM complicates approximately 4% of all pregnancies in the U.S.; however, the prevalence is higher among some minority groups. Six weeks or more after the pregnancy ends, a woman with GDM should be tested to rule out type 1 or 2 diabetes or impaired glucose tolerance. Women with GDM have a higher risk for type 2 diabetes later in life.

## **1.3 Diagnostic tests for diabetes**

### **The new criteria**

The diagnostic criteria for diabetes mellitus have been modified from those previously recommended by the NDDG(11) or WHO (12). The revised criteria for the diagnosis of diabetes are show in Table 2.

**Table 2 :** Criteria for the diagnosis of diabetes mellitus.

<p>1. Symptoms of diabetes plus casual plasma glucose concentration <math>\geq 200</math> mg/dl (11.1 mmol/l). Casual is defined as any time of day without regard to time since last meal. The classic symptoms of diabetes include polyuria, polydipsia, and unexplained weight loss.</p> <p style="text-align: center;">or</p> <p>2. FPG <math>\geq 126</math> mg/dl (7.0 mmol/l). Fasting is defined as no caloric intake for at least 8 hours.</p> <p style="text-align: center;">or</p> <p>3. 2-h PG <math>\geq 200</math> mg/dl (11.1 mmol/l) during an OGTT. The test should be performed as described by WHO (2), using a glucose load containing the equivalent of 75-g anhydrous glucose dissolved in water.</p>
---

The Expert Committee recognizes an intermediate group of subjects whose glucose level, although not meeting criteria for diabetes, are nevertheless too high to be considered altogether normal. This group is defined as having FPG levels  $\geq 110$  mg/dl (6.1 mmol/l) but  $<126$  mg/dl (7.0 mmol/l) or 2-h values in the OGTT of  $\geq 140$  mg/dl (7.8 mmol/l) but  $<200$  mg/dl (11.1 mmol/l). Thus, the categories of FPG values are shown in Table 3 (13).

**Table 3 :** The categories of FPG values and OGTT.

	Fasting Plasma Glucose	Casual Plasma Glucose	Oral Glucose Tolerance Test (2 hr. after 75g. glucose in water)
Normal	$<100$ mg/dl		2 hr. PG $<140$ mg/dl
Pre-diabetes (IFG)	100-125 mg/dl		2 hr. PG 140-199mg/dl (IGT)
Diabetes	$\geq 126$ mg/dl	$\geq 200$ mg/dl	2 hr. $\geq 200$ mg/dl

**A1C (7)**

A1C (Hemoglobin A1C) is a glycosolated hemoglobin test which provides an average blood glucose over the preceding 2-3 months. The A1C is considered as the "Gold Standard" for evaluation of diabetes control. Normal A1C levels are between 4 - 6.8 % for people without diabetes. According to the 2003 American Diabetes Association Clinical Practice Recommendations, an A1C of < 7 % is desired for good diabetes control. An A1C of 7% equates to an average blood glucose of 150 mg/dl. In individuals who have pre-meal blood glucose values within desired target ranges, but who are not meeting A1C targets should consider monitoring their blood glucose 1-2 hours after the start of a meal to determine post-meal readings. If average post-meal readings are above 180mg/dl, diabetes management should be evaluated to decrease post-meal blood glucose values to less than 180 mg/dl (ADA, 2003).

**1.4 Signs and symptoms (14)**

The main initial symptoms of diabetes are :

1. Polydipsia (increased thirst)
2. Polyuria (increased urinary frequency with increased volume)
3. Fatigue
4. Polyphagia (increased appetite)
5. Weight loss
6. Abnormal healing
7. Blurred vision
8. Increased occurrence of infections, particularly those caused by yeast.

**1.5 Causes and risk factors for type 2 diabetes (15)**

Type 2 diabetes is a very heterogeneous syndrome with many possible causes. It is due to the interaction of environmental factor with a genetic susceptibility to the disease, and it is clear that the relative contributions of genes and environment can differ considerably, even among individuals whose clinical phenotype is closely similar .

### **Genetic factors**

A striking feature of type 2 diabetes is the strength of its genetic component, which is much greater than in type 1 diabetes and is estimated to account for 40 – 80 % of total disease susceptibility. Type 2 diabetes is highly concordant (60 – 90%) in monozygotic twin pairs, but less so (17 – 37%) in non-identical twins. The risk of developing type 2 diabetes increases strikingly if there is a family history of the disease, especially among first-degree relatives.

Diabetogenic genes could influence either or both of the basic defects in type 2 diabetes, namely insulin resistance and the inability of the  $\beta$  cell to secrete enough insulin to overcome the effects of the resistance. Candidate genes therefore include, on the one hand, the signalling mediators and enzymes that regulate insulin's biological actions, and on the other, components of the  $\beta$  cell's secretory machinery and the mechanisms that ensure  $\beta$  cell survival.

### **Obesity**

Total body adiposity, a central fat distribution and the duration and time-course of developing obesity are all established risk factors for type 2 diabetes in both sexes. Indeed, having a body-mass index (BMI) of  $>35 \text{ kg/m}^2$  increases the risk of developing diabetes over a 10-year period by a staggering 80-fold, as compared with thin individuals ( $\text{BMI} < 22 \text{ kg/m}^2$ ). Recent data from the long-term prospective study of North American nurses show that lifestyle factors account for 90% of the excess susceptibility to type 2 diabetes and that obesity is the most important of these.

Obesity (especially abdominal and visceral) is associated with insulin resistance, and fat is presumed to secrete potentially diabetogenic factors that can act on distant tissues (mainly liver and muscle) to induce insulin resistance. Candidate factors include FFA and perhaps cytokines such as THF- $\alpha$ , which interfere with glucose metabolism in liver and muscle.

### **Urbanization and industrialization**

These changes inevitably accompany the adoption of a westernized lifestyle and are associated with a high prevalence of diabetes in susceptible populations. Before the advent of these new habits, diabetes was virtually unknown among numerous populations in developing countries. Noteworthy examples include the inhabitants of the Pacific island Nauru, urbanized people in Papua New Guinea and

the Pima Indians, all of whom now have a prevalence of type 2 diabetes of > 40%. Readily available high-energy foods and physical inactivity are largely to blame; obesity (particularly abdominal) is the result, and lack of physical exercise may also be diabetogenic in its own right. Mechanization and the replacement of physically active occupations may be an important factor in the rising prevalence rates of type 2 diabetes in rural areas.

### **Malnutrition early in life**

Malnutrition in utero and during the first year of life has been associated with the subsequent development of type 2 diabetes in some studies, but not other. The 'thrifty phenotype' hypothesis suggests that specific nutritional deficits in fetal and early infant life predispose to type 2 diabetes, by compromising the development and function of the  $\beta$  cells and possibly by inducing insulin resistance .

## **1.6 Complications**

### **1.6.1 Acute (anytime) complications of diabetes**

#### **Primary and secondary hypoglycemia (16)**

Hypoglycemia can have severe, and sometimes very rapid consequences for the organism. The symptoms often originate in the brain where metabolism depends almost entirely on glucose as a substrate. The organism responds very sensitively to hyperglycemia as compared to hypoglycemia. The causes of hypoglycemia are manifold, and on the basis of the etiology, and particularly the presence or absence of hyperinsulinism.

#### **Diabetic Ketoacidosis (17-18)**

This acute metabolic complication typically results from a profound insulin deficiency (absolute or relative) associated with uncontrolled type I diabetes mellitus and occasionally in decompensated type II diabetes. The incidence of DKA is approximately 40 episodes/10,000 diabetic subjects, mortality remains high 10% for DKA.

Individuals with type II diabetes may develop DKA under certain conditions:

1. Poor nutrition that contributes to dehydration and catabolism of fat to provide necessary calories.

2. Severe physiologic stress (eg, infection, myocardial infarction) that leads to increased levels of counterregulatory hormones (eg, epinephrine, cortisol, and glucagon), which stimulate betaoxidation of fatty acids.

3. Chronic poor metabolic control that leads to decreased insulin secretion and decreased glucose uptake (glucose toxicity).

4. Dehydration that leads to decreased excretion of ketones in urine and a buildup of ketone bodies in the blood.

Diabetic ketoacidosis is a metabolic acidosis caused by a significant insulin deficiency. The following physiologic abnormalities are characteristics of DKA and require prompt correction:

- Chronic hyperglycemia and glucose toxicity.
- Acidosis caused by catabolism of fat and the buildup of ketone bodies.
- Low blood volume because of dehydration (loss of fluid and electrolytes).
- Hyperosmolality because of renal water loss and water depletion from sweating, nausea, and vomiting, included associated potassium loss.

### **Hyperosmolar Hyperglycemic Nonketotic Coma**

Hyperglycemic Hyperosmolar Nonketotic Coma (HHNKC) is characterized by severe hyperglycemia (glucose level typically greater than 600 to 800 mg/dL), dehydration, and altered mental status in the absence of ketosis. In HHNKC, hyperglycemia causes glycosuria. Osmotic diuresis results in volume contraction and a reduction in both the glomerular filtration rate and glucose excretion. Worsening hyperglycemia causes further extracellular hypertonicity and intracellular dehydration.

Occurrence: HHNKC occurs most often among persons over 60 years. Most persons with HHNKC have a history of NIDDM, but in a sizable minority, NIDDM is undiagnosed or untreated. When persons who are chronically ill, debilitated, or institutionalized have mild renal insufficiency and lack normal thirst mechanisms or access to water, they are at risk of developing HHNKC. Acute illnesses (stroke, myocardial infarction, or pneumonia), drugs (diuretic or glucocorticoid), surgery, and, occasionally, large glucose loads (through enteral or parenteral nutrition or peritoneal dialysis) may precipitate HHNKC.

### **1.6.2 Chronic (longer term) Complication (17),(19-21)**

The long-term complications that may develop in patients with type II diabetes include:

#### **Macrovascular disease**

##### **Cardiovascular Disease**

Diabetes is recognized as a major risk factor for cardiovascular disease. Many people with diabetes have other risk factors for cardiovascular disease, including high blood pressure, high blood lipids (blood fats including total cholesterol, HDL, LDL, and triglycerides), and obesity. Changes in the blood vessel occur during the course of diabetes, although the precise mechanism for these changes are unknown.

Major cardiovascular disease is a broadly inclusive term that encompasses heart disease, cerebrovascular disease, and peripheral vascular disease, all of which are complications from diabetes. In Colorado, the annual hospitalization rate for major cardiovascular disease is 59 per 1000 persons with diabetes.

##### **Heart Disease**

The terms that refer to heart disease alone are coronary heart disease (ischemic heart disease) and heart attack (myocardial infarction). Diabetes can increase the risk of the heart attack in persons over age 20. Abnormally high blood lipids can be found in 30% of people with diabetes. The annual hospitalization rate with coronary (ischemic) heart disease as the primary diagnosis is 24 per 1000 persons with diabetes.

##### **Cerebrovascular Disease and Stroke**

The incidence of cerebrovascular disease and stroke is two to three times greater in people with diabetes than in the general population. This is because diabetes can damage blood vessels that supply the brain. The risk factors for heart disease and stroke are essentially the same .

##### **Peripheral Vascular Disease**

The incidence of peripheral vascular disease is five times greater in people with diabetes than in the general population. Peripheral vascular disease is a major contributor to foot problems and amputation in diabetes . It results from damage to the blood vessels in the arms and legs, with problems particularly evident in the lower legs and feet. Peripheral vascular disease is sometimes experienced as pain in the legs upon exertion, and in extreme cases, also pain at rest. Poor circulation to the

extremities diminishes healing in these areas. Extremities that are seriously affected may need to be amputated.

## **Microvascular complications**

### **Diabetic Neuropathy**

Diabetes can damage the nervous system. Peripheral neuropathy (damage to the peripheral nervous system) is the most common form of damage, present in 12% of persons at the time of diagnosis of diabetes, and in 25% after 25 years of disease. It affects the peripheral nerves, usually in a bilateral "stocking glove" pattern of the legs and arms. In some instances, this is associated with painful sensation, but more often nerve sensitivity is diminished or absent. With lost sensitivity, damage may not be detected until the secondary problem, such as infection, develops.

The other form of nerve damage, autonomic neuropathy, affects autonomic nervous system, which innervates cardiovascular, gastrointestinal, and genitourinary systems. It can be responsible for a number of conditions, including orthostatic hypertension, gastroparesis, bladder dysfunction, constipation, diarrhea, fecal incontinence, and impotence. Autonomic neuropathy can be life-threatening. Lack of sensation in the autonomic nervous system may have serious consequences, including non-painful ("silent") heart attack and inability of an individual to perceive the symptoms of hypoglycemia.

### **Diabetic Retinopathy**

Eye disorders are frequently associated with high blood sugar and also with hypertension. They are often missed in the early stages unless a physician or eye care specialist screens for them. The small blood vessels of the eye are affected by diabetes, leading to damage of the retinal or macular regions. Damage to these structures will induce a loss of visual function. Eye problems that occur more frequently in people with diabetes include damage to the retina (diabetic retinopathy), damage to the macula (maculopathy), glaucoma, and cataracts.

Diabetic eye problems may occur singly or together and can progress to more serious problems. This can have serious consequences and even result in blindness. After 15 years of diabetes, proliferative retinopathy occurs in 15% of those with Type

II diabetes. Untreated proliferative retinopathy associated with diabetes progresses to blindness within five years in 20-50% of cases .

Edema, or swelling, of the eye's macula is another serious complication and can be sight- threatening. People with diabetes have a 40% risk of developing macular edema over their lifetime. In addition, with diabetes, there is 1.6 times greater risk for cataracts and 1.4 times greater risk for open-angle glaucoma. In people with Type II diabetes, cataracts and glaucoma cause blindness more frequently than retinopathy .

### **Diabetic nephropathy**

Over 20% of adults who have had diabetes for 20 years or more have clinically apparent nephropathy. This disease is progressive, takes years to develop, and requires laboratory evaluation for early detection because it generally is asymptomatic in the early stages.

Structural and functional changes in the kidneys occur early in the course of poorly controlled diabetes but do not produce clinical symptoms. The important clinical point is that, in this early stage of nephropathy, aggressive management may reverse or completely stabilize any abnormalities.

Finally, the end-stage renal disease is similar to kidney failure requiring dialysis. Patients with diabetes tend to start dialysis earlier because they develop symptoms sooner than other patients with renal disease. Early detection is essential. Renal function should be evaluated initially in all new patients and at yearly intervals in all adult patients with diabetes. A dipstick method is recommended for screening for microalbuminuria or determining the albumin-to-creatinine ratio.

### **Diabetic foot disorder**

More than half of all non-traumatic amputations in the United States occur in individuals with diabetes, and the majority of these could have been prevented by proper foot care. Efforts aimed at prevention, early detection, and treatment of diabetic foot disorders can have a significant impact on the incidence of these problems. Unless foot problems are diagnosed early and dealt with aggressively, they can progress to ulceration and gangrene. This may result in lower limb amputation. In many cases, early management of a foot problem will avoid an amputation. And, if an amputation must be performed, early amputation is less extensive. Once a limb is amputated, the other limb often requires amputation within several years. This is due

to increased weight-bearing pressure and movement pattern changes in the remaining limb, increasing its susceptibility for injury. The risk for amputation is greatest in persons over 40 years old who have had diabetes for more than 10 years. Men have 1.5 to 3 times of lower limb amputations than women and incidence is higher in black and native American populations.

### **1.7 Treatment and self – care (22-23)**

At present, the available choices of treatment are education, diet, insulin, oral agents and exercise .

#### **Education**

This is one of the most crucial aspects of treatment and, for this reason, should be considered first. It is necessarily a continuous education process for the diabetic and his family involving their physical and emotional problem, looking forward to the patient's health and happiness.

Without education, control is practically impossible and the patient cannot hope to delay or minimize complications. It is imperative for the patient and close relatives to know presently available methods of treatment and health professionals as well as the lay associations related to the care and protection of diabetics should combine their efforts in this matter.

The topics should include general information, diet principles, therapy, psychological concerns, exercise, etc., in the form of both theoretical and practical classes with opportunity for questions and discussions. Families and particularly both parents of diabetic children should attend the lectures and demonstrations. While it is the responsibility of the physician to start this program, it should be continued afterwards by specialized nurses or dietitians under medical supervision.

#### **Diet**

Proper dietary management is fundamental in the treatment of diabetes. Insulin and / or oral hypoglycemic agents cannot restore the patient to a normal metabolic status if a proper diet is not followed. The proper diagnosis of the type of diabetes is very important before prescription of a diet or any other treatment .

Usually patients with type I diabetes have no excessive body weight and the caloric intake prior to onset should be maintained. On the other hand, Type II diabetics,

while either obese or non – obese, will require caloric restriction and weight reduction or a normocaloric diet for optimal treatment in each case. Later, when the desirable body weight is reached, calories may be adjusted to permit weight maintenance.

### **Insulin and oral hypoglycemic agents**

In many patients with diabetes, diet alone is not adequate in treatment. Sometimes physiological or pathological states such as pregnancy, stress, general surgery or infection make other therapeutic measures necessary in addition to diet. The physician must determine the appropriate treatment, such as type of insulin, administration method and schedule ( the use of devices for continuous delivery of insulin or multiple injections ) or even which oral hypoglycemic agent should be used.

Once again the importance of education must be emphasized since some patients have incorrect ideas about the use of insulin or oral hypoglycemic agents and their beneficial or harmful effects. Sometimes oral hypoglycemic compounds have been reported to be useful in those patients who have a high degree of insulin resistance.

### **Exercise**

Exercise, while useful for everyone, is especially important for diabetics. It affects metabolic control, body weight, cardiovascular risk factors and the psycho – social status of the patient as well as increasing the sensitivity of cell receptors. The metabolism of glucose increases during activity in both normal and diabetic person, since there is much greater glucose release from the liver and a marked increase of uptake by muscles, even if insufficient insulin is available. Likewise, the blood level of free fatty acids increases during exercise which is another important benefit.

Exercise should be consistent, planned by the physician after complete physical and laboratory examinations and determination of the patient's needs and abilities . Continuing education for both doctors and patients have to be emphasized . Severe hypoglycemia may occur during over – activity in diabetics. Appropriate reduction of insulin doses in Type I diabetes, especially during heavy exercise , camping and other outdoor activities, must be considered .

### 1.8 Body mass index

Obesity is an important public health problem in most countries, which is associated with metabolic syndrome (24). Over-eating and physical inactivity in combination with genetic factors are the major causes for the development of obesity in humans (25). Although severe obesity is clearly associated with increased mortality and the incidence of cardiovascular disease, type 2 diabetes mellitus, stroke, dyslipidemia, osteoarthritis and some cancers, the health consequences of being mildly-to-moderately overweight remain controversial(26). The International Obesity Task Force of WHO proposed a system of classification based on body mass index (BMI) and selected a BMI of 30.0 as the cut-off point for obesity (WHO criteria), similar to classifications used in a number of previous studies based on mortality and morbidity outcomes in Europe and the U.S.A. Frequency of obesity, defined by WHO criteria as a BMI over 30.0 is found no more than 2-3% in the Japanese population, in contrast to the 10-20% in Europe and the U.S.A. However, metabolic syndrome with mildly-to-moderately overweight may be found at the onset of cardiovascular diseases in Japanese workers(27-29).

Body weight is often described in terms of BMI (body mass index). Body Mass Index (BMI) describes relative weight for height. The formula for BMI is: weight (kg)/height (m<sup>2</sup>).

**Table 4 :** BMI classifications

WPRO (2000)	
Classification	BMI ( kg/m <sup>2</sup> )
Underweight	< 18.5
Normal range	18.5-22.9
Overweight at risk	23-24.9
Obese I	25-29.9
Obese II	≥ 30

## **2. Health behaviors**

### **2.1 Dietary**

Dietary consumption is important for good diabetes control. Diets should be reviewed periodically so that each patient will have an individual, more likely to be accepted diet allowing for differences in culture, personal preference, economic level, availability of food types, activity and other individual characteristics(22).

Diet prescription should be implemented according to disease stages with caloric restriction in the first place, as weight loss itself diminishes hyperglycemia to or toward normal. Combinations of foods and even different processing or cooking of the same food may produce different glucose responses. These factors minimize the role of the glycemic index in overall diabetes management. Foods with high soluble fiber content may diminish glucose elevations after meals; however, high-fiber foods appear to be less important for the obese diabetic person than adhering to a calorie-restricted diet and achieving weight loss. Dietary therapy must supply caloric requirements for carbohydrate, protein and fat both in proper proportion and at regular intervals. This is to maintain both homeostatic mechanisms and ideal body weight. There has to be special consideration for adequate intake of vitamins and minerals. When possible, nutritionists or dietitians should explain and amplify physicians' diet prescription to achieve the desired nutritional goals (30) .

### **2.2 Physical activity**

Regular physical activity was recognized in ancient times as an important part of the treatment of diabetes mellitus. In 1919, Allen et al. demonstrated that exercise lowers the blood glucose concentration and transiently improves glucose tolerance in persons with diabetes.

Goal 5 of the Healthy People 2010 initiative states, "Through prevention programs, reduce the disease and economic burden of diabetes, and improve the quality of life for all persons who have or are at risk for diabetes."

It is now clear that regular physical activity is an important role in both the prevention and treatment of type 2 diabetes mellitus (31).

The recent Surgeon General's Report on Physical Activity and Health underscores the pivotal role physical activity plays in health promotion and disease prevention. It recommends that individuals accumulate 30 minutes of moderate physical activity on most days of the week. In the context of diabetes, it is becoming increasingly clear that the epidemic of type 2 diabetes sweeping the globe is associated with decreasing levels of activity and increasing prevalence of obesity. It must also be recognized that the benefit of exercise in improving the metabolic abnormalities of type 2 diabetes (32).

Physical activity has many advantages for all individuals. Activity is beneficial in type 2 diabetes by (33-34):

- Reducing blood glucose, A1C and lipids.
- Lowering blood glucose during and after exercise
- Improving insulin sensitivity by increased insulin uptake of muscles and peripheral tissues.
- Reducing medication/insulin needs
- Improving blood pressure
- Aiding in weight loss
- Increasing muscle mass
- Increasing energy
- Improving strength and flexibility
- Improving cardiovascular function
- Improving self-esteem and quality of life

Risks of Exercise/Activity for type 2 Diabetes:

- hypoglycemia
- injury
- silent myocardial infarction
- exacerbation of complications such as foot injury/infection, advanced retinopathy, etc.

Maintaining a balance of physical activity with food and pharmacological glucose lowering agents is an important skill for type 2 individuals. Continued reassurance and guidance is necessary for individuals to learn how to plan and maintain a balance to achieve desired glucose levels.

### 2.3 Drug compliance (35)

Pharmacological intervention is recommended after medical nutritional therapy, physical activity and weight management have failed to achieve desired glucose control. Many varieties of oral agents and insulin are currently available. Oral agents are most often chosen over insulin therapy for newly diagnosed individuals with type 2 diabetes, unless glucose levels are very high at time of diagnosis. The type of oral agents is determined by the individual's past medical history, renal and hepatic status, alcohol ingestion habits, weight, and medication allergies. If weight is above desired limits, usually an oral agent that reduces insulin resistance is prescribed. If weight is within desired limits, an oral agent that reduces the hepatic glucose production or the one that stimulate insulin production is prescribed.

#### **Oral agent**

Oral agents currently available may act at the beta cells of the pancreas to release insulin, at the liver to reduce glucose production, at the digestive system to slow carbohydrate absorption, or lastly at peripheral and muscle tissues to enhance glucose uptake.

#### **- Sulfonylureas and Metformin**

Sulfonylureas and Metformin have been proven to be a very effective combination(36). Patients failing maximum doses of either Metformin or a Sulfonylurea can be given the other medication in combination therapy. The Sulfonylurea dose should be lowered to achieve consistent daytime glucose values in a safe range. Metformin will also blunt the weight gain that may occur with the use of Sulfonylureas alone. The combination of a Sulfonylurea and Metformin tends to be more potent in terms of lowering glycosylated hemoglobin than any other oral agents combinations.

#### **- Sulfonylureas and Acarbose**

Sulfonylureas and Acarbose also work well together (37). Acarbose, in a fashion similar to Metformin, tends to blunt the weight gain that can occur with the Sulfonylurea when they are used alone. Because of their unique mechanisms of action, Acarbose and the Sulfonylureas complement each other and can reduce both fasting and postprandial glucose values.

- Metformin and Acarbose

Neither of these drugs causes weight gain or hypoglycemia when used alone or in combination. These two medications have been used together successfully without excessive gastrointestinal side effects(38).

- Sulfonylureas, Metformin, and Acarbose

In Europe, the combination of all three oral agents has been used in clinical practice. Each of these oral agents has a unique mechanism of action, and they can potentially complement one another to improve glycemic control and avoid insulin therapy.

**Insulin(39)**

Insulin may be necessary to control glucose when beta cells can no longer produce adequate insulin. Insulin can be used in combination with oral agents or alone for type 2 diabetes.

### **3. Factors associated with glycemic control in diabetic patients and involved research**

#### **3.1 Age**

Seekhaow W (40) studied about non-medical factors determining blood glucose level in type 2 diabetes. After adjusting for gender and oral hypoglycemic agents, one year older in age could improve glycemic control (  $p = 0.011$ ).

Rittichu C (41) studied about the patients adherence to regimens and glycemic control in type 2 diabetes. This study found that age was not associated with glycemic control .

Ramachandran A, et al.(42) studied about high prevalence of diabetes and impaired glucose tolerance in India : National Urban Diabetes Survey. This study found that the age of diabetic patients showed associations with impaired glucose tolerance.

Sornnarin K(43) studied about the factors affecting blood glucose levels among 88 patients attending Banlad Hospital, Phetburi Province. Age did not associate with blood glucose control.

A report of Harris S (44) found that the elderly had less sugar tolerance than the young. On the other hand, in the population aged between 18 – 44 years old the chance that diabetic patients could be found was 1.5% while in the population aged between 45 – 65 years old the chance increased to 6 % . Among the populations age 65 and higher ,the chance further increased up to 11 %.

Keawkerd O(45)studied about the factors affecting blood sugar level in diabetes mellitus patients at Sappasithiprasong Hospital, Ubonratchathani. This studied found that age was not associated with blood glucose level.

### **3.2 Gender**

Lindstrom J, et al.(46) studied about the Finnish diabetes prevention study. This study found that patients of both the intervention group and control group were female more than male .

Nontasorn T, et al. (47) studied about the effects of the supportive educative nursing system of self care on non-insulin dependent diabetes mellitus patients, Ubonratchathanee Province. This study found that patients of the intervention group and control group were female more than male .

Nampraditkul (48) studied about the factors related to glycemic control in type 2 diabetic patients at Paholpolpayuhasena Hospital, Kanchanaburi Province. This study found that patients of the controllable and uncontrolled groups were female more than male .

Rittichu C (41) studied about the patients adherence to regimens and glycemic control in type 2 diabetes. This study found that gender was not associated with glycemic control .

Seekhaow W (40) studied about non-medical factors determining blood sugar level in type 2 diabetes. After adjusting for age and oral hypoglycemic agents, gender was not associated with blood glucose level .

### **3.3 Marital status**

Nampraditkul (48) studied about the factors related to glycemic control in type 2 diabetic patients. She found that marital status was not associated with plasma glucose control of type 2 diabetic patients .

The study of Seekhaow W(40) studied about non-medical factors determining blood sugar level in type 2 diabetes. She found that those who were married and widow had poor glycemic control compared to the single ones.

### **3.4 Occupation**

Keawkerd (45) studied about the factors affecting blood sugar level in diabetes mellitus patients at Sappasithiprasong Hospital, Ubonratchathani. This study found that occupation was not associated with blood glucose level .

The study of Seekhaow W (40) found that those who were employed had 1.38 times more likely to have poor glycemic control compared to those who were unemployed patients.

Kelestimur F, et al.(49) studied about the prevalence and identification of risk for type 2 diabetes mellitus and impaired glucose tolerance in Kayseri, Central Anatolia, Turkey. This study found that the prevalences of type 2 diabetes mellitus were 9.7% and 4.1% in those who had light physical activity and heavy physical activity respectively(  $p < 0.0001$ ).

Gu D, et al.(50) studied about the prevalence of diabetes and impaired fasting glucose in the Chinese adult population in International Collaborative Study of Cardiovascular Disease in Asia(Inter ASIA). This study found that diabetic patients were laborer more than other groups.

### **3.5 Income**

The study of Pothiwara (51) found that the patients with high family income had better compliance than those with lower income. The majority of the patients who had problems in diabetic control had financial problem .

Rittichu C (41) studied about patients adherence to regimens and glycemic control in type 2 diabetes. This study found that income status was not associated with glycemic control .

### 3.6 Educational level

Rittichu C (41) studied about the patients adherence to regimens and glyceimic control in type 2 diabetes. This study found that education level was not associated with glyceimic control .

The study of Seekhaow W (40) found that subjects who had higher education level had poor glyceimic control compared to illiterate individuals (  $p$  for trend = 0.038).

The study of Keawkerd (45) found that the proportion of patients in the controllable group who graduated with a certificate and bachelor degree were 0.33 times higher than the uncontrolled group, significantly (  $p = 0.024$  ).

### 3.7 Body mass index

O'Connor PJ, et al.(52) studied about metabolic factors association with glucose control in non-insulin-dependent diabetes mellitus. They found that the change of body weight did not relate to plasma glucose control.

Hiranwan S (53) studied about the factors related to self-care and glyceimic control in non-insulin dependent diabetes mellitus patients. She found that body mass index was not associated with glyceimic level .

Nampraditkul (48) studied about the factors related to glyceimic control in type 2 diabetic patients. She found that body mass index of type 2 diabetic patients between the controllable group and uncontrollable group of glucose level were not different .

Tansakul P (54) studied about the factors related to glyceimic control in type 2 diabetic patients. She found that body mass index of type 2 diabetic patients between the controllable group and uncontrollable group of glucose level were not different .

### 3.8 Duration of Diabetes Mellitus

Nampraditkul (48) studied about the factors related to glyceimic control in type 2 diabetic patients. She found that the duration of diabetes mellitus was significantly associated with the controllability of blood glucose level (  $p = 0.02$  ). This study also indicated that patients who had diabetes for more than 5 years were 1.52

times more likely to be at risk of uncontrolling blood glucose level compared to those who were ill for 5 years or less .

Hiranwan S (53) studied about the factors related to self-care and glycemic control in non-insulin dependent diabetes mellitus patients. She found that the duration of disease was not associated with self-care behavior and it did not depend on how long the patients had disease .

Rittichu C (41) studied about the patients adherence to regimens and glycemic control in type 2 diabetes. This study found that duration of diabetes mellitus was not associated with glycemic control .

The study of Seekhaow W (40) was about non-medical factors determining blood sugar level in type 2 diabetes. She found that duration of diabetes mellitus was not associated with glycemic control.

### **3.9 Dietary**

Hiranwan S (53) studied about the factors related to self-care and glycemic control in non- insulin dependent diabetes mellitus patients .The results revealed that the following factors are found to be significantly related to glycemic control : dietary behavior, taking oral hypoglycemic drugs, compliance with appointments and exercise. Other variables tested, including activities of daily living and body mass index , were not related to glycemic control .

The study of Ary et al. (55) found that dining out (such as at restaurant) resulted in poor plasma glucose control due to improper food choices.

Rittichu C (41) studied about the patients adherence to regimens and glycemic control in type 2 diabetes. After adjusting for all other variables. This study found that diet control was significantly associated with the controllability of blood glucose level ( $p < 0.001$  ).

The study of Keawkerd (45) found that diet control was not associated with blood glucose level.

The study of Seekhaow W (40) found that subjects who had no diet control had poor glycemic control.

### 3.10 Physical activity

The study of Akekoshi H, Matsuoka K, Suzuki Y, et al. (56) assessed the long term effect of endurance exercise to glucose and lipid metabolism in non – insulin dependent diabetics during a ten year study. From this study, jogging group showed extremely good results, though walking group had better than non – exercise group. Some authors recently reported a long term effect on improving blood glucose control as measured by HbA1c and 24 – hour urine glucose excretion .

Rittichu C (41) studied about the patients adherence to regimens and glycemic control in type 2 diabetes. After adjusting for all other variables, exercise was significantly associated with the controllability of blood glucose level. ( $p < 0.001$  )

Seekhaow W (40) studied about non-medical factors determining blood sugar level in type 2 diabetes. After adjusting for age and oral hypoglycemic agents, exercise was not associated with blood glucose level .

The study of Keawkerd (45) found that exercise was not associated with blood glucose level. It was different from the other studies. This difference may be due to many factors such as definition, poor research design and questionnaire.

### 3.11 Drug compliance

Tansakul P (54) studied about the factors related to glycemic control in type 2 diabetic patients. She found that compliance to medicine was not associated with blood glucose level .

Hiranwan S (53) studied about the factors related to self-care and glycemic control in non - insulin dependent diabetes mellitus patients. She found that taking oral hypoglycemic agents was not associated with blood glucose level.

### 3.12 Knowledge of diabetes

Chaveepojnkamjorn W, et al (57) studied about glycemic self-control in type 2 diabetes mellitus patients. He found that knowledge of diabetes was significantly associated with glycemic control ( $p < 0.013$  ).

Watanapahu S and Saranop S (58) studied about the factors affecting the control of blood sugar level of non-insulin dependent diabetic patients in Saraburi Hospital. Knowledge was not associated with glycemic control ( $p = 0.05$  ).

### 3.13 Family support (59)

Studies indicate that one of the best predictors of how well someone takes care of their diabetes is the amount of support they get from their family and friends. However, not all support is helpful. For example, one person might enjoy their family watching everything they eat while another person could be driven to do the exact opposite by that type of scrutiny. Family members and friends need to understand diabetes, listen to what the patient thinks and feels, and deliver support. Perhaps the two most important guidelines for family members are to have realistic expectations about blood glucose levels and to avoid blame. Blaming the patients with diabetes for too high or low blood sugar levels never helps and frequently causes hurt feelings, arguments or serious conflicts. The key to genuine support is to avoid blame and focus on problem solving.

Rittichu C (41) studied about the patients adherence to regimens and glycemic control in type 2 diabetes. She found that the social support was not associated with blood glucose level .

Chaveepojnkamjorn W, et al (57) studied about glycemic self control in type 2 diabetes mellitus patients. He found that family support was not associated with glycemic control .

Chomsamut K (60) studied about effectiveness of support from relatives on diabetic control among elderly patients at diabetes clinic in Chulaongkorn Hospital. She found that family support was not associated with glycemic control .

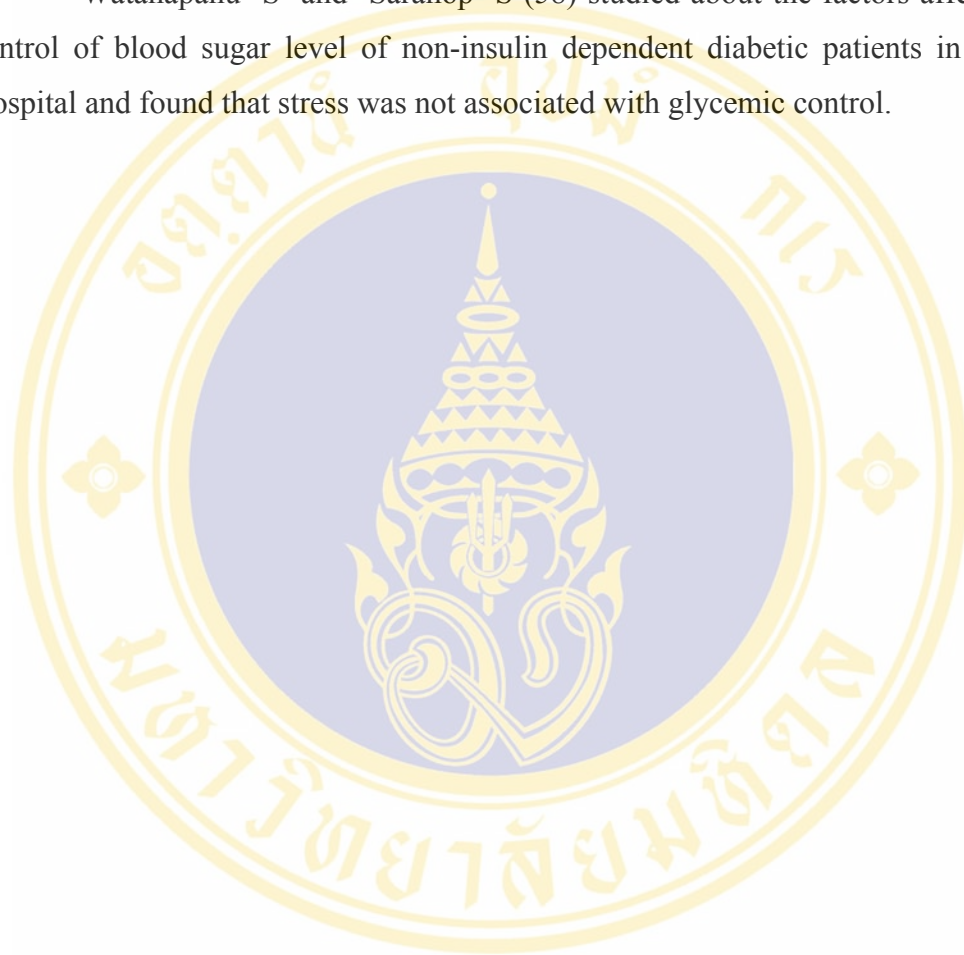
### 3.14 Stress (61-62)

In people who have diabetes, the fight-or-flight response does not work well. Insulin is not always able to let the extra energy into the cells, so glucose piles up in the blood. Stress can alter blood glucose levels. It does this in two ways. First, people under stress may not take good care of themselves. Second, stress hormones may also alter blood glucose levels directly. Scientists have studied the effects of stress on glucose levels in animals and people. Diabetic mice under physical or mental stress have elevated glucose levels. The effects in people with type 1 diabetes are more mixed. While most people's glucose levels go up with mental stress, others'

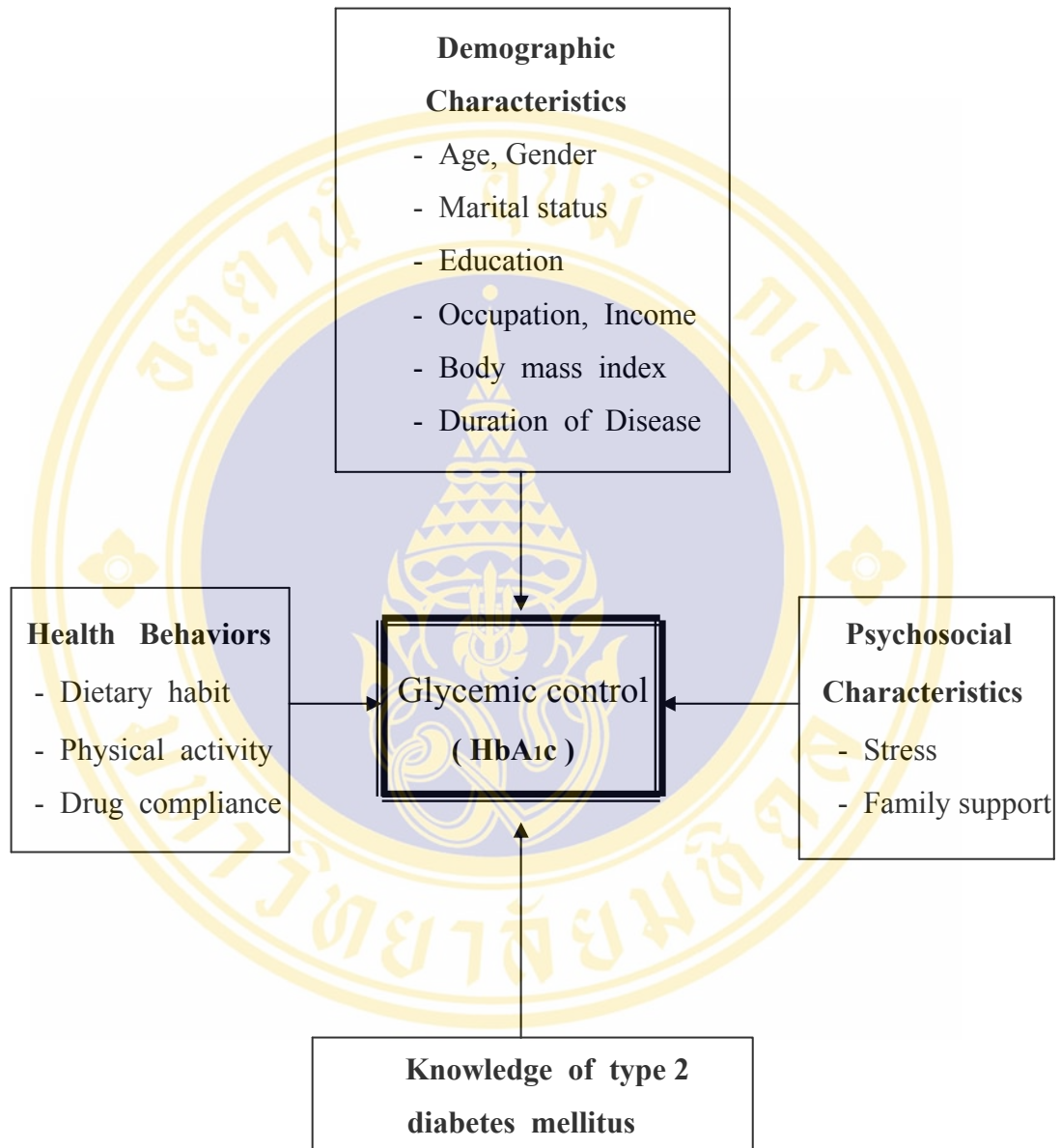
glucose levels can go down. In people with type 2 diabetes, mental stress often raises blood glucose levels.

Physical stress, such as illness or injury, causes higher blood glucose levels in people with either type of diabetes.

Watanapahu S and Saranop S (58) studied about the factors affecting the control of blood sugar level of non-insulin dependent diabetic patients in Saraburi Hospital and found that stress was not associated with glycemic control.



### Conceptual frame work



## CHAPTER III

### MATERIALS AND METHODS

#### **Study Design**

A cross-sectional analytical study design was used to determine factors associated with glycemic control in type 2 diabetic patients.

#### **Study Populations**

The population of this study was type 2 diabetic patients who were treated at diabetes clinic in Pattananikom Hospital between April 22 to June 10, 2004 .

#### **Sample selection**

The purposive sampling was used in this study. Inclusion criteria and exclusion criteria are as follows :

##### **Inclusion Criteria**

1. Being diagnosed of type 2 diabetes by the physicians
2. Having treatment for at least 6 months after diagnosed by the physicians at diabetic clinic in Pattananikom Hospital.
3. Having good orientation and ability to communicate orally.
4. Agreeing to participate the study.

##### **Exclusion Criteria**

1. Patients who had endocrine diseases (e.g. thyrotoxicosis, cushing's syndrome, etc.). Because it is difficult to classify between type 2 diabetes mellitus and other types of diabetes mellitus.
2. Pregnancy. Because it is difficult to classify between type 2 diabetes mellitus and gestational diabetes mellitus.
3. Admission in hospital. Because activity could affect glycemic control leading to inaccurate activity assessment during the interview.
4. Age < 30 years. Because it is difficult to classify between type 2 diabetes mellitus and other types.

**Sample size**

In this study the total sample size was limited to 148 subjects ( 78 cases in study group and 70 cases in control group) due to limited budget available for HbA1c measurement. With 148 subjects, the power of the study to detect each level of minimum odds ratio can be calculated from the following formula (63) and was shown in table 5 .

$$Z_{\beta} = \frac{(P_1 - P_2) \sqrt{n c} - Z_{\alpha/2} \sqrt{(c + 1) P (1 - P)}}{\sqrt{c P_1 (1 - P_1) + P_2 (1 - P_2)}}$$

n = Sample size of case group = 78

c = Proportion of control to case = 47/53

$$P = \frac{P_1 + c P_2}{c + 1}$$

$$P_1 = \frac{(OR) P_2}{(OR) P_2 + (1 - P_2)}$$

P2 = Exposure rate in uncontrollable group (53%) = 0.53

Z α/2 = Standard valve from Z table at type I error of α (0.05) = 1.96  
(95 % confidence level)

**Table 5 :** The power of test, odds ratio in each level.

Odds ratio	Power of test
2.6	80
2.4	71
2.2	61
2.0	51

## Research instruments

The research instruments used to collect data comprise 4 parts, as follows :

**part 1** Demographic characteristics questionnaire consists of age, gender, marital status, education, occupation, family income, body mass index and duration of diabetes mellitus.

**part 2** Knowledge of diabetes questionnaire consists of pathogenesis, signs and symptoms, complications, treatment and self-care. These questionnaire were based on resources from WHO recommendation(12). It had a two dimensional rating scale composed of 15 items.

The negative items are items number: 1, 5, 9, 14, 15

The positive items are items number: 2, 3, 4, 6, 7, 8, 10, 11, 12, 13

Each answer scored 1 point for correct answer, 0 point for incorrect answer and unknow. The total score ranged from 0 - 15 points. Subjects were classified into 3 groups according to the tertile of the score.

Score	Meaning
1 <sup>st</sup> tertile (total score 0-10)	Poor knowledge
2 <sup>nd</sup> tertile (total score 11-12)	Fair knowledge
3 <sup>rd</sup> tertile (total score 13-15)	Good knowledge

**part 3** Health behaviors questionnaire assessed life-styles including dietary control, physical activity and drug compliance which consists of three sections.

**Section I** : Dietary questionnaire assessing food consumption and its frequency. It has a two dimensional rating scale composed of 16 items.

The negative items were items number: 1, 4, 5, 6, 7, 8, 9,12, 13,15

The positive items were items number : 2, 3, 10, 11, 14, 16

These items used 4 rating scales, as shown :

Scale	Negative item	Positive item
Usually	3	0
Often	2	1
Sometimes	1	2
Never	0	3

The total score ranged from 0 – 48 points. Subjects were classified into 3 groups according to the tertile of the score.

Score	Meaning
1 <sup>st</sup> tertile (total score 0-29)	Poor dietary habit
2 <sup>nd</sup> tertile (total score 30-34)	Fair dietary habit
3 <sup>rd</sup> tertile (total score 35-48)	Good dietary habit

**Section II** : Physical activity was measured by short International Physical Activity Questionnaire (IPAQ) questionnaire(64) which was summarized according to the physical activity record (walking, moderate intensity and vigorous activities). The short form data is used to estimated total weekly physical activity by weighting the reported minutes per week within each activity category by a MET energy expenditure estimate assigned to each category of activity. This part contained 6 items with the continuous scores, as follows:

MET-minutes per week : MET level × minutes of activity × events/week

The weighted MET- minutes per week (MET-min/week) were calculated as duration × frequency per week × MET intensity (Walking = 3.3 METs, Moderate intensity = 4.0 METs, Vigorous intensity = 8.0 METs). Then, total MET-min/week show as follow:

Total MET-min/week = (Walk METs × min × day) + (moderate METs × min × day) + (vigorous METs × min × day)

Vigorous physical activities refer to activities that take hard physical effort at least 10 minutes at a time and make breathe much harder than normal.

Moderate physical activities refer to activities that take moderate physical effort at least 10 minutes at a time and make breathe some what harder than normal.

Categorical score – three levels of physical activity, as follows:

1. Insufficiently Active

- No activity is reported OR
- Some activity is reported but not enough to meet categories 2 or 3

2. Sufficiently Active (Any one of the following 3 criteria)

- 3 or more days of vigorous activity of at least 20 minutes per day OR
- 5 or more days of moderate- intensity activity or walking of at least 30 minutes per day OR
- 5 or more days of any combination of walking, moderate - intensity or vigorous intensity activities achieving a minimum of at least 600 MET-min/week.

3. Hightly Active (Any one of the following 2 criteria)

- Vigorous intensity activity of at least 3 days and accumulating at least 1500 MET-min/week OR

- 7 or more days of any combination of walking, moderate – intensity or vigorous intensity activities achieving a minimum of at least 1500 MET-min/week.

**Section III** : Drug compliance questionnaire was initiated by Morisky DE, et al (65). There were 4 items.

If answered “Yes” = 0 point

answered “No” = 1 point

The total score ranged from 0 – 4 points .The classification of drug compliance were divided into 3 levels, as shown :

Score	Meaning
4	High drug compliance
3 – 2	Moderate drug compliance
0 – 1	Low drug compliance

**part 4** Psychosocial questionnaire assessed about stress and family support, which consisted of two sections .

**Section I:** Stress was measured by Thai stress test (TST) questionnaire (66) . It had a two dimensional rating scale composed of 24 items.

The negative items were items number : 1 – 12

The positive items were items number : 13 – 24

These items used 3 rating scales, as shown:

Scale	Negative item	Positive item
Often	0	3
Sometimes	1	1
Never	3	0

The total score ranged from 0 – 36 points for each negative and positive scales. The following matrix in Table 6 showed how the two types of scores were then combined to form the index of TST. Separated scores of negative scales and positive scales, respectively, were combined to form the index .

**Table 6 :** Matrix table for the index of TST

Negative Scale Scores (Sum of Items 1 – 12 )	Positive Scale Scores (Sum of Items 13 – 25)				
	12-36	9-11	6-8	3-5	0-2
0 – 1	1	2	3	4	5
2 – 3	2	3	4	5	6
4 – 5	3	4	5	6	7
6 – 7	4	5	6	7	8
8 – 36	5	6	7	8	9

The distribution of the samples of the index of TST

Scoring Group	Stress indicator
1	Excellent mental health
2, 3, 4	Normal mental health
5, 6	Mild stress
7, 8, 9	Stressful

**Section II :** Family support questionnaire was modified by Duke-UNC Function Social Support Questionnaire (SSQB)(67). There were 8 items with 3 rating scales, as shown:

Scale	score
Usually	2
Sometimes	1
Never/ no assistant	0

The total score ranged from 0 – 16 points . Subjects were classified into 3 groups according to the tertile of the score.

Score	Meaning
1 <sup>st</sup> tertile (total score 0-6)	High family support
2 <sup>nd</sup> tertile (total score 7-10)	Moderate family support
3 <sup>rd</sup> tertile (total score 11-16)	Low family support

### Validity and reliability

1. Content validity. The questionnaire were examined by thesis advisors and nutritional experts.

2. Questionnaire test. It was tested in thirty type 2 diabetic patients at diabetic clinic in Pattananikom hospital. Results from questionnaire test were used to modify the questionnaire.

3. Test-retest reliability. SPSS/PC computer program was used for assessing the reliability of the questionnaire, as shown :

1. Knowledge of diabetes questionnaire	= 0.95
2. Dietary questionnaire	= 0.89
3. Drug compliance questionnaire	= 0.91
4. Thai Stress Test	= 0.98
5. Family support questionnaire	= 0.99

### Data collection

1. After permission to study was given, the study was secured from the Faculty of Graduate Study, Mahidol University and the director of Pattananikom hospital. The study objectives and data collection procedures were explained to the health care team and the head of the diabetic clinic.

2. The data collection was done during the working hours of diabetic clinic i.e. every Thursday 6.00 am. – 12.00 am.

3. The researcher interviewed the participants using the structured questionnaire. The interview took about 25 - 30 minutes per one patient. After the interview was finished, questionnaire form was then checked for data completion.

### Data analysis

Data was analysed using computer programs SPSS for windows (Statistical Package for Social Science for windows) Version 10.0 in the following steps :

1. Descriptive Statistics were used to explain the distribution of demographic data of the study participants and presented as frequency, percentage, mean and standard deviation.

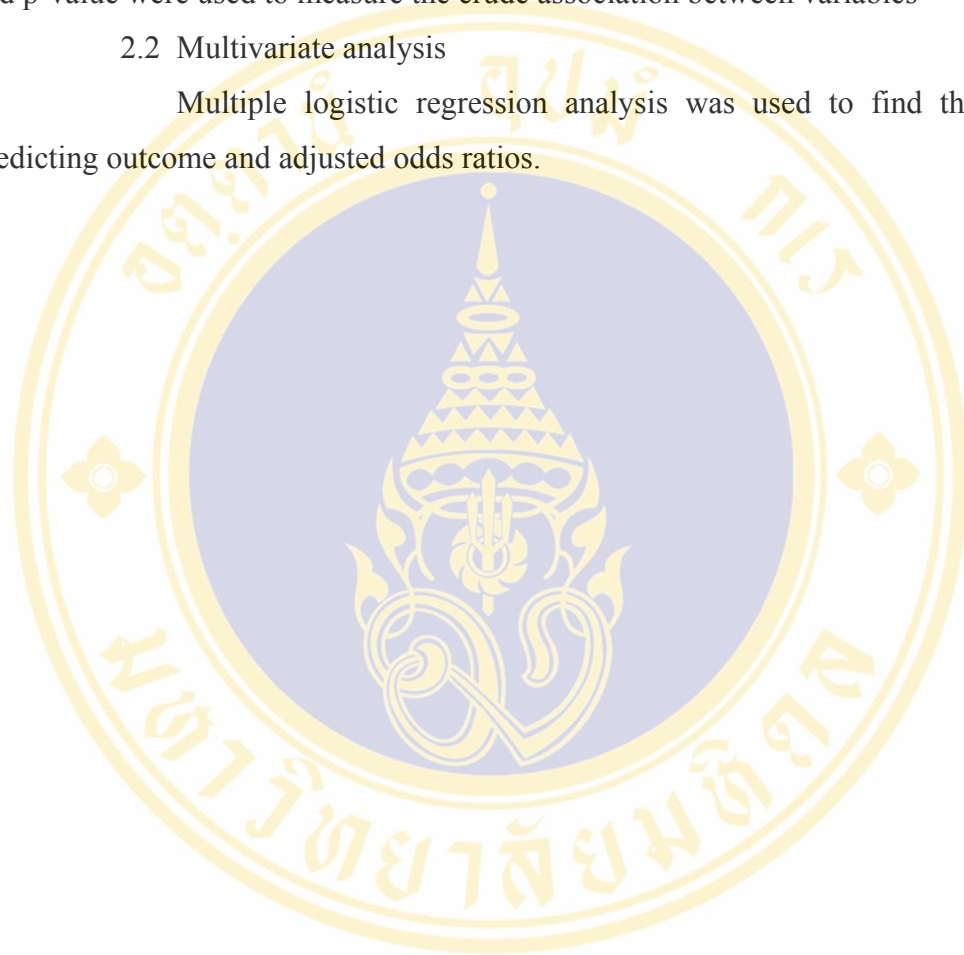
2. Analytic statistics were used to describe the factors related to glycemic control of type 2 diabetic patients.

2.1 Univariate analysis

Chi-square Test, odds ratio, 95 % confidence interval of odds ratio and p-value were used to measure the crude association between variables

2.2 Multivariate analysis

Multiple logistic regression analysis was used to find the factors predicting outcome and adjusted odds ratios.



## CHAPTER IV

### RESULTS

The sample population were diabetic patients at diabetic clinic in Pattananikom hospital, Lopburi province. The total number of patients who were eligible and agreed to participate in this study was 148. There were 101 patients who had uncontrollable plasma glucose level and 47 patients who had controllable plasma glucose level.

The results of study were presented as following:

General and demographic characteristics.

Knowledge of diabetes.

Health behaviors.

Psychosocial factors.

5. The association between independent factors and glycemic control by univariate analysis.

6. The association between independent factors and glycemic control by multivariate analysis.

#### **1. General and demographic characteristics .(table 7)**

##### **Age**

The largest age group of the subjects was 50-59 years old (36.4%). The second and third largest groups were 40-49 years old and 60-69 years old (23.0% and 22.3%). The smallest age group was 30-39 years old (5.4%). Test distribution is a normal distribution pattern. The mean age of the subjects was 55.70 years old (SD = 10.54).

##### **Gender**

About 71.6% of the subjects were female, whereas the minority were male (28.4%).

**Table 7: Number and percentage of type 2 diabetes mellitus patients by demographic characteristics.**

<b>Characteristics</b>	<b>Uncontrolled (n = 101) Number %</b>	<b>Controlled (n = 47) Number %</b>	<b>Total (n = 148) Number %</b>
<b>Age</b>			
70-79	12 (11.9)	7 (14.9)	19 (12.8)
60-69	24 (23.8)	9 (19.1)	33 (22.3)
50-59	40 (39.6)	14 (29.8)	54 (36.5)
40-49	19 (18.8)	15 (31.9)	34 (23.0)
30-39	6 (5.9)	2 (4.3)	8 (5.4)
Mean , SD	= 55.70 , 10.54		
<b>Gender</b>			
Female	76 (75.2)	30 (63.8)	106 (71.6)
Male	25 (24.8)	17 (36.2)	42 (28.4)
<b>Marital status</b>			
Single	4 (4.0)	2 (4.3)	6 (4.0)
Widowed/divorced/separated	19 (18.8)	7 (14.9)	26 (17.6)
Married	78 (77.2)	38 (80.8)	116 (78.4)
<b>Education level</b>			
No education	8 (7.9)	6 (12.8)	14 (9.5)
Primary	81 (80.2)	35 (74.5)	116 (78.4)
Secondary	10 (9.9)	5 (10.6)	15 (10.1)
Bachelor's degree or higher	2 (2.0)	1 (2.1)	3 (2.0)
<b>Occupation</b>			
Housework	26 (25.7)	13 (27.7)	39 (26.3)
Merchant	10 (9.9)	4 (8.5)	14 (9.5)
Agriculturist	53 (52.5)	20 (42.6)	73 (49.3)
Government officer	0 (0.0)	1(2.1)	1 (0.7)
Labour	12 (11.9)	9 (19.1)	21 (14.2)

**Table 7: Number and percentage of type 2 diabetes mellitus patients by demographic characteristics (continued).**

Characteristics	Uncontrolled (n = 101) Number %	Controlled (n = 47) Number %	Total (n = 148) Number %
<b>Income (bahts/month)</b>			
> 4,000	32 (31.7)	15 (31.9)	47 (31.8)
3,000-4,000	39 (38.6)	18 (38.3)	57 (38.5)
< 3,000	30 (29.7)	14 (29.8)	44 (29.7)
Median	= 3,000		
IQR* (bahts)	= 2,000 – 5,000		
<b>Adequacy of income</b>			
Some saving	4 (4.0)	2 (4.3)	6 (4.1)
Sufficient	45 (44.5)	16 (34.0)	61 (41.2)
Insufficient	52 (51.5)	29 (61.7)	81 (54.7)
<b>Duration of diabetes (yrs.)</b>			
>10	18 (17.8)	4 (8.5)	22 (14.9)
5-10	39 (38.6)	15 (31.9)	54 (36.5)
<5	44 (43.6)	28 (59.6)	72 (48.6)
Median	= 5		
IQR* (yrs.)	= 2 – 8		
<b>Body mass index (kg/m<sup>2</sup>)</b>			
≥30	15 (14.8)	11 (23.4)	26 (17.5)
25-29.9	34 (33.7)	12 (25.5)	46 (31.1)
23-24.9	21 (20.8)	9 (19.2)	30 (20.3)
18.5-22.9	27 (26.7)	14 (29.8)	41 (27.7)
<18.5	4 (4.0)	1 (2.1)	5 (3.4)
Mean , SD	= 25.93 , 5.29		

\* Interquartile range (IQR) =  $Q_1 - Q_3$

### Marital status

The majority of the subjects were married(78.4%).The smaller group was widowed,divorced or separated(17.6%).The smallest group had single status (4.1%).

**Education**

The majority of the subjects had completed primary school (78.4%). The smaller group had completed secondary school and had no education (10.1% and 9.5%). Bachelor degree graduates represented the smallest group (2.0%).

**Occupation**

Nearly half of the subjects were agriculturist (49.3%), while 26.4% were houseworker, 14.2% were labour and 9.5% were merchant. The smallest group of the subjects were government officers (0.7%).

**Income**

The largest group of the subjects had income between 3,000-4,000 bahts/month (38.5%). The second largest group of the subjects had income more than 4,000 bahts/month (31.8%). The third largest group of the subjects had income less than 3,000 bahts/month (29.7%). The median income was 3,000 bahts/month. There was no difference in terms of income distribution and median income.

**Adequacy of income**

The majority of the subjects had insufficient income (54.7%). The smaller group had sufficient income (41.2%). The smallest group had some savings (4.1%).

**Duration of diabetes**

Nearly half of subjects had diabetes for less than 5 years (48.6%). The second group had diabetes for 5-10 years (36.5%). The smallest group had diabetes for more than 10 years (14.9%). Test distribution is not normal. The median duration was 5.00 years. There was no difference in terms of duration distribution and median duration.

**Body Mass Index**

The largest group of the subjects (31.1%) were in obese I category (BMI 25-29.9 kg/m<sup>2</sup>). The second and third largest group of subjects (27.7% and 20.3%) were in normal range (BMI 18.5-22.9 kg/m<sup>2</sup>) and overweight category (BMI 23-24.9 = kg/m<sup>2</sup>), respectively. The smallest group of the subjects (3.4%) were in underweight category (BMI = < 18.5 kg/m<sup>2</sup>). Test distribution is normal. The mean duration of diabetes was 25.93 years (SD = 5.29).

## 2. Knowledge of diabetes. (Table 8)

**Table 8: Number and percentage of type 2 diabetes mellitus patients by categorized knowlegde of diabetes.**

Variable	Uncontrolled	Controlled	Total
	(n = 101) Number %	(n = 47) Number %	(n = 148) Number %
<b>Knowlegde of diabetes</b>			
Poor (score 0-10)	30 (29.7)	13 (27.6)	43 (29.0)
Fair (score 11-12)	33 (32.7)	17 (36.2)	50 (33.8)
Good (score 13-15)	38 (37.6)	17 (36.2)	55 (37.2)

### Knowledge of diabetes

The largest group of the subjects had good knowledge of diabetes (37.2%). The second largest group of subjects had fair knowledge of diabetes (33.8%). The smallest group had poor knowledge of diabetes (29.1%).

## 3. Health behaviors: health behaviors consisted of dietary, physical activity and medical adherence. (Table 9)

**Table 9: Number and percentage of type 2 diabetes mellitus patients by health behaviors.**

Variable	Uncontrolled	Controlled	Total
	(n = 101) Number %	(n = 47) Number %	(n = 148) Number %
<b>Dietary habit</b>			
Poor (score 0-29)	39 (38.6)	7 (14.9)	46 (31.0)
Fair (score 30-34)	40 (39.6)	11 (23.4)	51 (34.5)
Good (score 35-48)	22 (21.8)	29 (61.7)	51 (34.5)

**Table 9: Number and percentage of type 2 diabetes mellitus patients by health behaviors (continued).**

Variable	Uncontrolled (n = 101)		Controlled (n = 47)		Total (n = 148)	
	Number	%	Number	%	Number	%
<b>Physical activity</b>						
Insufficiently Active	36	(35.6)	21	(44.7)	57	(38.5)
Sufficiently Active	35	(34.7)	10	(21.3)	45	(30.4)
High Active	30	(29.7)	16	(34.0)	46	(31.1)
<b>Drug compliance</b>						
Low (score 0-1)	24	(23.8)	5	(12.8)	30	(20.3)
Moderate (score 2-3)	51	(50.5)	19	(40.4)	70	(47.3)
High (score 4)	26	(25.7)	22	(46.8)	48	(32.4)

**Dietary habit**

The largest group of the subjects had good dietary habit (34.5%) and fair dietary habit (34.5%). The smallest group had poor dietary habit (31.1%).

**Physical activity**

About 38.5% of the subjects was in insufficiently active category, while 31.1% of the subjects was in highly active category. The smallest group of the subjects was sufficiently active category (30.4%).

**Drug compliance**

The largest group of the subjects had moderate drug compliance (47.3%). The second largest group of subjects had high drug compliance (32.4%). The smallest group of the subjects had low drug compliance (20.3%).

**4. Psychosocial characteristic** ; psychosocial characteristics consisted of stress and family support. (Table 10)

**Table 10: Number and percentage of type 2 diabetes mellitus patients by psychosocial characteristic**

Variable	Uncontrolled (n = 101)	Controlled (n = 47)	Total (n = 148)
	Number %	Number %	Number %
<b>Mental stress</b>			
Stressful	1 (1.0)	0 (0.0)	1 (0.7)
Mild stress	97 (96.0)	46 (97.9)	143 (96.6)
Normal	3 (3.0)	1 (2.1)	4 (2.7)
<b>Family support</b>			
Low family support (score 0-6)	30 (29.7)	16 (34.0)	46 (31.1)
Moderate family support (score 7-10)	41 (40.6)	18 (38.3)	59 (39.9)
High family support (score 11-16)	30 (29.7)	13 (27.7)	43 (29.0)

#### **Mental stress**

The majority of the subjects had mild stress (96.6%), while 2.7% had normal mental health. Less than 1% were in stressful condition.

#### **Family support**

The largest group of the subjects had moderate family support (39.9%). The second largest group had low family support (31.1%). The smallest group had high family support (29.1%).

**5. The association between independent factor and glycemic control by univariate analysis.**

### 5.1 Demographic characteristics. (Table 11)

**Table 11: The association between demographic characteristics and glycemic control by univariate analysis.**

Variable	Uncontrolled	Controlled	OR	95%CI	<i>p-value</i> **
	(n = 101) Number %	(n = 47) Number %			
<b>Age</b>					0.555
70-79	12 (11.9)	7 (14.9)	0.58	0.09-3.65	
60-69	24 (23.8)	9 (19.1)	0.89	0.16-5.25	
50-59	40 (39.6)	14 (29.8)	0.96	0.18-5.28	
40-49	19 (18.8)	15 (31.9)	0.42	0.08-2.40	
30-39 #	6 (5.9)	2 (4.3)	1.00		
<b>Gender</b>					0.216
Female	76 (75.2)	30 (63.8)	1.73	0.82-3.64	
Male #	25 (24.8)	17 (36.2)	1.00		
<b>Marital status</b>					0.843
Single	4 (4.0)	2 (4.3)	0.98	0.17-5.56	
Widowed /divorced /separated	19 (18.8)	7 (14.9)	1.25	0.53-2.95	
Married #	78 (77.2)	38 (80.8)	1.00		
<b>Education level</b>					0.622
No education	8 (7.9)	6 (12.8)	0.67	0.16-2.83	
Primary	81 (80.2)	35 (74.4)	1.16	0.41-3.34	
Secondary/Bachelo #	12 (11.9)	6 (12.8)	1.00		
<b>Occupation</b>					0.594
Housework	26 (25.7)	13 (27.7)	1.50	0.51-4.47	
Merchant/Government	10 (9.9)	5 (10.6)	1.50	0.38-5.96	
Agriculturist	53 (52.5)	20 (42.6)	1.99	0.73-5.44	
Labour #	12 (11.9)	9 (19.1)	1.00		

# Reference group

\*\* *p-value* from chi-square

**Table 11: The association between demographic characteristics and glycemetic control by univariate analysis (continued).**

Variable	Uncontrolled	Controlled	OR	95%CI	<i>p-value</i> **
	(n = 101) Number %	(n = 47) Number %			
<b>Income (bahts/month)</b>					0.999
> 4,000	32 (31.7)	15 (31.9)	1.00	0.42-2.41	
3,000-4,000	39 (38.6)	18 (38.3)	1.02	0.44-2.36	
< 3,000 #	30 (29.7)	14 (29.8)	1.00		
<b>Adequacy of income</b>					0.477
Some saving	4 (4.0)	2 (4.3)	1.12	0.20-6.47	
Sufficient	45 (44.5)	16 (34.0)	1.57	0.76-3.26	
Insufficient #	52 (51.5)	29 (61.7)	1.00		
<b>Duration of diabetes (yrs.)</b>					0.138
>10	18 (17.8)	4 (8.5)	2.87	0.88-9.35	
5-10	39 (38.6)	15 (31.9)	1.66	0.78-3.55	
<5 #	44 (43.6)	28 (59.6)	1.00		
<b>Body mass index</b>					0.557
Obese II	15 (14.8)	11 (23.4)	0.66	0.25-1.78	
Obese I	34 (33.7)	12 (25.5)	1.38	0.56-3.38	
Overweight	21 (20.8)	9 (19.2)	1.13	0.42-3.06	
Underweight/normal #	31 (30.7)	15 (31.9)	1.00		

# Reference group, \*\* *p-value* from chi-square

### Age

The study showed that age did not significantly associate with glycemetic level in type 2 diabetes mellitus patients (*p-value* = 0.555).

### Gender

Gender did not significantly associate with glycemetic level in type 2 diabetes mellitus patients (*p-value* = 0.216).

**Marital status**

Marital status was divided into 3 groups : single, married and widowed, divorced and separated. The married group accounted for 77.2% of the uncontrolled group and 80.9% of controlled group. The single group accounted for 4.0% of the uncontrolled group and 4.3% of controlled group. The widowed, divorced and separated group accounted for 18.8% of the uncontrolled group and 14.9% of controlled group. Marital status did not significantly associate with glycemic level in type 2 diabetes mellitus patients ( $p$ -value = 0.843).

**Education**

Education was divided into 3 groups : no education, primary school and secondary school and bachelors. The no education group accounted for 7.9% of the uncontrolled group and 12.8% of controlled group. The primary school group accounted for 80.2% of the uncontrolled group and 74.5% of controlled group. The secondary school and bachelors group accounted for 11.9% of the uncontrolled group and 12.8% of controlled group. The education did not significantly associate with glycemic level in type 2 diabetes mellitus patients ( $p$ -value = 0.622).

**Occupation**

Occupation was divided into 4 groups: employee, housework, merchant and government officer and agriculturist. The labour group accounted for 11.9% of the uncontrolled group and 19.1% of controlled group. The housework group accounted for 25.7% of the uncontrolled group and 12.8% of controlled group. The merchant and government officer group accounted for 9.9% of the uncontrolled group and 10.6% of controlled group. The agriculturist group accounted for 52.5% of the uncontrolled group and 42.6% of controlled group. The occupation did not significantly associate with glycemic level in type 2 diabetes mellitus patients ( $p$ -value = 0.594).

**Income**

Income was divided into 3 groups using the 33.3 and 66.6 percentile income of the sample as the cut off point : less than 3,000 bahts/month, between 3,000-4,000 bahts/month and more than 4,000 bahts/month. The majority of

uncontrolled group (38.6%) and controlled group (38.3%) had income between 3,000-4,000 bahts/month. Income did not significantly associate with glycemic level in type 2 diabetes mellitus patients ( $p$ -value = 0.999).

#### **Adequacy of income**

The majority of uncontrolled group and controlled group had insufficient income (51.5% and 61.7%). The second largest group of the subjects had sufficient income (44.6% and 34.0%). The smallest group of the subjects had some saving (4.0% and 4.3%). Adequacy of income did not significantly associate with glycemic level in type 2 diabetes mellitus patients ( $p$ -value = 0.477).

#### **Duration of diabetes**

Duration of diabetes was divided into 3 groups : less than 5 years, between 5-10 years and more than 10 years. The duration of diabetes less than 5 years group accounted for 43.6% of the uncontrolled group and 59.6% of controlled group. The duration of diabetes between 5-10 years group accounted for 38.6% of the uncontrolled group and 31.9% of controlled group. The duration of diabetes more than 10 years accounted for 17.8% of the uncontrolled group and 8.5% of controlled group. Duration of diabetes did not significantly associate with glycemic level in type 2 diabetes mellitus patients ( $p$ -value = 0.138).

#### **Body mass index**

Body mass index did not significantly associate with glycemic level in type 2 diabetes mellitus patients ( $p$ -value = 0.557).

## 5.2 Knowledge of diabetes. (Table 12)

**Table 12: The association between knowledge of diabetes and glycemic control by univariate analysis.**

Variable	Uncontrolled (n = 101)		Controlled (n = 47)		OR	95%CI	p-value**
	Number	%	Number	%			
<b>Knowledge of diabetes</b>							0.914
Poor	30	(29.7)	13	(27.6)	1.04	0.44-2.46	
Fair	33	(32.7)	17	(36.2)	0.87	0.39-1.97	
Good <sup>#</sup>	38	(37.6)	17	(36.2)	1.00		

### Knowledge of diabetes

Knowledge of diabetes was divided into 3 groups : good knowledge, fair knowledge and poor knowledge. The good knowledge group accounted for 37.6% of the uncontrolled group and 36.2% of controlled group. The fair knowledge group accounted for 32.7% of the uncontrolled group and 36.2% of controlled group. The poor knowledge group accounted for 29.7% of the uncontrolled group and 27.7% of controlled group. Knowledge of diabetes did not significantly associate with glycemic level in type 2 diabetes mellitus patients ( $p$ -value = 0.914).

### 5.3 Health behaviors. (Table 13)

**Table 13: The association between health behavior and glycemic control by univariate analysis.**

Variable	Uncontrolled (n = 101)		Controlled (n = 47)		OR	95%CI	<i>p-value</i> **
	Number	%	Number	%			
<b>Dietary habit</b>							<0.001
Poor	39	(38.6)	7	(14.9)	7.35	2.77-19.51	
Fair	40	(39.6)	11	(23.4)	4.80	2.02-11.42	
Good <sup>#</sup>	22	(21.8)	29	(61.7)	1.00		
<b>Physical activity</b>							0.251
Insufficiently Active	36	(35.6)	21	(44.7)	0.92	0.41-2.06	
Sufficiently Active	35	(34.7)	10	(21.3)	1.87	0.74-4.73	
High Active <sup>#</sup>	30	(29.7)	16	(34.0)	1.00		
<b>Drug compliance</b>							0.030
Low	24	(23.8)	5	(12.8)	3.39	1.18-9.77	
Moderate	51	(50.5)	19	(40.4)	2.28	1.05-4.93	
High <sup>#</sup>	26	(25.7)	22	(46.8)	1.00		

# Reference group

\*\* *p-value* from chi-square

#### Dietary habit

Dietary habit was divided into 3 groups : good dietary habit , fair dietary habit and poor dietary habit .The good dietary habit group accounted for 21.8% of the uncontrolled group and 61.7% of controlled group. The fair dietary habit group accounted for 39.6% of the uncontrolled group and 23.4% of controlled group. The poor dietary habit group accounted for 38.6% of the uncontrolled group and 14.9% of controlled group. Dietary habit did significantly associate with glycemic level in type 2 diabetes mellitus patients (*p-value*< 0.001). It was found that the fair dietary habit group had 4.8 times higher risk of uncontrollable

plasma glucose level when compared to the good dietary habit group (95%CI = 2.02-11.42, *p-value* < 0.001) and the poor dietary habit group had 7.35 times higher risk of uncontrollable plasma glucose level when compared to the good dietary habit group (95%CI = 2.77-19.51, *p-value* < 0.001) .

#### **Physical activity**

The majority of uncontrolled group and controlled group had insufficiently active (35.6% and 44.7%). The second largest group of uncontrolled group and controlled group had high active (29.7% and 34.0%). The smallest group of uncontrolled group and controlled group had sufficiently active (34.7% and 21.3%). Physical activity did not significantly associate with glycemic level in type 2 diabetes mellitus patients (*p-value* = 0.251).

#### **Drug compliance**

Drug compliance was divided into 3 groups : high drug compliance, moderate drug compliance and low drug compliance. Drug compliance did significantly associate with glycemic level in type 2 diabetes mellitus patients (*p-value* = 0.030). It was found that the low drug compliance group had 3.39 times higher risk of uncontrollable plasma glucose level when compared to the high drug compliance group (95%CI = 1.18-9.77, *p-value* = 0.030) and the moderate drug compliance group had 2.28 times higher risk of uncontrollable plasma glucose level when compared to the high drug compliance group (95%CI = 1.05-4.93, *p-value* = 0.030) .

#### 5.4 Psychosocial characteristic. (Table 14)

**Table 14: The association between psychosocial characteristic and glyceimic control by univariate analysis.**

Variable	Uncontrolled	Controlled	OR	95%CI	<i>p-value</i>
	(n = 101)	(n = 47)			
	Number %	Number %			
<b>Mental stress</b>					
Mild stress/ Stressful	98 (97.0)	46 (97.9)	1.41	0.15-13.91	0.755
Normal #	3 (3.0)	1 (2.1)	1.00		
<b>Family support</b>					
Low family support	30 (29.7)	16 (34.0)	0.8	0.34-1.98	0.868
Moderate family support	41 (40.6)	18 (38.3)	0.9	0.42-2.32	
High family support #	30 (29.7)	13 (27.7)	1.00		

# Reference group

\*\* *p-value* from chi-square

#### **Mental stress**

The majority of uncontrolled group and controlled group had mild stress and stressful condition (97.0% and 97.9%), The smallest group of uncontrolled group and controlled group had normal mental health (3.0% and 2.1%). Mental stress did not significantly associate with glyceimic level in type 2 diabetes mellitus patients (*p-value* = 0.755).

#### **Family support**

Family support was divided into 3 groups : low family support, moderate family support and high family support. The majority of uncontrolled group and controlled group had moderate family support (40.6% and 38.3%). The second largest group of uncontrolled group and controlled group had low family support (29.7% and 34.0%). The smallest group of uncontrolled group and controlled group had high family support (29.7% and 27.7%). Family support did not significantly associate with glyceimic level in type 2 diabetes mellitus patients (*p-value* = 0.868).

## 6. The association between independent factor and glycemic control by multivariate analysis.

Univariate analysis did not take into account the influence of confounding factors which may affect the relationship between factors and uncontrolled blood level in diabetes mellitus patients. To adjust for all variables affected in this study, the data were simultaneously analyzed by multiple logistic regression. The results in univariate analysis showed that two variables in health behaviors did significantly associate with glycemic control. After being adjusted by a multivariate analysis, there were three variables that had significant association with glycemic control. They were gender (adjusted OR = 3.12, 95% CI = 1.25-7.79, *p-value* = 0.015), dietary habit (adjusted OR = 11.23, 95% CI = 3.69-34.18, *p-value* < 0.001 for poor dietary habit and adjusted OR = 7.95, 95% CI = 2.85-22.17, *p-value* < 0.001 for fair dietary habit) and low drug compliance (adjusted OR = 3.67, 95% CI = 1.16-13.65, *p-value* = 0.029) as shown in Table 15.

**Table 15: The association between factor and glycemic control by multivariate analysis.**

Variable	Adjusted OR	95%CI	<i>p-value</i>
<b>Gender</b>			
Female	3.12	1.25-7.79	0.015
Male #	1.00		
<b>Dietary habit</b>			
Poor	11.23	3.69-34.18	< 0.001
Fair	7.95	2.85-22.17	< 0.001
Good #	1.00		
<b>Drug compliance</b>			
Low	3.67	1.16-13.65	0.029
Moderate	2.32	0.95-5.65	0.065
High #	1.00		

# Reference group

\*\* *p-value* from chi-square

## CHAPTER V

### DISCUSSION

The results of this study were discussed as the following issues:

1. Discussion on study design and methodology.
2. Discussion on statistical analysis.
3. Discussion on study results.

#### **1. Discussion on study design and methodology.**

This study was a hospital - based, cross - sectional study. A cross - sectional study is easier and quicker to conduct than population-based study. This design was selected for explaining the relationship among variables. The data were collected in a limited period of time and the outcome was measured only once. In the study, the data were collected by interview questionnaires. It may lead to a bias answer given by interviewee. The most common or important types of information bias include interview bias and recall bias. In this study, physical activity questionnaire assessed about the kinds of physical activities that the subjects did as part of their everyday lives. A recall bias may be encountered due to it involved the activity over the last 7 days. Moreover, face-to-face interviews can give interviewer an opportunity to assess the reliability of information by the behaviors expressed by interviewee. Measures to prevent information bias in this study were carefully done to avoid a leading questioning. However, the data can still be used for further analysis and future studies.

#### **2. Discussion on statistical analysis.**

Univariate analysis was used to test the crude association among variables but it did not take into account the influence of confounding factors. Using univariate analysis, gender did not associate with glycemic control. While in multivariate analysis, gender associated with glycemic control because it was done to calculate adjusted odds ratio.

### 3. Discussion on study results.

Using multivariate analysis, three factors associated with glycemic control in type 2 diabetes mellitus patients, including gender, dietary habit and low medication adherence.

#### Gender

Gender was tested by univariate analysis. There was no association between gender and glycemic control. After multivariate logistic regression analysis gender associated with glycemic control. Female had 3.12 times more likely to have uncontrollable plasma glucose level when compared to male ( adjusted OR = 3.12, 95%CI = 1.25-7.79, *p-value* = 0.015 ). About 75.2% of the uncontrolled group were female, whereas 24.8% were male. In addition, 69.2% of female who had poor glycemic control also had poor dietary habit and 72.2% of female who had poor glycemic control also had insufficient physical activity. The combination of inadequate exercise and poor eating habit might be the answer of why female patients had more uncontrollable plasma glucose level. This agreed with the previous study (70) which found that male diabetic patients cooperate with therapeutic compliance and perceived benefits more than female patients. In addition Mercado (71) found that 87% of female patients had poor disease control. All male patients received special attention regarding their meals from the family's members but only 13% female patients had so. However, there were other studies (40,41,52) found that gender did not associate with glycemic control. This difference may be explained by different characteristics of the subjects, research design and lifestyle .

#### Food consumption behavior

In this study, dietary habit was found to be associated with glycemic control in type 2 diabetes mellitus patients according to the multivariate analysis (adjusted OR = 11.23, 95%CI = 3.69 - 34.18 , *p-value* < 0.001 for poor food consumption behavior and adjusted OR = 7.95, 95% CI = 2.85-22.17, *p-value* < 0.001 for fair food consumption behavior ). In our study, the majority of the uncontrolled group had fair dietary habit (39.6%) and 38.6% had poor dietary habit. They tended to eat high fat, high carbohydrate and very sweet diet. The majority of uncontrolled group had

consumed high fat and high energy diet. The poor dietary habit group accounted for 38.6% of the uncontrolled group and only 14.9% of controlled group. Although, the largest group of the subjects had good knowledge of diabetes (37.2%) but they did not follow it because of consumption habit (74). The result agreed with other studies (41,53) which found that dietary habit associated with glycemic control. However, some other studies (40,45,57) found that dietary habit did not associate with glycemic control. This might be from difference in the characteristics of the subjects and instruments used to assess outcome.

However, proper dietary management is fundamental to the treatment of diabetes. Insulin and / or oral hypoglycemic agents cannot restore the patient to a normal metabolic status if a proper diet is not followed (22) .

### **Drug compliance**

The finding of this study showed that poor drug compliance significantly associated with poor glycemic control in multivariate analysis. The risk of uncontrollable plasma glucose level was 3.67 times in poor drug compliance group compared to the high drug compliance group (adjusted OR = 3.67, 95% CI = 1.16-13.65, *p-value* = 0.029). The poor drug compliance group accounted for 23.8% of the uncontrolled group and 12.8% of controlled group. From the diabetic clinic records in May, 2003 of Pattananikom hospital, 8% of diabetic patients used herbs instead of medicine. Our result also found that 29.7% of the uncontrolled group and 14.9% of controlled group took medicine inconsistently. This corresponded with the studies of Keawerd (45) which found that self - adjustment of drug dosage associated with poor blood glucose control and with study of Numpraditkul (48), which showed that the patients who took incorrect medicine and ran out of medicine associated with poor plasma glucose control. However, Tansakul (54) found that time of taking medicine, self-adjustment of dosage and poor drug compliance did not associate with glycemic control. These differences might be from different research design. The research design of Tansakul was a case-control study. Case-control studies are usually restricted to a single outcome of interest and are efficient for studying rare exposure (72). Therefore, drug compliance is also an important factor for glycemic control.

However, there were other factors that did not associate with glycemic control in type 2 diabetes mellitus patients, discussion were as following:

### **Knowledge of diabetes**

Knowledge of diabetes did not associate with glycemic control. Many subjects reported that they generally received health related knowledge through various media including television, newspaper and health education program at diabetic clinic in Pattananikom Hospital. Although, diabetic patients had knowledge of diabetes, but they could not control the blood glucose to the normal level. As we can see from table 12, good knowledge group accounted for 37.6% of the uncontrolled group and 36.2% of controlled group.

Watanapahu S and Saranop S (58) found that knowledge did not associate with glycemic control. However, Chaveepojnkamjorn W, et al (57) found that knowledge of diabetes, education level significantly associated with glycemic control. This may be explained that the education level affects learning ability. But in our study, education level did not significantly associate with glycemic control. This might be due to the different education background of the majority of sample population.

### **Physical activity**

Physical activity did not associate with glycemic control in type 2 diabetes mellitus patients. The reason might be from physical activity questionnaire, it involved the time spent for physically active activity over the last 7 days. It was difficult to get an accurate data because the subjects might have recall bias. Although, physical activity is an important measure in the prevention and treatment of type 2 diabetes mellitus patients. This result agreed with a previous studies (40,45) which found that physical activity did not associate with glycemic control in type 2 diabetes mellitus patients. However, the result was different from that of a previous study by Rittichu C (41) which found that exercise significantly associated with the controllability of blood glucose level ( $p < 0.001$ ). This difference may be due to many factors such as definition, research design and questionnaire.

### **Mental stress**

In this study, stress did not associate with glycemic control. Stress generally can alter blood glucose levels in two ways. First, people under stress may not take good care of themselves. Second, stress hormones may also raise blood glucose level directly (61,62). All subjects attended at diabetic clinic in Pattananikom Hospital where they had a chance to receive health information from health care staff. Furthermore, they had a chance to meet and share their ideas and feelings with other patients who attended the clinic as well. This might have made them feel that they were not alone and account for our result which showed that the stress did not differ between the uncontrolled group and controlled group. This was confirmed from table 14 which revealed that mild stress or stressful group accounted for 97.0% of uncontrolled group and 97.9% of controlled group. This result agreed with previous study (58) which found that stress did not associate with glycemic control. In contrast, some authors had reported that stress associated with glycemic control. These differences might be from the instrument used to measure stress.

### **Family support**

In this study, family support did not associate with glycemic control in type 2 diabetes mellitus patients. Although family members of diabetic patients generally were encouraged to support the patients to control their blood sugar. However, not all support is helpful. As we could see from table 14, that high family support group accounted for 29.7% of the uncontrolled group and 27.7% of controlled group. The result agreed with other studies (41,57,60), which found that family support did not associate with glycemic control. However, family support was important that constitutes the primary support for the patients.

In summary, our results were either similar or different from other studies. The differences might be due to many factors such as study design, characteristics of samples, methodology, sample selection, lifestyle and culture. Therefore, there should be a continuation of further study.

## CHAPTER VI

### CONCLUSION AND RECOMMENDATION

#### Study summary

This research was a cross-sectional study which had the objective to study the factors associating with glycemetic control in type 2 diabetes mellitus patients attending Pattanakom hospital, Lopburi. The data were collected by the researcher between April 22 to June 10, 2004. The sample groups were 148 diabetes mellitus patients. The data were analysed by univariate and multiple logistic regression to contemplate the association between the study variables.

After using the univariate analysis, two variables were found to have significant associations with glycemetic control as shown:

1. Poor dietary habit (OR = 7.35, 95%CI = 2.77-19.51, p-value < 0.001) and fair dietary habit (OR = 4.80, 95%CI = 2.02-11.42, p-value < 0.001)
2. Poor drug compliance (OR = 3.39, 95%CI = 1.18-9.77, p-value = 0.030) and moderate drug compliance (OR = 2.28, 95%CI = 1.05-4.93, p-value = 0.030)

After controlling for confounder and effect modifiers by using multiple logistic regression analysis, the result of the study showed that the factors significantly associated with glycemetic control were ;

1. Gender (OR<sub>adj</sub> = 3.12, 95% CI = 1.25-7.79, p-value = 0.015)
2. Poor dietary habit (OR<sub>adj</sub> = 11.23, 95% CI = 3.69-34.18, p-value < 0.001) and fair dietary habit (OR<sub>adj</sub> = 7.95, 95% CI = 12.85-22.17, p-value < 0.001)
3. Poor drug compliance (OR<sub>adj</sub> = 3.67, 95% CI = 1.16-13.65, p-value = 0.029)

#### Recommendation on study result

1. The results of this study showed that 68.3% of diabetes patients failed to control glycemetic level. Health care team should provide counseling for these diabetic patients and focus on dietary habit, physical activity and drug compliance. This health

program can change health behaviors of patients on dietary habit, physical activity and drug compliance. An experimental study using this health program can further be studied for its effectiveness.

2. A special room should be arranged to demonstrate healthy kinds of food for diabetic patients. The patients should also keep food record consumed over the last week before going to the hospital for their appointment. The food records from those who could and could not control their blood glucose level could be compared and discussed during the group activity.

### **Recommendation for further study**

1. The factors associated with glycemic control should be studied in other settings. The results of this study can not be applied to other groups due to socioeconomic and geographic difference.

2. A study of diet control and drug compliance among diabetic patients should be further explored in details because it can be used in the clinical setting.

3. Further study of the factors associated with glycemic control in type 2 diabetes mellitus patients should be an experimental one. Behavioral modification or other preventive strategies can be proved for their effectiveness in glucose control.

4. Research focusing on factors affecting drug compliance in type 2 diabetic patients should be further investigated.

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## APPENDIX A QUESTIONNAIRE

### Factors associated with glycemc control in type 2 diabetes mellitus in Pattananikom hospital Faculty of Medicine, Siriraj hospital, Mahidol University

Name ..... H.N. ....  
 Address .....  
 Telephone no. ....  
 Date of interview .....

---

#### Part I: Demographic characteristic data

**Explanation:** Please mark ✓ into  or fill up the word into the blanks.

1. Age.....years (Full years)
2. Gender  
 Male  Female
3. Marital status  
 Single  Married  Widow  Divorced / Separated
4. Education  
 No education  Secondary school 4 – 6  
 Primary school 1 – 4  Diploma  
 Primary school 5 – 7  Bachelor’s degree  
 Secondary school 1 – 3  Higher  
 Other (please specify).....
5. Current occupation  
 Housework  Agriculturist  Government officer  
 Labourer  Merchant  Other (please specify) .....
6. Monthly income.....baht/month  
 Adequate but no saving  Inadequate  Adequate with saving

7. You have known that you have diabetes mellitus for.....year.....month

8. Body weight.....kg. Height.....cm.

**Part II: Knowledge of type 2 diabetes mellitus**

**Explanation:** Please mark ✓ into the blanks.

Items	Agree	Not agree	Not known
1. Diabetic patient who received continuously treatment can be disappear complete diabetes mellitus.			
2. The normal people should have fasting plasma glucose level between 70 mg/dl to 109 mg/dl.			
3. Obesity is an important risk factor of type 2 diabetes mellitus.			
4. Diabetic patients have a higher risk of hypertension more than normal people			
5. Diabetic patients who have high plasma glucose level for a long time can be immunity for complications.			
6. Practice doctor’s order can be well glycemic control.			
.....			
.....			
.....			
.....			
15. Alcohol consumption is not associated with glycemic control.			

**Part III: Health behavior**

**3.1 Dietary**

**Explanation:** Please mark ✓ into the blanks.

Food items	Never	Sometime	Often	Usually
		1-3 time/month	1-3 time/week	≥ 4 time/week
1. The legs of a pork, hide of a chicken, sausage, a kind of chinese sausage				
2. Lean meat (red meat, chicken)				
3. Fish, crustacean, crab				
4. Chicken fritter, leavened wheat dough fried in deep oil, banana fritter				
5. Coconut cream, whole bananas boiled in coconut cream				
6. Cake, cookie, donut , bread				
7. Sweetmeats ,whole bananas boiled in sirup				
8. Aerated water, soft drinks, fruit juices, icecream				
.....				
.....				
.....				
.....				
16. Rose apple, guava, orange, mangosteen, mango				

### 3.2 Physical activity

**Explanation:** Please mark ✓ into  or fill up the word into the blanks.

1. During the last 7 days, on how many days did you do vigorous physical activities like heavy lifting, digging, aerobics, or fast bicycling? Vigorous physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

- No vigorous physical activities Skip to question 3
- .....Days per week

2. How much time did you usually spend doing vigorous physical activities on one of those days?

- .....Hours per day
- .....Minutes per day
- Don't know/Not sure

3. During the last 7 days, on how many days did you do moderate physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking. Moderate activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

- No moderate physical activities Skip to question 5
- .....Days per week

4. How much time did you usually spend doing moderate physical activities on one of those days?

- .....Hours per day
- .....Minutes per day
- Don't know/Not sure

5. During the last 7 days, on how many days did you walk for at least 10 minutes at a time? This includes at work and at home, walking to travel from place to place, and any other walking that you might do solely for recreation, sport, exercise, or leisure.

- No walking
- .....Days per week

6. How much time did you usually spend walking on one of those days?

- .....Hours per day
- .....Minutes per day

**3.3 Drug compliance (1 month ago)**

1. Have you ever forgotten to take your medicine?

- Yes  No

2. Are you careless at time about taking your medicine?

- Yes  No

3. When your feel better do you sometimes stop taking your medicine?

- Yes  No

4. Sometimes if you feel worse when you take the medicine do you stop taking?

- Yes  No

**4. Phychosocial**

**4.1 Thai stress test**

**Explanation:** These questions are your feelings that you may have in daily living. Please answer every questions by marking ✓ in the blank that describes yours feelings.

Items	Often	Sometimes	Never
1. Do you feel lonely?			
2. Do you feel unhappy			
3. Do you feel boring, discouraged or lose of interest todo anything?			

Thai stress test (Cont.)

Items	Often	Sometimes	Never
4. Do you feel agitated at all the time?			
5. Do you feel anxious at all the time?			
6. Do you feel unhappy without any reason?			
7. Do you lose your concentration to do anything?			
8. Have you lose interest to carry on routine activity?			
9. Do you want to be left alone?			
10. Do you feel disheartened?			
.....			
.....			
.....			
.....			
.....			
23. Do you always want to improve your future life?			
24. Do you feel that your mentality is normal?			

**4.2 Family support**

**Explanation:** Please mark ✓ into the blanks.

Items	Often	Sometimes	Never
1. Family persons care what happens to me			
2. Chances to talk about illness			
3. Help when I am sick in bed			
4. Help when I need transportation			
.....			
.....			
8. Chances to talk about money matters			

## แบบสัมภาษณ์

เรื่อง ปัจจัยที่มีความสัมพันธ์ต่อระดับน้ำตาลในเลือดของผู้ป่วยเบาหวานชนิดที่ 2

ในโรงพยาบาลพัฒนานิคม

คณะแพทยศาสตร์ศิริราชพยาบาล มหาวิทยาลัยมหิดล

ชื่อ – นามสกุล ..... H.N. ....

ที่อยู่ .....

เบอร์โทรศัพท์ .....

วันที่สัมภาษณ์ .....

## ส่วนที่ 1 ข้อมูลทั่วไป

คำชี้แจง : ผู้สัมภาษณ์บันทึกข้อมูลที่ได้รับ จากการสัมภาษณ์ลงในช่องว่าง เขียนเครื่องหมาย ✓ ลง  
ใน  หน้าข้อความ ตามที่เป็นจริงที่ผู้ให้สัมภาษณ์ตอบ

1. อายุ.....ปี

2. เพศ

 ชาย       หญิง

3. สถานภาพสมรส

 โสด       คู่       หม้าย       หย่า/แยก

4. การศึกษา

 ไม่ได้เรียน       มัธยมปีที่ 4-6 หรือ มัธยมศึกษาปีที่ 4-5 , ปวช.

 ประถมศึกษาปีที่ 1-4       อนุปริญญา , ปวส.

 ประถมศึกษาปีที่ .....       ปริญญาตรีหรือเทียบเท่า

 มัธยมปีที่ 1-3 หรือ มัธยมศึกษาปีที่ 1-3       สูงกว่าปริญญาตรี

 อื่นๆ ระบุ .....

5. อาชีพ

 ทำงานบ้าน       เกษตรกรรม

 รับจ้าง       รับราชการหรือรัฐวิสาหกิจ

 ค้าขาย       อื่นๆ ระบุ.....

6. รายได้ของท่านหรือรายได้ที่ได้รับจากบุคคลที่ดูแลท่าน.....บาทต่อเดือน

 พอใช้จ่าย       ไม่พอใช้จ่าย       มีเหลือเก็บ

7. ท่านได้รับการวินิจฉัยว่าเป็นเบาหวานมานาน.....ปี ( $\geq 6$  เดือนให้ปัดขึ้น < 6 เดือนให้ปัดลง)  
 8. ขณะนี้ท่านมีน้ำหนัก.....กก. ส่วนสูง.....ซม.

**ส่วนที่ 2 ความรู้เกี่ยวกับโรคเบาหวาน**

**คำชี้แจง :** ผู้สัมภาษณ์อ่านคำถามแล้วให้ผู้ถูกสัมภาษณ์ตอบว่าใช่ หรือ ไม่ใช่ ผู้สัมภาษณ์เขียนเครื่องหมาย ✓ ลงในช่องที่ตรงกับคำตอบของผู้ให้สัมภาษณ์ตามความเป็นจริง

ลำดับที่	ข้อความ	ใช่	ไม่ใช่	ไม่ทราบ
1.	โรคเบาหวานถ้าได้รับการรักษาอย่างต่อเนื่องจะมีโอกาสหายขาดจากโรคได้			
2.	คนปกติจะมีระดับน้ำตาลในเลือด 70-109 มิลลิกรัมเปอร์เซ็นต์			
3.	ปัจจัยส่งเสริมให้เกิดโรคเบาหวานได้ง่ายคือความอ้วน			
4.	โรคเบาหวานเป็นสาเหตุทำให้เกิดโรคความดันโลหิตสูงได้			
5.	ผู้ป่วยเบาหวาน ที่มีระดับน้ำตาลในเลือดสูงเป็นระยะเวลานานๆ จะทำให้ร่างกายทนทานต่อต้านโรคแทรกซ้อนได้			
6.	การปฏิบัติตัวตามคำสั่งแพทย์จะทำให้ควบคุมระดับน้ำตาลได้ดี			
7.	อาการของคนที่มีระดับน้ำตาลในเลือดสูง คือ หิวบ่อย ปัสสาวะบ่อย ผอมลง เพื่อย ไม่มีแรง			
8.	การออกกำลังกายเป็นประจำและถูกวิธี สามารถควบคุมระดับน้ำตาลในเลือดได้			
9.	การควบคุมอาหาร ไม่มีผลต่อระดับน้ำตาลในเลือดได้			
10.	ความเครียด มีผลต่อการควบคุมระดับน้ำตาลในเลือด			
11.	ผู้ป่วยเบาหวานไม่ควรรับประทานอาหารจุกจิก			
12.	ผู้ป่วยเบาหวานไม่ควรใช้น้ำมันหมูในการประกอบอาหาร			
13.	ผู้ป่วยเบาหวานสามารถรับประทานผัก ในปริมาณมากๆ ได้เท่าที่ต้องการ			
14.	ผู้ป่วยเบาหวานควร ดื่มนมที่มีรสหวาน เพื่อป้องกันน้ำตาลในเลือดต่ำ และ บำรุงร่างกาย			
15.	ผู้ป่วยเบาหวาน ดื่มหเล้าเปียร์ได้ เพราะไม่มีผลต่อการควบคุมระดับน้ำตาลในเลือด			

## ส่วนที่ 3 พฤติกรรม

## หมวดที่ 1 การบริโภคอาหาร

คำชี้แจง : ให้ผู้สัมภาษณ์ถามคำถามต่อไปนี้ ทำเครื่องหมาย ✓ ลงในช่องว่างแต่ละข้อความ ตามที่ผู้ให้สัมภาษณ์ตอบ เพียงข้อเดียว

ประเภทอาหาร	ไม่ รับประทาน	นานๆครั้ง	บ่อยๆ	ประจำ
		1 – 3 ครั้ง/ เดือน	1-3 ครั้ง/ สัปดาห์	≥ 4 ครั้ง/ สัปดาห์
1. ขาหมู หมูสามชั้น หนังเป็ด หนังไก่ ไส้กรอก กุนเชียง หมูยอ				
2. เนื้อไก่ หมูเนื้อแดง เนื้อวัว				
3. ปลา กุ้ง หอย ปู ปลาหมึก				
4. อาหารทอด เช่น ไก่ทอด ปาท่องโก๋ กล้วยทอด มันทอด				
5. อาหารที่มีกะทิ เช่น แกงใส่กะทิ กล้วยบัวควง บวดฟักทอง				
6. อาหารที่มีเนยและแป้ง เช่น เค้ก ลูกเกด ขนมปัง โดนัท				
7. อาหารหวาน เช่น ทองหยิบ ทองหยอด ฝอยทอง หม้อแกง ของเชื่อม				
8. น้ำอัดลม น้ำหวาน น้ำผลไม้ ไอศกรีม				
9. นมสด นมที่มีรสหวาน นมรสช็อคโกแลต				
10. น้ำเต้าหู้ นมถั่วเหลือง นมสดพร้อมมันเนย				
11. ถั่วและผลิตภัณฑ์ เช่น ถั่วเขียว เต้าหู้ วุ้นเส้น				
12. ชา กาแฟ โอวัลติน ที่ใส่นมข้นหวานหรือน้ำตาล				
13. เครื่องดื่มชูกำลัง เช่น กระทิงแดง ลิโพ คาราบาวแดง ลูกทุ่ง				
14. ผักต่างๆ				
15. ผลไม้ที่มีรสหวานมาก เช่น มะม่วงสุก องุ่นหวาน ละมุด ทุเรียน ลำไย ลิ้นจี่				
16. ผลไม้ที่มีรสไม่หวานมาก เช่น ชมพู ฝรั่ง ส้มเปรี้ยว มังคุด มะม่วงดิบ				

## หมวดที่ 2 การออกกำลังกาย

คำชี้แจง : ให้ผู้สัมภาษณ์ถามคำถามต่อไปนี้ โดยทำเครื่องหมาย ✓ ลงใน  และเติมข้อความลงในช่องว่างตามที่ผู้ให้สัมภาษณ์ตอบ

1. ในช่วง 7 วันที่ผ่านมา ท่านได้ทำกิจกรรมที่ต้องออกแรงมาก หรือ ออกกำลังกายหนัก จนทำให้รู้สึกเหนื่อยมาก หายใจแรงและลึกหรือหัวใจเต้นเร็วและแรงมากขึ้น เช่น ขุดดิน, ยกของหนัก, เต้นแอโรบิก, จักรยานเร็วๆ, วิ่งเร็วๆ

โดยกระทำอย่างต่อเนื่องเป็นเวลาตั้งแต่ 10 นาที ขึ้นไป

- ไม่มี (ข้ามไปตอบข้อ 3)  
 มี โดย .....วัน/สัปดาห์

2. โดยเฉลี่ย ท่านใช้เวลานานเท่าใด ในการทำกิจกรรมที่ต้องออกแรงมาก หรือ ออกกำลังกายหนัก

- .....ชั่วโมง/วัน  
 .....นาที/วัน  
 ไม่ทราบ/ไม่แน่ใจ

3. ในช่วง 7 วันที่ผ่านมา ท่านได้ทำกิจกรรมที่ต้องออกแรงปานกลาง หรือ ออกกำลังกายปานกลาง จนทำให้รู้สึกเหนื่อยพอสมควรหรือพอสมควร โดยหายใจแรงกว่าปกติ เช่น ยกของที่ไม่นหนักมาก, กวาดบ้านถูบ้าน, จักรยานไปเรื่อยๆ, วิ่งเหยาะๆ, แบดมินตัน

โดยกระทำอย่างต่อเนื่องเป็นเวลาตั้งแต่ 10 นาที ขึ้นไป

- ไม่มี (ข้ามไปถามข้อ 5)  
 มี โดย .....วัน/สัปดาห์

4. โดยเฉลี่ย ท่านใช้เวลานานเท่าใด ในการทำกิจกรรมที่ต้องออกแรงปานกลาง หรือ ออกกำลังกายปานกลาง

- .....ชั่วโมง/วัน  
 .....นาที/วัน  
 ไม่ทราบ/ไม่แน่ใจ

5. ในช่วง 7 วันที่ผ่านมา ท่านมีการเดิน ซึ่งรวมถึงการเดินในบ้าน, ที่ทำงาน และการเดินจากที่หนึ่งไปอีกที่หนึ่ง เช่น เดินไปซื้อของ, เดินเล่นที่สนามหญ้าหรือสวนสาธารณะ

โดยเดินอย่างต่อเนื่องเป็นเวลาตั้งแต่ 10 นาที ขึ้นไป

- ไม่มี (ไม่ต้องถามข้อ 6)
- มี โดย .....วัน/สัปดาห์

6. โดยเฉลี่ย ท่านใช้เวลาในการเดินนานเท่าใด

- .....ชั่วโมง/วัน
- .....นาที/วัน
- ไม่ทราบ/ไม่แน่ใจ

### หมวดที่ 3 ความร่วมมือในการรับปรึกษา

คำชี้แจง : ให้ผู้สัมภาษณ์ถามคำถามต่อไปนี้ ทำเครื่องหมาย ✓ ลงในช่องว่างแต่ละข้อความ ตามที่ผู้ให้สัมภาษณ์ตอบ เพียงข้อเดียว

ในรอบ 1 เดือนที่ผ่านมา

1. ท่านเคยลืมหินยาเบาหวานหรือไม่

- เคย  ไม่เคย

2. ท่านรับปรึกษาตามคำสั่งแพทย์หรือไม่

- ใช่  ไม่ใช่

3. เมื่อแพทย์บอกว่าท่านมีระดับน้ำตาลในเลือดเป็นปกติ ท่านเคยหยุดกินยาเบาหวานหรือไม่

- เคย  ไม่เคย

4. เมื่อท่านมีอาการผิดปกติ เนื่องมาจากการกินยา เช่น คลื่นไส้, อาเจียน หรือผื่นคัน ท่านเคยหยุดกินยาเอง หรือ ลดจำนวนยา โดยไม่ได้ปรึกษาแพทย์ก่อนหรือไม่

- เคย  ไม่เคย

**ส่วนที่ 4 ปัจจัยทางจิตสังคม**

**คำชี้แจง :** โปรดทำเครื่องหมาย ✓ ลงในช่องว่างแต่ละข้อความ ซึ่งแสดงระดับอาการที่เกิดขึ้นกับผู้ถูกสัมภาษณ์ ตามความเป็นจริง เพียงข้อเดียว

**หมวดที่ 1 ด้านความเครียด**

ลำดับ	ข้อความ	รู้สึกบ่อยๆ	รู้สึกเป็นครั้งคราว	ไม่เคยรู้สึกเลย
1.	ท่านรู้สึกเหงาและว้าเหว่			
2.	ท่านรู้สึกไม่มีความสุขเลย			
3.	ท่านรู้สึกเบื่อหน่าย ท้อแท้ ไม่อยากทำอะไรเลย			
4.	ท่านรู้สึกกระวนกระวายเกือบตลอดเวลา			
5.	ท่านรู้สึกกังวลเกือบตลอดเวลา			
6.	ท่านรู้สึกไม่สบายใจโดยหาสาเหตุไม่ได้			
7.	ท่านรู้สึกไม่ค่อยมีสมาธิในการกระทำสิ่งต่างๆ			
8.	ท่านรู้สึกไม่อยากทำในสิ่งที่เคยสนใจทำเป็นประจำ			
9.	ท่านอยากจะถอยหนี ไม่อยากพบปะพูดคุยกับคนอื่น			
10.	ท่านรู้สึกหมดกำลังใจ			
11.	ท่านรู้สึกสิ้นหวัง			
12.	ท่านรู้สึกว่าตนเองไม่มีคุณค่า			
13.	ท่านรู้สึกภาคภูมิใจว่า ท่านเป็นคนเก่ง			
14.	ท่านรู้สึกภาคภูมิใจว่า ท่านเป็นคนที่มีความสามารถ			
15.	ท่านรู้สึกภาคภูมิใจว่า ท่านไม่ได้ด้อยไปกว่าใคร			
16.	ท่านรู้สึกพอใจกับชีวิตความเป็นอยู่ในขณะนี้			
17.	ท่านรู้สึกว่าสิ่งต่างๆ รอบตัวท่าน ยังมีอะไรบางอย่างที่ทำให้ท่านมีความสนใจเป็นพิเศษอยู่			
18.	ท่านรู้สึกยินดีและพึงพอใจกับการที่ตนเองได้ประสบความสำเร็จในบางสิ่งบางอย่าง			
19.	ท่านรู้สึกกระตือรือร้นในการกระทำสิ่งต่างๆ ในชีวิตประจำวัน			
20.	ท่านรู้สึกสนุกสนานกับการพบปะพูดคุยกับคนอื่นที่อยู่รอบตัวท่าน			

ลำดับ	ข้อความ	รู้สึก บ่อยๆ	รู้สึกเป็น ครั้งคราว	ไม่เคย รู้สึกเลย
21.	การคิดและการตัดสินใจของท่านยังเป็นปกติเหมือนก่อน			
22.	ท่านรู้สึกว่าชีวิตนี้ยังมีความหวัง			
23.	ท่านรู้สึกมีกำลังใจที่จะปรับปรุงเปลี่ยนแปลงตนเองในทางที่ดีหรือก้าวหน้าขึ้น			
24.	ท่านรู้สึกว่าจิตใจของท่านเป็นปกติ			

## หมวดที่ 2 ด้านแรงสนับสนุนทางครอบครัว

คำชี้แจง : ให้ผู้สัมภาษณ์ถามคำถามต่อไปนี้ ทำเครื่องหมาย ✓ ลงในช่องว่างแต่ละข้อความ ตามที่ผู้ให้สัมภาษณ์ตอบ เพียงข้อเดียว  
ในรอบ 1 เดือนที่ผ่านมา

ลำดับ ที่	ข้อความ	ประจำ	เป็น บางครั้ง	ไม่เคย / ไม่มีผู้ดูแล
1.	เมื่อท่านมีปัญหาต่างๆ ในชีวิต บุคคลในครอบครัวของท่านสามารถให้การดูแล และให้คำปรึกษา			
2.	ท่านสามารถปรับทุกข์กับบุคคลในครอบครัว ในเรื่องการเจ็บป่วยของท่าน			
3.	เมื่อท่านเจ็บป่วย บุคคลในครอบครัวของท่านจะคอยดูแลช่วยเหลือในกิจวัตรประจำวัน			
4.	เมื่อท่านไปพบแพทย์ บุคคลในครอบครัวเป็นผู้พาท่านไปด้วย			
5.	บุคคลในครอบครัวจะคอยเตือนท่านเมื่อถึงวันที่แพทย์นัดพบ			
6.	ในยามปกติ บุคคลในครอบครัวของท่าน ดูแลและแนะนำท่านเกี่ยวกับสุขภาพ			
7.	ในยามปกติ บุคคลในครอบครัวของท่าน ดูแลช่วยเหลือในการประกอบอาหารและงานบ้าน			
8.	บุคคลในครอบครัวของท่าน ดูแลและช่วยเหลือค่าใช้จ่ายในการรักษาพยาบาล			

## APPENDIX B

### The list of variables

#### ตารางรายละเอียดของตัวแปร

ตัวแปร	ชนิดของตัวแปร	ค่าที่เป็นไปได้	วิธีการวัดและเกณฑ์ในการอ่านผล
1. อายุ	Continuous (Ratio scale)	30 - ∞	-จากการสัมภาษณ์โดยนำมา เปรียบเทียบกับยื่นยันกับ OPD card -บันทึกอายุเป็นจำนวนเต็มปี เศษของ ปีเกิน 6 เดือนให้ปัดขึ้นเป็น 1 ปี -การวิเคราะห์ จัดแบ่งช่วงอายุ ช่วงละ 10 ปี คือ 30-39, 40-49,.....70-79
2. เพศ	Category (Nominal scale)	ชาย หญิง	- จากการสัมภาษณ์ การสังเกต และ OPD card
3. สถานภาพ สมรส	Category (Nominal scale)	โสด คู่ หม้าย หย่า แยก	-จากการสัมภาษณ์โดยนำมา เปรียบเทียบกับยื่นยันกับ OPD card -การวิเคราะห์ จัดแบ่งช่วงสถานภาพ สมรส ออกเป็น 3 ระดับ โสด คู่ หม้าย / หย่า/แยก
4. ระดับ การศึกษา	Category (Ordinal scale)	ไม่ได้เรียน ประถมศึกษาปีที่ 1-4 ประถมศึกษาปีที่ 5-7 มัธยมศึกษาปีที่ 1-4 มัธยมศึกษาปีที่ 5-7, ปวช อนุปริญญา, ปวส ปริญญาตรี หรือเทียบเท่า สูงกว่าปริญญาตรี อื่นๆ ระบุ.....	-จากการสัมภาษณ์ -ระดับการศึกษา บันทึกชั้นปีที่เรียน สูงสุด เกณฑ์ในการอ่านผล ไม่ได้เรียน ประถมศึกษา มัธยมศึกษา ปริญญาตรีหรือสูงกว่าปริญญาตรี

## ตารางรายละเอียดของตัวแปร (ต่อ)

ตัวแปร	ชนิดของตัวแปร	ค่าที่เป็นไปได้	วิธีการวัดและเกณฑ์ในการอ่านผล
5. อาชีพ	Category (Nominal scale)	ทำงานบ้าน รับจ้าง ค้าขาย เกษตรกรกรรม รับราชการ/รัฐวิสาหกิจ อื่นๆระบุ.....	-จากการสัมภาษณ์ -กรณีที่มีหลายอาชีพให้ระบุเพียง 1 อาชีพ ที่เป็นอาชีพหลักโดยใช้เวลาส่วนใหญ่ใน การประกอบอาชีพนั้น
6. รายได้	Continuous (Ratio scale)	0 - ∞	- จากการสัมภาษณ์ - รายได้ หมายถึง เงินที่ได้รับจากอาชีพ หลัก อาชีพเสริม หรือจากบุคคลอื่น โดย ได้รับเป็นประจำวัน หรือประจำสัปดาห์ หรือ ประจำเดือน หรือ ประจำปี (ผู้เก็บ ข้อมูลเป็นผู้คำนวณรายได้โดยเฉลี่ยเป็น จำนวนบาทต่อเดือน) - จัดแบ่งรายได้ออกเป็น 3 ระดับ <3,000 บาท 3,000 – 4,000 บาท > 4,000 บาท
7. รายได้ พอใช้ หรือไม่	Category (Nominal scale)	-พอใช้ -ไม่พอใช้	- จากการสัมภาษณ์ โดยผู้ให้สัมภาษณ์ เป็นผู้ประเมินรายได้ของตนเองว่าพอใช้ จ่ายหรือไม่
8. ระยะเวลา ในการ เป็น เบาหวาน	Continuous (Ratio scale)	6 เดือน - ∞	- จากการสัมภาษณ์และ OPD card - ระยะเวลา นับเป็นจำนวนเต็มปี শেষของปี เกิน 6 เดือนให้ปัดขึ้นเป็น 1 ปี - แบ่งช่วงระยะเวลาในการเป็นเบาหวาน ออกเป็น 3 ระดับ ดังนี้ < 5 ปี 5 – 10 ปี > 10 ปี

## ตารางรายละเอียดของตัวแปร (ต่อ)

ตัวแปร	ชนิดของตัวแปร	ค่าที่เป็นไปได้	วิธีการวัดและเกณฑ์ในการอ่านผล
9. BMI	Continuous (Ratio scale)	< 18.5 กก./เมตร <sup>2</sup> 18.5–22.9 กก./เมตร <sup>2</sup> 23–24.9 กก./เมตร <sup>2</sup> 25 – 29.9 กก./เมตร <sup>2</sup> ≥ 30 กก./เมตร <sup>2</sup>	- จาก OPD card ที่บันทึก น้ำหนักและ ส่วนสูง ของผู้ป่วยในครั้งที่มารับบริการ ในวันที่ให้สัมภาษณ์และนำมาคำนวณหา ค่า BMI [น้ำหนัก (กก.) / ส่วนสูง (เมตร <sup>2</sup> )] - แบ่งช่วง BMI ออกเป็น 4 ระดับ < 18.5 กก./เมตร <sup>2</sup> 18.5 – 22.9 กก./เมตร <sup>2</sup> 23 – 24.9 กก./เมตร <sup>2</sup> 25 – 29.9 กก./เมตร <sup>2</sup> ≥ 30 กก./เมตร <sup>2</sup>
10. ความรู้เกี่ยวกับโรคเบาหวาน	Category (Ordinal scale)	ใช่ ไม่ใช่ ไม่ทราบ	- จากการสัมภาษณ์เรื่องความรู้เรื่องโรคเบาหวาน โดยให้ผู้ตอบแบบสัมภาษณ์พิจารณาว่าถูกต้องหรือไม่ ถ้าถูกต้องให้ตอบว่าใช่ ถ้าไม่ถูกต้องให้ตอบว่าไม่ใช่ ถ้าไม่ทราบให้ตอบว่าไม่ทราบ - แบบสัมภาษณ์มี 15 ข้อเป็นคำถามในเชิงบวกและเชิงลบ การให้คะแนนให้ตามเกณฑ์ที่กำหนดไว้ในบทที่ 3 นำคะแนนของผู้ให้สัมภาษณ์ทั้งหมดมาเรียงลำดับจากน้อยไปหามาก - เกณฑ์ในการอ่านผล แบ่งระดับความรู้ ออกเป็น 3 ระดับ โดยใช้ percentile ที่ 34, 67 ดังนี้ มีความรู้ดี (ช่วง percentile ที่ 68 – 100) มีความรู้ปานกลาง (ช่วง percentile ที่ 35 – 67) มีความรู้น้อย (ช่วง percentile ที่ 1- 34)

## ตารางรายละเอียดของตัวแปร (ต่อ)

ตัวแปร	ชนิดของตัวแปร	ค่าที่เป็นไปได้	วิธีการวัดและเกณฑ์ในการอ่านผล
11. พฤติกรรม การบริโภค อาหาร	Category (Ordinal scale)	ไม่รับประทาน นานๆครั้ง (1-3 ครั้ง/ เดือน) บ่อยๆ (1-3 ครั้ง/ สัปดาห์) ประจำ ( $\geq 4$ ครั้ง/ สัปดาห์)	- จากการสัมภาษณ์ในด้านพฤติกรรมกร บริโภคอาหาร โดยให้ผู้ตอบแบบ สัมภาษณ์ ตอบตามความเป็นจริง - แบบสัมภาษณ์มี 16 ข้อเป็นคำถามใน เชิงบวกและเชิงลบ การให้คะแนนให้ตาม เกณฑ์ที่กำหนดไว้ในบทที่ 3 นำคะแนน ของผู้ให้สัมภาษณ์ทั้งหมดมาเรียงลำดับ จากน้อยไปหามาก - เกณฑ์ในการอ่านผล แบ่งระดับความรู้ ออกเป็น 3 ระดับ โดยใช้ percentile ที่ 34, 67 ดังนี้ มีพฤติกรรมกรบริโภคอาหารดี (ช่วง percentile ที่ 68 – 100) มีพฤติกรรมกรบริโภคอาหาร พอใช้ (ช่วง percentile ที่ 35 – 67) มีพฤติกรรมกรบริโภคอาหาร ไม่ดี (ช่วง percentile ที่ 1 - 34)
12. พฤติกรรม การออกกำลังกาย	Category (Nominal scale)  Discrete (Ratio scale)  Continuous (Ratio scale)	- การกระทำกิจกรรม มี ไม่มี  - จำนวนวันที่ทำ กิจกรรมในช่วง 7 วันที่ผ่านมา  - ระยะเวลาโดยเฉลี่ย ในแต่ละวันที่ทำ กิจกรรม	- จากการสัมภาษณ์เรื่องพฤติกรรมกร ออกกำลังกายโดยผู้ให้สัมภาษณ์ ตอบ คำถามตามความเป็นจริงในช่วง 7 วันที่ ผ่านมา - แบบสัมภาษณ์ มีทั้งหมด 6 ข้อ การ คำนวณพลังงาน และเกณฑ์การอ่านผลใช้ ตามแบบวัดของ IPAQ (64) ในบทที่ 3 ออกกำลังกายไม่เพียงพอ = ..... ออกกำลังกายเพียงพอ = ..... ออกกำลังกายเพียงมาก = .....

## ตารางรายละเอียดของตัวแปร (ต่อ)

ตัวแปร	ชนิดของตัวแปร	ค่าที่เป็นไปได้	วิธีการวัดและเกณฑ์ในการอ่านผล
13. ความร่วมมือในการรับประทา นยา	Category (Nominal scale)	เคย หรือ ไข้ ไม่เคย หรือ ไม่ใช่	- จากการสัมภาษณ์เรื่องความร่วมมือในการรับประทา นยาโดยผู้ให้สัมภาษณ์ ตอบ คำถามตามความเป็นจริงในช่วง 1 เดือนที่ ผ่านมา - แบบสัมภาษณ์ มีทั้งหมด 4 ข้อ - เกณฑ์การให้คะแนนและเกณฑ์การอ่าน ผลใช้ตามแบบวัดของ Morisky DE, et al (65) ในบทที่ 3 ให้ความร่วมมือดี คะแนน = 4 ให้ความร่วมมือปานกลาง คะแนน = 2 - 3 ให้ความร่วมมือน้อย คะแนน = 0- 1
14. ความเครียด	Category (Ordinal scale)	รู้สึกบ่อยๆ รู้สึกเป็นครั้งคราว ไม่เคยรู้สึก	- จากการสัมภาษณ์ ในด้านความเครียด โดยผู้ให้สัมภาษณ์ ตอบคำถามตามความ เป็นจริงที่ผู้ให้สัมภาษณ์รู้สึกในปัจจุบัน -แบบสัมภาษณ์ มีทั้งหมด 24 ข้อ เป็น คำถามเชิงลบ 12 ข้อ และเชิงบวก 12 ข้อ - เกณฑ์การให้คะแนนและเกณฑ์การอ่าน ผลใช้ตามแบบวัดของ Thai stress test (TST) (66) ในบทที่ 3 สุขภาพจิตดี = ..... สุขภาพจิตปกติ = ..... เครียดเล็กน้อย = ..... เครียดมาก = .....

## ตารางรายละเอียดของตัวแปร (ต่อ)

ตัวแปร	ชนิดของตัวแปร	ค่าที่เป็นไปได้	วิธีการวัดและเกณฑ์ในการอ่านผล
15. แรงสนับสนุนทางครอบครัว	Category (Ordinal scale)	ประจำ เป็นบางครั้ง ไม่เคย หรือ ไม่มี ผู้ดูแล	จากการสัมภาษณ์เรื่องความร่วมมือในการรับประทานยา โดยผู้ให้สัมภาษณ์ ตอบคำถามตามความเป็นจริงในช่วง 1 เดือนที่ผ่านมา - แบบสัมภาษณ์ มีทั้งหมด 4 ข้อการให้คะแนนให้ตามเกณฑ์ที่กำหนดไว้ในบทที่ 3 นำคะแนนของผู้ให้สัมภาษณ์ทั้งหมดมาเรียงลำดับจากน้อยไปหามาก - เกณฑ์ในการอ่านผล แบ่งระดับความรู้ ออกเป็น 3 ระดับ โดยใช้ percentile ที่ 34, 67 ดังนี้ แรงสนับสนุนทางครอบครัว ดี (ช่วง percentile ที่ 68 – 100) แรงสนับสนุนทางครอบครัว ปานกลาง (ช่วง percentile ที่ 35 – 67) แรงสนับสนุนทางครอบครัว น้อย (ช่วง percentile ที่ 1 - 34)

## BIOGRAPHY

<b>NAME</b>	Miss.Varataya Pintong
<b>DATE OF BIRTH</b>	8 March 1966
<b>PLACE OF BIRTH</b>	Bangkok, Thailand
<b>INSTITUTIONS ATTENDED</b>	Boromarajchonanee Saraburi Nursing College, 1984 – 1986 : Diploma in Nursing Science (Equivalent to Bachelor of Science in Nursing) Mahidol University, 1992 – 1994 : Bachelor of Science in Nursing (Public Health Administration) Mahidol University, 2002 – 2005 : Master of Science (Epidemiology)
<b>RESEARCH GRANT</b>	Supported in part by the Thesis Grant, Faculty of Graduate Studies, Mahidol University
<b>POSITION AND OFFICE</b>	1986 - Present: Registered Nurse Pattananikom hospital, Lopburi province, Thailand