FACTORS ASSOCIATED WITH GLYCEMIC CONTROL IN TYPE 2 DIABETES PATIENTS AT PRIMARY CARE UNIT, PATHUMRAT DISTRICT, ROI- ET PROVINCE, THAILAND

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A Thesis Submitted in Partial Fulfillment of the Requirements
for the Degree of Master of Public Health Program in Public Health
College of Public Health Sciences
Chulalongkorn University
Academic Year 2010

ปัจจัยที่มีความสัมพันธ์ต่อการควบคุมระดับน้ำตาลในเลือดของผู้ป่วยเบาหวานชนิดที่ 2 ในหน่วยบริการปฐมภูมิ อำเภอปทุมรัตต์ จังหวัดร้อยเอ็ด ประเทศไทย

นางนิยม ประโคสันตัง

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาสาธารณสุขศาสตรมหาบัณฑิต
สาขาวิชาสาธารณสุขศาสตร์
วิทยาลัยวิทยาศาสตร์สาธารณสุข จุฬาลงกรณ์มหาวิทยาลัย
ปีการศึกษา 2553

Thesis Title	FACTORS ASSOCIATED WITH GLYCEMIC CONTROL IN TYPE 2 DIABETES PATIENTS AT PRIMARY CARE UNIT, PATHUMRAT DISTRICT, ROI- ET PROVINCE, THAILAND.
By	Mrs. Niyom Pragosuntung
Field of Study	Public Health
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Accepted by the College of Public Health Sciences, Chulalongkorn University in Partial Fulfillment of the Requirements for the Master's Degree

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นิยม ประโกสันตัง : ปัจจัยที่มีความสัมพันธ์ต่อการควบคุมระดับน้ำตาลในเลือดของผู้ป่วยเบาหวานชนิดที่ 2 ในหน่วยบริการปฐมภูมิ อำเภอปทุมรัตต์ จังหวัดร้อยเอ็ด ประเทศไทย (FACTORS ASSOCIATED WITH GLYCEMIC CONTROL IN TYPE 2 DIABETES PATIENTS AT PRIMARY CARE UNIT, PATHUMRAT DISTRICT, ROI-ET PROVINCE, THAILAND.) อ.ที่ปรึกษาวิทยานิพนธ์หลัก: ผศ.ดร. ประเทือง หงสรานากร, 74 หน้า

การศึกษาแบบภาคตัดขวางนี้ มีวัตถุประสงค์เพื่อศึกษาปัจจัยที่มีความสัมพันธ์กับการควบคุมระดับน้ำตาลในเลือดของผู้ป่วยเบาหวานชนิดที่ 2 ที่ได้รับการส่งตัวไปเพื่อรับการรักษาต่อเนื่องในหน่วยบริการปฐมภูมิ จำนวน 13 แห่ง ในเขตอำเภอปทุมรัตต์ จังหวัดร้อยเอ็ด ประเทศไทยในปี พ.ศ. 2554 หลังจากที่ได้รับการผ่านการพิจารณาจริยธรรม จึงได้เริ่มเก็บข้อมูลในเดือนเมษายน ปี พ.ศ.2554 จากประชากรผู้ป่วยด้วยโรคเบาหวานชนิดที่2 จำนวน 1,071 ราย ได้ทำการคัดเลือกกลุ่มตัวอย่างจำนวน 307 รายโดยวิธีการสุ่มอย่างเป็นระบบ ณ หน่วยบริการปฐมภูมิแต่ละแห่ง เครื่องมือที่ใช้เป็นแบบสอบถามเรื่องปัจจัยที่มีความสัมพันธ์ต่อการควบคุมระดับน้ำตาลในเลือดของผู้ป่วยเบาหวานชนิดที่2 แบบสอบถามประกอบด้วย ลักษณะทางประชากร ความรู้เกี่ยวกับโรคเบาหวาน พฤติกรรมการดูแลสุขภาพ และปัจจัยทางจิตสังคม รวมทั้งข้อมูลเรื่องระดับน้ำตาลในเลือดจากรายงานทางการแพทย์ การวิเคราะห์ข้อมูลใช้สถิติเชิงพรรณา(ค่าความถี่ ร้อยละ ค่ามัธยฐาน ค่าเฉลี่ย และส่วนเบี่ยงเบนมาตรฐาน) และใช้สถิติไค สแควร์ สหสัมพันธ์ของเพียร์สัน และสหสัมพันธ์อันดับของสเปียร์แมนเพื่อทดสอบความสัมพันธ์ระหว่างตัวแปรที่ศึกษา โดยใช้ SPSS version 17 ผลการศึกษาพบว่า กลุ่มตัวอย่างเป็นเพศหญิงจำนวน 238 ราย และเพศชายจำนวน 69 ราย โดยมีอายุเฉลี่ย 58.72 ± 6.49 ปี ระยะเวลาของการป่วยเป็นโรคเบาหวานอยู่ที่ 6.24 ± 4.10 ปี ประมาณร้อยละ 42.7 ของกลุ่มตัวอย่างมีภาวะโรคอ้วน (BMI เฉลี่ย 25.36 ± 3.44) ระดับ HbA1C เฉลี่ย 8.26±1.96% และสัดส่วนของกลุ่มตัวอย่างที่ควบคุมระดับน้ำตาลได้ดี (HbA1C<7%) คือร้อยละ 26.1 ในขณะที่ร้อยละ 73.9 ของกลุ่มตัวอย่างมีค่าของการควบคุมระดับน้ำตาล ≥ 7 ซึ่งแสดงถึงการควบคุมที่ไม่ดี ปัจจัยที่มีความสัมพันธ์ต่อการควบคุมระดับน้ำตาลในเลือด ซึ่งมีนัยสำคัญทางสถิติ ได้แก่ ระยะเวลาของการป่วยเป็นโรคเบาหวาน (ความสัมพันธ์ทางบวก, $r = 0.185$, $p < 0.001$) พฤติกรรมการบริโภคอาหาร(ความสัมพันธ์ทางลบ, $r = -0.220$, $p < 0.001$) และการปฏิบัติตัวตามคำแนะนำเรื่องการใช้ยาของผู้ป่วย (ความสัมพันธ์เชิงลบ, $r = -0.469$, $p < 0.001$)

การศึกษาครั้งนี้ชี้ให้เห็นถึงผลลัพธ์การดูแลรักษาผู้ป่วยเบาหวานชนิดที่ 2 ที่รับการรักษาในหน่วยบริการปฐมภูมิยังไม่บรรลุเป้าหมายของการดูแลรักษาโรคเบาหวาน จึงนับเป็นความท้าทายยิ่ง ในการพัฒนาระบบการดูแลผู้ป่วยเบาหวานในชุมชนให้มีคุณภาพ

สาขาวิชา สาธารณสุขศาสตร์ ลายมือชื่อนิสิต .....

ปีการศึกษา 2553 ลายมือชื่อ อ.ที่ปรึกษาวิทยานิพนธ์หลัก .....

##5279135853 : MAJOR PUBLIC HEALTH
KEYWORDS : DIABETES MELLITUS / GLYCEMIC CONTROL / FACTORS ASSOCIATED / PRIMARY CARE UNIT

NIYOM PRAGOSUNTUNG : FACTORS ASSOCIATED WITH GLYCEMIC CONTROL IN TYPE 2 DIABETES PATIENTS AT PRIMARY CARE UNIT, PATHUMRAT DISTRICT, ROI-ET PROVINCE, THAILAND. ADVISOR: ASST.PROF. PRATHURNG HONGSRANAGON, Ph.D.,74 pp.

This study was a cross-sectional research design to determine the factors associated with glycemic control in type 2 diabetes mellitus patients who were referred to 13 Primary Care Units at Pathumrat District, Roi-Et Province, Thailand (2011). After obtaining the ethics review protocol, data collection was conducted in April, 2011. Out of 1,071 populations with type 2 diabetes, 307 patients were chosen by systematic sampling procedure carried out at each Primary Care Unit. A questionnaire was used to interview the subjects regarding factors associated with glycemic control in type 2 diabetes mellitus patients. The questionnaire consisted of demographic characteristics, knowledge of diabetes, healthcare behaviors, and psychosocial factors, including data collection on glycemic level from medical record. Descriptive statistics was used (frequency, percentage, mean, median, standard deviation) and Chi- square test, Pearson Correlation, and Spearman Rank Test were used to analyze the association between the study variables. SPSS version 17 was employed.

The result showed that there were 238 women and 69 men with the mean age of 58.72±6.49 years old, duration of diabetes was mean 6.24± 4.10 years. Approximately 42.7% of the subjects were obese (mean BMI of 25.36±3.44). The mean glycosylated hemoglobin (HbA1C) level was 8.26±1.96% and the proportion of patients who had good control (HbA1C <7%) was 26.1% while 73.9% of the subjects had value ≥7 identified as poor control. Factors statistically significant with glycemic control were duration of diabetes (positive direction, $r = 0.185$, $p<0.001$), dietary habit (negative direction, $r = -0.220$, $p<0.001$) and drug compliance (negatively direction, $r = -0.469$, $p<0.001$).

This study has indicated that the unsuccessful diabetes care among patients with type 2 diabetes treated in Primary Care Unit according to the goals of diabetes care. This becomes a great challenge to develop diabetes care system in the community with quality.

Field of Study Public Health Student's Signature Niyom P.

Academic Year 2010 Advisor's Signature Prathurng H.

ACKNOWLEDGMENTS

This thesis had been accomplished by the collaboration of many wonderful persons. I would like to express my sincere gratitude and deep appreciation to Asst.Prof. Prathurng Hongsranagon**,** Ph.D. my principle supervisor, for her guidance, invaluable advice, supervisor and encouragement throughout my study. She has never lacked of kindness and support. I am equally grateful to Dr. Naowarat Kanchanakhan, Ph.D, Dr. Wongwat Liulak, M.D and Alessio Panza, M.D, M. Com. H, DTMH for their comments. I am very grateful to Asst. Prof. Sucheera Phattharayuttawar, Department of Psychiatry, Faculty of Medicine, Siriraj Hospital, for kindly granting me permission to use her instrument of the Thai Stress Test in the study. I would also like to thank Ms.Venus Udomprasertkul, Ms.c and Dr. Sommai Khochanam my statistician for their invaluable advice and support in the defense of this thesis.

I am most grateful to official and staff nurses at Primary Care Unit, Pathumrat District, Roi-Et province for great assistance and wonderful friendship. I grateful to thank diabetic patients, who kindly took part in the study and provided the vital information on which the study was based I would like to thank principle advisor and for her advice regarding my English language usage as well. Further, I am particularly thankful to the College of Public Health Sciences, Chulalongkorn University for the partial thesis grant, which enabled me to undertake this study.

Finally, my special thanks to my family, lovely brother for their support and encouragement that inspired me to succeed in my study.

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LIST OF ABBREVIATIONS

A1C : GLYCOCYLATE HEMOGLOBIN

ADA : AMERICAN DIABETES ASSOCIATION

DCCT : DIABETES CONTROL AND COMPLICATIONS TRIAL

FPG : FASTING PLASMA GLUCOSE

GDM : GESTATIONAL DIABETES MELLITUS

IDF : INTERNATIONAL DIABETES FEDERATION

IFG : IMPAIRED FASTING GLUCOSE

IGT : IMPAIRED GLUCOSE TOLERANCE

IPQA : INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE

NGSP : NATIONAL GLYCOHEMOGLOBIN STANDARDIZATION PROGRAM

PCU : PRIMARY CARE UNIT

OGGT : ORAL GLUCOSE TOLERANCE TEST

SMBG : SELF-MONITORING OF BLOOD GLUCOSE

WHO : WORLD HEALTH ORGANIZATION

CHARPTER I

INTRODUCTION

1.1 Background

Diabetes Mellitus (DM) comprises a group of metabolic disorder. The pathogenesis of diabetes include reduce insulin secretion, decrease glucose usage and increase glucose production. Diabetes is a chronic illness and major public health problem worldwide, that requires continuing medical care and ongoing patient self-management education and support to prevent acute complications and to reduce the risk of long-term complications; such as blindness, kidney damage, cardiovascular disease, and lower – limb amputation. Diabetes diminished quality of life that affects people both in developed and developing countries. World Health Organization (WHO) estimates people in the world with diabetes will increase to 366 million by the year 2030 (WHO, 2009). At the same time, the International Diabetes Federation (IDF) estimates of the prevalence of Impaired Glucose Tolerance (IGT) was 344 million and the number of people with diabetes has risen to 285 million for 2010. The report that showed IGT would be increased to 472 million and 438 million of people for diabetes by the year 2030 (IDF, 2009) (Table 1).

Table 1: Global Burden: Prevalence and Projections, 2010 and 2030

	2010	2030
Total world population (billions)	7.0	8.4
Adult population (20-79 years, billions)	4.3	5.6
Diabetes and IGT (20-79 years)		
Diabetes		
Global prevalence (%)	6.6	7.8
Number of people with diabetes (millions)	285	438
IGT		
Global prevalence (%)	7.9	8.4
Number of people with IGT (millions)	344	472

Source: IDF Diabetes Atlas, 4th ed. International Diabetes Federation, 2009.

Diabetes mellitus is one of the most common non- communicable diseases globally. It is the fourth or fifth leading cause of death in most high-income countries. Complications from diabetes, such as coronary artery and peripheral vascular disease, stroke, diabetic neuropathy, amputations, renal failure and blindness are resulting in increasing disability, reduce life expectancy and enormous health cost for virtually every society(IDF, 2009). Finding the new data from the International

Diabetes Federation (IDF) comes from researchers in five African countries who interviewed 2,300 men and women with type 2 diabetes and an additional 2,300 of their neighbors who did not have diabetes. The studies reveal that people with diabetes have roughly 3 times the rates of heart disease, stroke, kidney disease and heart failure than their otherwise similar neighbors. In addition to, the number of deaths attributable to diabetes in 2010 shows 5.5% increase over the estimates for the year 2007(ADA, 2007). According to the American Diabetes Association (ADA) the national costs of diabetes in the USA for 2002 estimated to be $US 132 billion, increasing to $US 192 billion in 2020. Studies in the United States and other countries have found that improved glycemic control benefits people with type 2 diabetes, every percentage point drop in HbA_1C blood test result can reduce the risk of microvascular complication by 40%.

Diabetes Mellitus is classification, Type 1 diabetes mellitus is characterized by insulin deficiency and a tendency to develop ketosis, whereas type 2 diabetes mellitus is a heterogenouse group of disorders characterized by variable degree of insulin resistance, impaired insulin secretion, and excessive hepatic glucose production. Other specific types include DM caused by genetic defects, diseases of the exocrine pancreas, endocrinopathies, drug and pregnancy (gestational diabetes mellitus). Criteria of diagnosis of DM include one of the classic symptoms of diabetes include polyuria, polydipsia, and unexplained weight loss symptoms of diabetes plus casual plasma glucose concentration ≥ 200 mg/dl (11.1 mmol/l). Or FPG ≥ 126 mg/dl (7.0 mmol/l). Fasting is defined as no caloric intake for at least 8 hours. Or; 2-h PG≥200 mg/dl (11.1 mmol/l) during an OGTT. The test should be performed as described by WHO, using a glucose load containing the equivalent of 75-g anhydrous glucose dissolved in water. Two intermediated categories have also been designated: 1) Impaired fasting glucose (IFG) for the fasting plasma glucose between 6.1 and 7.0 mmol/L (110 and 126 mg/dL). 2) Impaired glucose tolerance (IGT) for plasma glucose level between 7.8 and 11.1 mmol/L (140 and 200 mg/dL) 2 h after a 75-g oral glucose load. Individual with IFG or IGT do not have DM but are at substantial risk for developing type 2 DM and cardiovascular disease in the future (ADA, 2010).

Measuring glycosylate hemoglobin is useful for predicting complication in patients with existing diabetes. HbA1C is a protein molecule found in red blood cell, there becomes modified by having glucose bound to it. The HbA1C should be used not only to assess the patient's control over the preceding 2–3 months, but also as a check on the accuracy of the meter (or the patient's self-reported results) and the adequacy of the Self Monitoring Blood Glucose (SMBG) testing schedule. Glycemic goals in adults should below or around 7% has been shown to reduce microvascularand neuropathic complications of type1 and typ2 diabetes. Therefore, for microvascular disease prevention, the A1C goal for nonpregnant adults in general is <7%. According to the 2010 American Diabetes Association clinical practice recommendations that perform the A1C test at least two times a year in patients who are meeting treatment goals (and who have stable glycemic control). Furthermore, they recommended perform the A1C test quarterly in patients whose therapy has changed or who are not meeting glycemic goals and use point- of-care testing for A1C allows for timely decisions on therapy changes, when need (ADA, 2010).

Diabetes mellitus in Thailand, Data from Bureau of Non Communicable Disease (NCD) found that more than 3 million people are living with diabetes (Bureau of Non Communicable Disease,2009).The prevalence of diabetes mellitus has significantly increased over recent decades to around 6.4 per 100 thousand in men and 7.3 in women. At the same time, in Roi-Et Province, the prevalence of diabetes patients were admitted in 2007 to 2009 were 2,715 and 784 per 100 thousand and the mortality rate of diabetes in 2007 to 2009 were 26.21, 28.92 and 27.92 per 100 thousand, respectively. In order to, for outcome measures by HbA1C level of type 2 DM in primary health care in the United States **(**Stephen, 2006) that showed mean glycosylated hemoglobin (HbA1C) level was 7.6% and 40.5% of patients had values <7%. Glycemic control in Rural areas of the United States (Haney, 2007) showed the achieves of HbA1C of <7% was attained in 75%. For outcome measures HbA1C level in Malaysia that was 26% of diabetes patients who had HbA1C <7%.

At Pathumrat hospital, Roi-Et Province, the data from diabetes clinic register of Information and Technology Center at, that shown the number of type 2 diabetes patients by the year 2007 to 2010 have been increased from 950, 1300, and 1,925 respectively. The most of all are type 2 diabetes patients (90%). The prevalence of type 2 diabetes patients are 34.1 per one thousand people and the re -admission ratio with acute short term complication of diabetes were increased to 54.3 per one thousand people (such as hypoglycemia, hyperglycemia, and acute myocardial infarction associated with underlying diabetes). The multidisciplinary team of Pathumrat hospital are providing the diabetes clinic on Thursday once a week. Since the year 2006, the referral system to 13 Primary Care Unit for continuity of treatment and care by a nurse and other public health care team. There were 1,071 patients with type 2 diabetes mellitus who can control Fasting Plasma Glucose (FPG) of < 140 mg/dl and without underlying disease. There have clinical practice guideline for management of care and treatment. They are followed up for annual health check include of foot, eye, and renal function. Nowadays, there were 9 people who have diabetes with chronic renal failure and they used Continuous Abdominal Peritoneal Dialysis (CAPD), that is the most inclusion among district in Roi-Et province. The result report of diabetes clinic at Pathumrat hospital 2009 that showed 9.47 % had the HbA1C level <6.5%, and 25.88% of patients had values 6.5-7.9% and 62.82% of patients had values >7.9%. Therefore, I want to study what are the factors associated with glycemic control in type 2 diabetes mellitus patients who were referred to Primary Care Unit in Pathumrat District, Roi-Et Province, Thailand. Furthermore, the main barriers and facilitators to care in the Primary Care Unit management of diabetes andfor develop an implementation strategy to provide the effectiveness of care and early prevention and reduce specific disease complications such as end-stage renal disease, blindness, and lower extremity amputations and for better quality of care to diabetes patients.

1.2 Research question

1. What is the quality of diabetes care in Primary Care Unit at Pathumrat District, Roi-Et Province?
2. What are the factors associated with glycemic control among type 2 diabetes patients?

1.3 Research Hypothesis

1. Demographic characteristics are associated with glycemic control in type 2 diabetes patients.
2. Knowledge of diabetes mellitus is associated with glycemic control in type 2 diabetes patients.
3. Healthcare behavior factors (dietary habit, physical activity and drug compliance) are associated with glycemic control in type 2 diabetes patients.
4. Psychosocial characteristics are associated with glycemic control in type 2 diabetes patients.

1.4 Objective

General Objective

To assess the degree of glycemic control and associated factors in type 2 diabetes mellitus patients attended by primary care teams in Pathumrat district, Roi Et province.

Specific Objective

1. To determine the association between demographic characteristics and glycemic control in type 2 diabetes patients at Primary Care Unit.
2. To determine the association between knowledge of diabetes mellitus and glycemic control in type 2 diabetes patients at Primary Care Unit.
3. To determine the association between healthcare behavior and glycemic control in type 2 diabetes patients at Primary Care Unit.
4. To determine the association between psychosocial characteristics and glycemic control of type 2 diabetes patients at Primary Care Unit.

1.5 Expected Benefit & Application

For health care provider Primary Care Unit and multidisciplinary team used the result to provide an effective strategies and taking control of diabetes mellitus patients. Moreover, for develop an implement strategy of process measures and quality of diabetes care for how to avoid or delay its complications.

1.7 Conceptual Framework

Independent Variable **Dependent Variable**

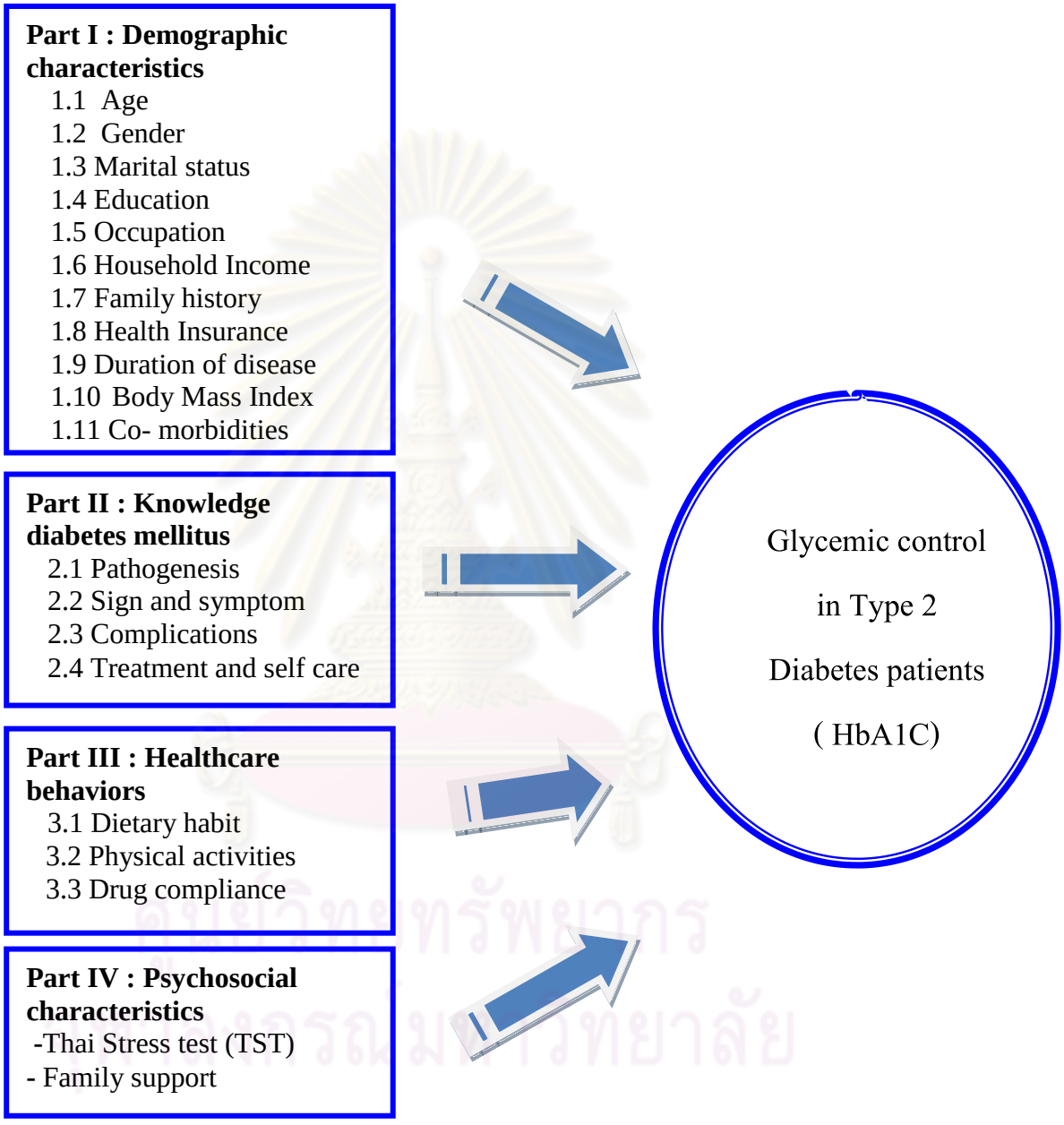

Figure 1. Conceptual framework of the factors associated with glycemic control in type 2 diabetes patients in Primary Care Unit.

1.8 Definitions

1. Age: Age of diabetes mellitus patients is contents 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 mellitus 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 diabetes mellitus patients: diabetes patients who had been diagnosed by the physician to have type 2 diabetes mellitus and who received treatment by oral glycemic medication at Primary Care Unit at Pathumrat District.

4. Glycemic control: the level of glycosylated hemoglobin (HbA1C) is used to determine glycemic control. Hemoglobin; a protein molecule found in red blood cell, becomes modified by having glucose bound to it. HbA1C less than 7% are considered as good glycemic control, whereas HbA1C equals or more than 7% indicates poor control.

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

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

7. Family support: some supports that diabetes patients may receive from their family member such as taking care, financial support, etc.

8. Stress: responses of the body or mind to harmful, threatening, or challenging events. The emotional responses to stress include anxiety, irritability, anger, embarrassment, depression, and hostility. Stress described by Thai Stress Test that refer to Psychosocial characteristic.

9. Body Mass Index: the measurement indicating the proper weight calculated by weight (kilogram) / height (meter)^2 on the interview day and can be interpreted as follow:

- Underweight is defined as body mass index of < 18.5 kg/m^2
- Normal range is defined as body mass index of 18.5-22.9 kg/m^2
- Overweight is defined as body mass index of 23-24.9 kg/m^2
- Obese I is defined as body mass index of 25-29.9 kg/m^2
- Obese II is defined as body mass index of ≥ 30 kg/m^2

10. Dietary: food consumption behaviors in daily life of diabetes patients including healthy food (such as rice, green leaf, lean meat, vegetables, low fat milk, etc.), unhealthy food (such as fatty /oily foods, fried food, water mixed of sugar, dessert, sweet fruit, etc.) and frequency of food consumption.

11. Physical activity: all activities during everyday life including working reaction, exercise and sport activities. was measured by short International Physical Activity Questionnaire (IPAQ) questionnaire 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.

12. Drug compliance: pattern of which diabetic patients follow prescribing order. There are define by high drug compliance, moderate drug compliance, low

drug compliance. Term of forgotten of taking antiglycemic drug is more than two times per month.

13. Co-morbidities: The need to classify co-morbid health problems in terms of their relevance to clinical management was recognized early, and a number of classification systems have been suggested). These systems are useful and widely reflected in clinical care practice. For example, ischemic heart disease, cardiovascular risk factors (hypertension, hyper-cholesterolemia, dyslypidemia, chronic kidney disease), and diabetes are commonly managed within the same cardiovascular clinics in primary care**.**

CHAPTER II

LITERATURE REVIEW

Theory and researches have been reviewed as follows:

1. Knowledge of diabetes mellitus

- 1.1 Definition
- 1.2 Classification
- 1.3 Diagnostic test for diabetes
- 1.4 Signs and symptoms
- 1.5 Causes and risk factors for type 2 diabetes
- 1.6 Complications
- 1.7 Treatment and self care

2. Health behaviors

- 2.1 Dietary
- 2.2 Physical Activity
- 2.3 Drug compliance

3. Factors associated with glycemic control in diabetes patients and involved research

- 3.1 Age
- 3.2 Gender
- 3.3 Marital status
- 3.4 Occupation
- 3.5 Family Income
- 3.6 Education level
- 3.7 Body Mass Index
- 3.8 Duration of Diabetes Mellitus
- 3.9 Dietary
- 3.10 Physical activity
- 3.11 Drug compliance
- 3.12 Knowledge of diabetes
- 3.13 Family support
- 3.14 Stress

1. Knowledge of diabetes mellitus

1.1 Definition and description of diabetes mellitus

Diabetes is a group of metabolic disease characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both. The chronic hyperglycemia of diabetes is associated with long-term damage, dysfunction, and failure of different organs, especially the eyes, kidney, nerves, heart and blood vessels. Several pathogenic processes are involved in the development of diabetes. These range from autoimmune destruction of the ß-cell of the pancreas with consequent insulin deficiency to abnormalities that result in resistance to insulin action. The basis of the abnormalities in carbohydrate, fat, and protein metabolism in diabetes is deficient action of insulin on target tissue. Deficient insulin action results

from inadequate insulin secretion and/or diminished tissue responses to insulin at one or more points in the complex pathways of hormone action. Impairment of insulin secretion and defect in insulin action frequently coexist in the same patient, and it is often unclear which abnormality, if either alone, is the primary cause of the hyperglycemia.

Symptoms of marked hyperglycemia include polyuria, polydipsia, weight loss, sometime with polyphagia, and blurred vision. Acute life-threatening consequences of uncontrolled diabetes are hyperglycemia with ketoacidosis or nonketotic hyperosmolar syndrome. Long term complications of diabetes include retinopathy with potential loss of vision, nephropathy leading to renal failure; peripheral neuropathy with risk of foot ulcer, amputations, and Charcot joints; and autonomic neuropathy causing gastrointestinal, genitourinary, and cardiovascular symptoms and sexual dysfunction. Patients with diabetes have increased incidence of atherosclerotic cardiovascular, peripheral arterial, and cerebrovascular disease. Hypertension and abnormalities of lipoprotein metabolism are often found in people with diabetes.

1.2 Classification

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 l diabetes or juvenile-onset diabetes, result from a cellular-mediated autoimmune destructive of the ß-cells of the pancreas. Patients with this form of diabetes are dependent upon insulin for survival and are at risk of ketoacidosis. Type l diabetes which account for only 5-10% of those with diabetes that commonly occurs in childhood and adolescence but may occur at any ages.

Type 2

Type 2 diabetes or adult-onset diabetes, which accounts for ~90-95% of those with diabetes, previously referred to as non-insulin dependent diabetes, encompasses individuals who have insulin resistance and usually have relative (rather than absolute) insulin deficiency. These individuals do not need insulin treatment to survive. There are probably many difference causes of this form of diabetes. Although the specific etiologies are not known, autoimmune destruction of ß-cells does not occur, and patients do not have any of the other causes of diabetes listed above or below. Most patients with this form of diabetes are obese, and obesity itself causes some degree of insulin resistance. Ketoacidosis seldom occurs spontaneously in this type of diabetes.

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 or 2 diabetes or impaired glucose tolerance. Women with GDM have a higher risk for type 2 diabetes later in life.

1.3 Diagnostic criteria for diabetes mellitus

The new criteria for diabetes mellitus have been modified form those previously recommended by the American Diabetes Association. The revised criteria for the diagnosis of diabetes are show in Table 2.

Table 2: Criteria for the diagnosis of diabetes mellitus.

1. A1C ≥ 6.5%. The test should be performed in a laboratory using that is NGSP certified and standardized to the DCCT assay.*
OR
2. FPG ≥ 126 mg/dl (7.0 mmol/l). Fasting is defined as no caloric intake for at least 8 hours.*
OR
3. 2-h plasma glucose ≥ 200 mg/dl (11.1 mmol/l) during an OGTT. The test should be performed as described by World Health Organization, using a glucose load containing the equivalent of 75 g anhydrous glucose dissolved in water.*
OR
4. In a patient with classic symptoms of hyperglycemia or hyperglycemic crisis, a random plasma glucose ≥ 200 mg/dl (11.1 mmol/l)

* In the absence of unequivocal hyperglycemia, criteria 1-3 should be confirmed by repeat testing.

Source; The diagnosis and classification of Diabetes Mellitus by the ADA, 2010

The Expert Committee recognizes an intermediate group of subjects whose glucose level. Although no meeting criteria for diabetes, are nevertheless too high to be considered altogether normal. This group is defined as having FPG levels ≥ 110 mg/dl (6.1 mmol/l) but <126 mg/dl (7.0 mmol/l). or 2-hr vales in the OGTT of ≥ 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.

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	100-125 mg/dl (IFG)		2 hr. PG 140-199mg/dl (IGT)
Diabetes	≥126mg/dl	≥ 200 mg/dl	2 hr. ≥ 200 mg/dl

Source: World Health Organization; 2006

Testing for diabetes in asymptomatic patients

Recommendation

- Testing for detect type 2 diabetes and assess risk for future diabetes in asymptomatic people should be considered in adult age who are overweight or obese (BMI ≥ 25kg/m^2) and who have one or more additional risk factors, testing should begin at age 45 years.
- If test are normal, repeat testing should be carried out at least at 3-years intervals.
- The test of diabetes or to assess risk of future diabetes, either A1C, FPG, or 2-h 75 g OGTT are appropriate.
- If those identified with increased risk for future diabetes, identify and, if appropriate, treat other CVD risk factors.

Table 4: Criteria for testing for diabetes in asymptomatic patients

No.	Criteria
1.	Testing should be considered in all adults who are overweight (BMI ≥25 kg/m^2) and have additional risk factors: - physical inactivity - first-degree relative with diabetes - high-risk race/ethnicity (e.g., African American, Latino, Native American, Asian American, Pacific Islander) - women who delivered a baby weighing >9 lb or were diagnosed with GDM - hypertension (≥140/90 mmHg or on therapy for hypertension) - HDL cholesterol level <35 mg/dl (0.90 mmol/l) and/or a triglyceride level >250 mg/dl (2.82 mmol/l) - women with polycystic ovarian syndrome (PCOS) - A1C ≥5.7%, IGT, or IFG on previous testing other clinical conditions associated with insulin resistance (e.g., severe obesity, acanthosis nigricans) - history of CVD
2.	In the absence of the above criteria, testing for diabetes should begin at age 45 years.
3.	If results are normal, testing should be repeated at least at 3-year intervals, with consideration of more frequent testing depending on initial results and risk status.

Source; Standard of medical care in diabetes 2010.

Glycemic control

Assessment of glycemic control

Two primary techniques are available for health providers and patients to assess the effectiveness of the management plan on glycemic control: patient self-monitoring of blood glucose (SMBG) or interstitial glucose, and A1C.

a. Glucose monitoring

Recommendations

- SMBG should be carried out three or more times daily for patients using multiple insulin injections or insulin pump therapy. (A)
- For patients using less-frequent insulin injections, noninsulin therapies, or medical nutrition therapy (MNT) alone, SMBG may be useful as a guide to the success of therapy. (E)
- To achieve postprandial glucose targets, postprandial SMBG may be appropriate. (E)
- When prescribing SMBG, ensure that patients receive initial instruction in, and routine follow-up evaluation of, SMBG technique and their ability to use data to adjust therapy. (E)
- Continuous glucose monitoring (CGM) in conjunction with intensive insulin regimens can be a useful tool to lower A1C in selected adults (age ≥25 years) with type 1 diabetes. (A)
- Although the evidence for A1C-lowering is less strong in children, teens, and younger adults, CGM may be helpful in these groups. Success correlates with adherence to ongoing use of the device. (C)
- CGM may be a supplemental tool to SMBG in those with hypoglycemia unawareness and/or frequent hypoglycemic episodes. (E)

Major clinical trials of insulin-treated patients that demonstrated the benefits of intensive glycemic control on diabetes complications have included SMBG as part of multifactorial interventions, suggesting that SMBG is a component of effective therapy. SMBG allows patients to evaluate their individual response to therapy and assess whether glycemic targets are being achieved. Results of SMBG can be useful in preventing hypoglycemia and adjusting medications (particularly prandial insulin doses), MNT, and physical activity.

The frequency and timing of SMBG should be dictated by the particular needs and goals of the patient. SMBG is especially important for patients treated with insulin to monitor for and prevent asymptomatic hypoglycemia and hyperglycemia. For most patients with type1 diabetes and pregnant women taking insulin, SMBG is recommended three or more times daily. For these populations, significantly more frequent testing may be required to reach A1C targets safely without hypoglycemia. The optimal frequency and timing of SMBG for patients with type 2 diabetes on noninsulin therapy is unclear. A meta-analysis of SMBG in non–insulin-treated patients with type 2 diabetes concluded that some regimen of SMBG was associated with a reduction in A1C of 0.4%. However, many of the studies in this analysis also included patient education with diet and exercise counseling and, in some cases, pharmacologic intervention, making it difficult to assess the contribution of SMBG alone to improved control . Several recent trials have called into question the clinical utility and cost-effectiveness of routine SMBG in non–insulin-treated patients. Because the accuracy of SMBG is instrument and user dependent, it is important to evaluate each patient's monitoring technique, both initially and at regular intervals

thereafter. In addition, optimal use of SMBG requires proper interpretation of the data. Patients should be taught how to use the data to adjust food intake, exercise, or pharmacological therapy to achieve specific glycemic goals, and these skills should be reevaluated periodically. CGM through the measurement of interstitial glucose (which correlates well with plasma glucose) is available. These sensors require calibration with SMBG, and the latter are still recommended for making acute treatment decisions. CGM devices also have alarms for hypo- and hyperglycemic excursions. Small studies in selected patients with type 1 diabetes have suggested that CGM use reduces the time spent in hypo- and hyperglycemic ranges and may modestly improve glycemic control. A larger 26-week randomized trial of 322 type 1 patients showed that adults age 25 years and older using intensive insulin therapy and CGM experienced a 0.5% reduction in A1C (from ~7.6% to 7.1%) compared to usual intensive insulin therapy with SMBG. Sensor use in children, teens, and adults up to age 24 years did not result in significant A1C lowering, and there was no significant difference in hypoglycemia in any group. Importantly, the greatest predictor of A1C-lowering in this study for all age-groups was frequency of sensor use, which was lower in younger age-groups. In a smaller randomized controlled trial of 129 adults and children with baseline A1C <7.0%, outcomes combining A1C and hypoglycemia favored the group utilizing CGM, suggesting that CGM is also beneficial for individuals with type 1 diabetes who have already achieved excellent control with A1C <7.0. Although CGM is an evolving technology, emerging data suggest that, in appropriately selected patients who are motivated to wear it most of the time, it may offer benefit. CGM may be particularly useful in those with hypoglycemia unawareness and/or frequent episodes of hypoglycemia, and studies in this area are ongoing.

A1C

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. According to 2010 by the American Diabetes Association recommendations that glycemic goals in adult, lowering A1C to below or around 7% has been shown to reduce microvascular and neuropathic complications of type 1 and type 2 diabetes. Therefore, for microvascular disease prevention, the A1C goal for nonpregnant adult in general is < 7%. Perform the A1C test at least two times a year in patients who are meeting treatment goals (and who have stable glycemic control). Furthermore, they recommended perform the A1C test quarterly in patients whose therapy has changed or who are not meeting glycemic goals and use point- of-care testing for A1C allows for timely decisions on therapy changes, when need (ADA, 2010).

1.4 Signs and symptoms

The main initial symptoms of diabetes are :

1. Polydipsia (increased thirst)
2. Polyuria (increased urinary frequency with increased volume)
3. Fatigue
4. Polyphagia (increased appetite0
5. Weight loss

6. Abnormal healing
7. Blurred vision
8. Increase occurrence of infections. Particularly those caused by yeast.

1.5 Causes and risk factors for type 2 diabetes

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 I 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 type2 diabetes, namely insulin resistance and the inability of the ß cell to secrete enough insulin to overcome the effects of the resistance. Candidate genes therefore include. On the one hand, the signaling mediators and enzymes that regulate insulin's biological actions, and on the other, components of the ß 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 sex. Indeed, having a body-mass index (BMI) of >35 kg/m^2 increases the risk of developing diabetes over a 10-year period by a staggering 80-fold, as compared with thin individuals (BMI<22kg/ 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-α, 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 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 2 diabetes in and the replacement of

physically active occupations may be an important factor in the rising prevalence rates of type 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 ß cells and possibly by inducing insulin resistance.

1.6 Complications

1.6.1 Acute (anytime) complications of diabetes

Primary and secondary hypoglycemia

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 hyperglycemia. The causes of hypoglycemia are manifold, and on the basis of the etiology, and particularly the presence or absence of hyperinsulinism.

Diabetic ketoacidosis

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 2 diabetes. The incidence of DKA is approximately 40 episodes/10,000 diabetic subjects. Mortality remains high 10% for DKA.

Individuals with type II diabetes ma 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 counter regulatory hormones (eg, epinephrine, cortisol, and glucagon).which stimulate beta oxidation 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).
- Hyperosmolarity because of renal water loss and water depletion from sweating, nausea, and vomiting, included associated potassium loss. 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 dieresis 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. Persons 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

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.

Micro vascular 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 persons at the time of diagnosis of diabetes, and in 25% after 25 years of disease. It l 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 2 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 2 diabetes, 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 microalbuminurea 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

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 control 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 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 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 1 diabetes have no excessive body weight and the caloric intake prior to onset should be maintained. On the other hand, type 2 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 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 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 1 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. Over-eating and physical inactivity in combination with genetic factors are the major causes for the development of obesity in humans. 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. 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 syndrome with mildly-to-moderately overweight may be found at the onset of cardiovascular diseases in Japanese workers.

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^2).

Table 5: BMI classifications

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

Source: World Health Organization; 2000

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.

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.

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. The recent Surgeon General's Report on 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.

Physical activity has many advantages for all individuals. Activity is beneficial in type 2 diabetes by:

- Reducing blood glucose, AIC 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

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 habits, weight and medication allergies. If weight is above desired limits, usually and oral agent that reduces insulin resistance is prescribed. If weight is within desired limits, and 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. Patients failing maximum doses of either Metformin or a Sulfonylurea can be given the other medication in combination therapy. The Sulfonylureea dose should be lowered to achieve consistent daytime glucose values in a safe range. Metforrmin 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. 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.

- 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

Insulin may be necessary to control glucose when beta cells can no longer produce adequate insulin. It 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

The study of Yan (Yan and Dalong, 2010); they study about the status of glycemic control of outpatients with type 2 diabetes mellitus across primary, secondary, and tertiary hospitals in the Jiangsu Province of China, and the factors associated with achieving glycemic targets, at 56 diabetes centers. Patients was performed in 2,966 subjects with a medical history of type 2 DM for >6 months and registration at each diabetes center for ≥6 months. In primary hospitals, patients with diabetes were treated by general physicians; secondary and tertiary hospitals, they were seen by specialists. During the patient enrollment visit, information about DM complications and co -morbidities, as well as DM management, was obtained by retrospectively reviewing medical records; basic patient data were obtained by patient interview. Blood samples were collected for assessment of glycosylated hemoglobin (HbA1C) at a central laboratory. They found that mean (SD) HbA1C value for analyzed patients was 7.2% (1.6%). The proportion of patients with tight glycemic control was 0.2% (1193/2966) when a threshold of HbA1C <6.5% was used, and 56.1% (1665/2966) when a threshold HbA1C < 7.0% was used. Compared with patients who had inadequate glycemic control, those with tight control were younger, had shorter duration of DM, had lower body mass index (BMI), had more education and income. Age, BMI, and DM duration did not different significantly between hospital types. Compared with primary(36.2%) and secondary hospitals (36.5%), tertiary hospitals (42.2%) had more patients with HbA1C <6.5% (P = 0.043); tertiary hospitals also had more patients with once-monthly glucose self-monitoring (P = 0.001), patients with higher income (P < 0.001) and education(P < 0.001), and those who were more likely to use ≥2 OADs or insulin with OADs (P < 0.001).The overall status of glycemic control was unsatisfactory during the study period, although patients at tertiary hospitals appeared to have better control than those at primary or secondary hospitals.

Prueksaritanond (Prueksaritanond, 2004), to evaluate the efficacy of patient-centered care on type 2 diabetes mellitus. Their fasting plasma glucose (FPG), hemoglobin A1c (HbA1C), eating and exercise behavior, compliance, symptoms of diabetes as well as satisfaction were compared before and after the intervention. The result that showed there were 53 females (67.9%) and 25 males (32.1%). Average age

was 57.2 years. Diabetes duration was 6.75 +/- 5.45 years. Mean FPG of overall subjects decreased 43.07 +/- 76.32 mg/dl. About 16.44% had FPG below 126 mg/dl. 55.13% retained the same hypoglycemic medications, 10.5% had decreased dosage. Amongst 33 subjects (42.3%) who completed the program, FPG decreased 73.58 +/- 70.99 mg/dl ($p < 0.000$). HbA1C decreased 0. 92 +/- 1.41% ($p = 0.001$). Eating behavior ($p < 0.000$) and exercise behavior ($p < 0.05$) were better. Symptoms of diabetes were improved. Patient's satisfaction indicated that they had a better understanding of the disease and illness. They were eager to share their experiences with others and able to develop a relationship with the health care team. Amongst 45 patients (57.7%) who partially followed the program, FPG decreased 39.55 +/- 68.54 mg/dl ($p = 0.001$).So they concluded glycemic control of type 2 diabetes subjects was improved by patient-centered care. Eating and exercise behaviors, compliance, symptoms of diabetes were better. This pilot study showed that the health status was improved not only by the biological indicators but also by behavior. The present study provided a beneficial impact on improving the health status of type 2 diabetes.

Mayurasakorn (Mayurasakorn et al, 2009), found the status of disease control and to compare the prevalence of micro vascular complications among type-2 diabetes in a primary care setting about 287 diabetic patients from 13 Primary Care Units in urban areas of Thailand. The status of diabetic control was dominantly defined by HbA1C, blood pressure. Screening programs for micro vascular complications included retinopathy and nephropathy. Retinopathy used a seven-field stereoscopic retinal photography while nephropathy was defined by a random urine albumin-to-creatinine ratio. The A1C of 41.3% of the patients was lower than 7% however 80% of them used only low doses of anti-diabetic drugs. The prevalence of micro albuminuria was 28.7% and macro albuminuria was 5.7%, whereas diabetic retinopathy was 15.1%. In multivariate analyses, nephropathy was significantly related to duration of diabetes > or =4 years (odds ratio 1.5, 95% CI 1.2-1.8,$p < 0.001$) and A1C > or =8% (odds ratio 2.2, 95% CI 1.3-3.8, $p < 0.05$), while retinopathy was related to duration of diabetes > or =4 years (odds ratio 9.5, 95% CI 1.17-77.8, $p < 0.05$).The present study shows that Primary Care Units provides patients with well-controlled diabetes. Nevertheless, those type 2 diabetes patients have significantly higher rates of microvascular complications, despite shorter diabetes duration and lower A1C. Type 2 diabetic patients in Primary Care Unit should be screened for complications and efforts should be done to reach optimal glycemic level, especially for individuals with diabetes > or =4 years.

The study of Khattab (Khattab et al., 2009), the risk factors associated with the presence of diabetes in Chinese communities in Beijing. They found diabetes survey was conducted in 2,801 citizens aged 35–79 years living in 10 communities in Beijing, China. There were no significant associations between the presence of diabetes and occupation, education level, household income, leisure time physical activities, current smoking and drinking status. They were concluded: age, diabetes family history, obesity, dyslipidemia and hypertension were all associated with the presence of diabetes in this study population. Other study of Khattab (Khattab et al., 2009), Found that the factors associated with poor glycemic control among patients with type 2 diabetes. They study on systematic random sample of 917 patients was selected from all patients with Type 2 diabetes over a period of 6 months in 2008. A restructured questionnaire sought information about sociodemographic, clinical

characteristics, self-care management behaviors, medication adherence, barriers to adherence, and attitude towards diabetes. Weight, height, and waist circumferences were measured. All available last readings of hemoglobin A1C (HbA1C), fasting blood sugar measurements and lipid were abstracted from patients' records. Poor glycemic control was defined as HbA1C ≥7%. The results, of the total 917 patients, 65.1% had HbA1C ≥7%. In the multivariate analysis, increased duration of diabetes (>7 years vs. ≤7years) (OR=1.99, *P*≤.0005), not following eating plan as recommended by dietitians (OR=2.98, *P*≤.0005), negative attitude towards diabetes, and increased barriers to adherence scale scores were significantly associated with increased odds of poor glycemic control. So conclusion that, the proportion of patients with poor glycemic control was high, which was nearly comparable to that reported from many countries. Longer duration of diabetes and not adherent to diabetes self-care management behaviors were associated with poor glycemic control. An educational program that emphasizes lifestyle modification with importance of adherence to treatment regimen would be of great benefit in glycemic control.

The study about degree of glycemic control and its associated factors in patients with diabetes mellitus (DM) attended by primary care teams in Spain (Velasco, 2009).The study was carried out using a structured questionnaire in diabetic patients consecutively attended from January to August 2007. Three groups were assessed: patients with type 1 diabetes mellitus (DM) and those with insulin treated or non-insulin-treated type 2 DM. The diagnosis of DM was established according to the American Diabetes Association (ADA) criteria. Good glycemic control was defined as a glycated hemoglobin (HbA1C) value ≤ 7%. Sociodemographic characteristics, medical history, and clinical complications were collected. Factors associated with glycemic control were analyzed by means of multiple logistic regression analysis. The results showed that a total of 679 patients were included, classified into type 1 DM (11.5%), insulin-treated type 2 DM (26.2%) and noninsulin-treated type 2 DM (62.3%). The mean age was 65.2 ± 13.7 years, 52.4% were women, 35.6% were obese, 86.0%, were dyslipidemic and 78.9% had hypertension. A total of 53.1% (CI: 49.3-56.9) showed good glycemic control (distribution among groups: 31.5%, 32.7% and 65.4%, respectively; $p < 0.001$). Predictive factors for unsatisfactory control were age (odds ratio [OR] = 0.984), time from diagnosis (OR = 1.033) and insulin treatment (OR = 4.054) ($p < 0.001$). Only 5.8% of the individuals achieved all the objectives recommended by the American Diabetes Association. Glycemic control in diabetic patients can be improved. Only one in two patients with diabetes attended in primary care is properly controlled. The percentage of patients with satisfactory control in the insulin-treated group (types 1 and 2) was half that in the non-insulin-treated group.

In Thailand, Phoolcharoen study about the factors associated with diabetes control (Phoolcharoen et al., 2003). This study was to investigate factors associated with depression in type 1 and type 2 diabetes and test whether these differ from factors associated with depression in the nondiabetic population. In an unselected population study comprising 60,869 individuals, potential sociodemographic, lifestyle, and clinical factors were investigated in participants with and without diabetes. The associations between hyperglycemia and depression in types 1 and 2 diabetes were also studied. The levels of depression were self-rated by using the Hospital Anxiety and Depression Scale. They found that several factors were

correlated with depression in types 1 and 2 diabetes. However, these factors were not different from those of the nondiabetic population. Comorbidity chronic somatic diseases were associated with depression in type 2 but not type 1 diabetes. In type 2 diabetes, those without comorbidity had the same odds of depression as the nondiabetic population with no chronic somatic diseases. No significant associations were found for hyperglycemia in relation to depression in type 1 and type 2 diabetes. Type 2 diabetes without other chronic somatic diseases did not increase the risk of depression. Factors associated with depression in type 1 and type 2 diabetes were shared with the nondiabetic population. The study of Pinthong (Pinthong, 2005) found that the factors associated with glycemic control in type 2 diabetes mellitus patients in Pattananikom hospital were gender, dietary habit and drug compliance. In the other hand, from Jiamjarasrangsi (Jiamjarasrangsi et al, 2008) they review listerature of Type 2 diabetes care in Primary Care Unit and they found that the factors were barrier to obstracle quality of care in diabetes patients are the pathology of diabetes, factors of patients, insulin therapy and the healthcare team.

The prevalence of microalbuminuria and associated risk factors in patients with type 2 diabetes in primary care in Thailand (Aekplakorn, 2009).Clinical information of diabetic patients in 70 Primary Care Units in Thailand was collected in a cross-sectional survey. Multinomial logistic regression model was used to examine several clinical risk factors with microalbuminuria and macroalbuminuria. Result that showed: A total of 4,162 patients were included. The prevalence of microalbuminuria was 39.12% and macroalbumninuria was 7.83%. The proportion of patients with HbA1C<7% was 37.9%. Independent risk factors for microalbuminuria and macroalbuminuria included HbA1C (adjusted OR 1.54, 95%CI 1.30-1.83 and 2.06, 95%CI 1.49-2.84 per unit increase in HbA1C, respectively), triglyceride >/=1.7mmol/L (1.31, 1.11-1.56 and 1.44, 1.06-1.98), hypertension (1.31, 1.10-1.54 and 1.64, 1.23-2.20), and duration of diabetes >/=5 years (1.31, 1.11-1.55 and 2.39, 1.74-3.28). Metabolic syndrome was associated with macroalbuminuria (OR 1.36, 95%CI 1.01-1.84).The high prevalence of microabuminuria and suboptimal glycemic control for the diabetic patients were found to highlight the need to improve in control of glycemia and metabolic risk factors.

Healthcare service in Thailand is stratified into three levels with different facilities of care. The survey study described diabetes management, diabetes control, and late complication status among patients managed in urban primary health care clinics (Nitiyanant, 2007). Thirty-seven primary health care units were randomly selected. Each unit enrolled up to 30 patients having been managed in the unit for at least one year. The patients were interviewed, and the medical records such as demographic data, management practice, glycemic control, and complications were retrospectively reviewed for a period of one year. The result that showed: Monitoring of glycemic control was largely by measurement of fasting plasma glucose (FPG) in the unit. Determination of hemoglobin A1C (HbA1C), total cholesterol, triglyceride, HDL-cholesterol, serum creatinine, urinary protein, and microalbuminuria were observed in 0.7, 17.4, 11.7, 6.9, 38.2, 33.0, and 0.9% of the patients, respectively. Mean +/- SD of FPG was 8.3 +/- 2.7 mmol/l, and HbA1C was 8.6 +/- 1.9%. The percentage of patients with FPG < 6.7 mmol/l and HbA1C < 7% were 28.7 and 19.6%, respectively. An annual eye and foot examination was performed in 21.5%

and 45% of the patients, respectively. The prevalence of late complications included retinopathy (13.6%), proteinuria (17.0%), end stage renal failure (0.1%), peripheral neuropathy (34%), acute foot ulcer/gangrene (1.2%), healed foot ulcer (6.9%), stroke (1.9%), and myocardial infarction (0.7%).

Risk factors associated with metabolic syndrome in type 2 diabetic patients at Bhumibol Adulyadej Hospital (Kamonwan, 2008). To assess the prevalence and the association between risk factors and metabolic syndrome in Type 2 diabetic patients. A cross-sectional study of type 2 diabetic patients aged 20 and older that visited the Medicine Department's outpatient service of Bhumibol Adulyadej Hospital during October to December 2007. The prevalence of the metabolic syndrome, as defined by International Diabetes Federation (IDF), was determined, and risk factors associated with predisposition to the metabolic syndrome were analyzed. Results: A total of 185 type 2 diabetic patients, 62 men and 123 women, were enrolled in this study. The prevalence of the metabolic syndrome was 77.3% (62.9% in men and 84.6% in women) when using the IDF criteria. By using NCEP ATP III criteria adjusted for Asians, the prevalence was 93.5%. Besides the large waist circumference and high FBS, other metabolic syndrome components with highest distributions were the high blood pressure (93.71%) and low HDL cholesterol (89.51%). The factors associated with the metabolic syndrome were age (OR 1.10, P=0.005), higher BMI (1.66, P=0.000), and female gender (OR 3.70, P=0.026). Other factors including smoking, household income, eating behavior, alcohol consumption, exercise, occupation, marital status and education levels were not associated with the metabolic syndrome. Metabolic syndrome is present in 77.3% of type 2 diabetic patients. Higher BMI were identified as independent modifiable risk factors of the metabolic syndrome. By the high prevalence in this study, therefore, suggested that the management of risk factors should be routinely done in the hospital to prevent patients from cardiovascular diseases.

Narenpitak's study of the prevalence of chronic kidney disease (CKD) in Type 2 diabetes and risk factors of decreased kidney function in Type 2 diabetes at primary health care unit of Udon Thani Province. (Narenpitak et al, 2008)**.** A descriptive cross-sectional study, cluster random sampling method was conducted from April to August 2007. Seven hundred and sixteen patients were enrolled. Medical histories, physical examinations, and blood tests for glucose, creatinine, total cholesterol, and triglyceride after 9-12 hours fasting were collected. The definition and classification of CKD are classified according to K/DOQI guideline 2002. The results that showed**:** The mean age of the diabetic patients was 58.70 +/- 9.83 years ranged from 30 to 92 years old. The mean duration of diabetes was 5.53 +/- 4.62 years, the majority (82.41%) had diabetes less than 10 years. More than half (51.82%) were obese (BMI > or = 25 kg/m2). Most of them (89.39%) had universal coverage health assurance. According to the ADA guideline 2006, the target systolic blood pressure, diastolic blood pressure, fasting plasma glucose, total cholesterol, and triglyceride level could be achieved 55.45, 52.93, 36.31, 33.66, and 45.65% respectively. The prevalence of CKD stage 3 to 5 were 27.09 and 25.28% by using C-G and MDRD formulae respectively. The duration of diabetes, diabetes with history of hypertension, triglyceride level, and diabetic retinopathy were significant

independent risk factors of the presence of decreased kidney function processed by logistic regression analysis. The present study demonstrated the clinical characteristic and the prevalence of decreased kidney function in type 2 diabetes in a primary health care setting. Intensive and optimal treatment of diabetes to slow the progression of long-term complications should be effectively managed by a disciplinary team.

Another study, Wahba and Chang (Wahba and Chang, 2007), performed at the factors associated with glycemic control in type 2 Diabetes mellitus in rural areas of the United States were the patients who were older, using oral antidiabetic medication and not using insulin. According to review literature can conclude that factors which probably associated with glycemic control in type 2 diabetes mellitus patients among Primary Care Unit that are; Demographic factors, drug compliance, dietary habit, physical and emotional health status, service system in PCU, family support or care giver.

Family support, studies indicate that one of the best predicators 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.

Stress, 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 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 and Saranop 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. On the other hand, the study of Darren (Darre, et al., 2009) found that rate of depression were higher in men and women with diabetes when compared to those without diabetes. For every 1-U in A1C, the odds of severe depression increased by 22%. They found that sex, body mass index were significantly associated with increased risk for severe depression.

The report of Velasco (Velasco et al, 2009) to assess the degree of glycemic control and its associated factors in patients with diabetes mellitus (DM) attended by primary care teams in Spain. A cross-sectional multicenter study was carried out

using a structured questionnaire in diabetic patients consecutively attended from January to August 2007. Three groups were assessed: patients with type 1 diabetes mellitus (DM) and those with insulin-treated or non-insulin-treated type 2 DM. The diagnosis of DM was established according to the American Diabetes Association (ADA) criteria. Good glycemic control was defined as a glycated hemoglobin (HbA1c) value<or=7%. Sociodemographic characteristics, medical history, and clinical complications were collected. Factors associated with glycemic control were analyzed by means of multiple logistic regression analysis. They found that: A total of 679 patients were included, classified into type 1 DM (11.5%), insulin-treated type 2 DM (26.2%) and noninsulin-treated type 2 DM (62.3%). The mean age was 65.2+/-13.7 years, 52.4% were women, 35.6% were obese, 86.0%, were dyslipidemic and 78.9% had hypertension. A total of 53.1% (CI: 49.3-56.9) showed good glycemic control (distribution among groups: 31.5%, 32.7% and 65.4%, respectively; p<0.001). Predictive factors for unsatisfactory control were age (odds ratio [OR]=0.984), time from diagnosis (OR=1.033) and insulin treatment (OR=4.054) (p<0.001). Only 3% [corrected] of the individuals achieved all the objectives recommended by the American Diabetes Association. So they suggest that glycemic control in diabetic patients can be improved. Only one in two patients with diabetes attended in primary care is properly controlled. The percentage of patients with satisfactory control in the insulin-treated group (types 1 and 2) was half that in the non-insulin-treated group.

Pittrow (Pittrow et al., 2006) studied about the primary care sector that is of key importance for the management of patients with diabetes mellitus. They investigated (a) the prevalence of diabetes mellitus type 1 and type 2, (b) the type and frequency of non-drug and drug treatment and its association with the presence of diabetic complications, and (c) the quality of metabolic control by HbA1c. They using a nationwide probability sample of 3,188 general practices (response rate [RR] 50.6%), a total of 55,518 (RR 93.5%) patients were assessed in a prospective cross-sectional study by their physicians in September 2003 in a standardized manner using questionnaires, physician interview, and laboratory assessments. In addition to diabetes mellitus, 28 diseases were explicitly screened for, among them typical macrovascular (coronary heart disease, cerebrovascular disease, peripheral arterial disease) and microvascular disease (neuropathy, nephropathy, retinopathy, diabetic foot) complications. They found that the prevalence of diabetes mellitus was 0.5% (type 1) and 14.7% (type 2), respectively. 49.5% (type 1) and 50.2% (type 2) of patients had micro- or macrovascular complications. 6.8% did not receive any treatment, 13.5% received non-drug treatment, and 75.3% received oral antidiabetic drugs and/or insulin (26.6% a combination of two or more). Compared to diabetics without any complications, treatment intensity was significantly higher in patients with microvascular complications (odds ratio [OR] 3.02), but not in those with macrovascular complications only (OR 0.98). An HbA1c value>or=7.0% was recorded in 39.6% of patients.

Katon (Katon et al., 2009) found that, many patients with diabetes fail to achieve American Diabetes Association Guidelines for glycemic, blood pressure and lipid control. Depression is a common comorbidity and may affect disease control through adverse effects on adherence and physician intensification of treatment. They study by a cohort of 4117 patients with diabetes, depression was measured at baseline with the Patient Health Questionnaire-9 (PHQ-9). Patient adherence and physician

intensification of treatment were measured in those who had evidence of poor disease control (HbA1C) >or=8.0%, LDL >or=130 mg/dL, systolic blood pressure >or=140 mm Hg) over this 5-year period. Poor adherence was defined as having medication refill gaps for >or=20% of days covered for medications prescribed for each of these conditions. Treatment intensification was defined as an increased medication dosage in a class, an increase in the number of medication classes, or a switch to a different class within 3-month periods before and after notation of above target levels. The result showed among patients with diabetes and poor disease control, depression was associated with an increased likelihood of poor adherence to diabetes control medications (odds ratio [OR] = 1.98; 95% Confidence Interval [CI] = 1.31, 2.98), antihypertensives (OR = 2.06; 95% CI = 1.47, 2.88), and LDL control medications (OR = 2.43; 95% CI = 1.19, 4.97). In patients with poor disease control who were adherent to medication or not yet started on a medication, depression was not associated with differences in likelihood of physician intensification of treatment. So, in patients with diabetes and poor disease control, depression is an important risk factor for poor patient adherence to medications, but not lack of treatment intensification by physicians.

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CHARPTER III

Research Methodology

3.1 Research Design

A cross-sectional research design was to determine factors associated with glycemic control in type 2 diabetes mellitus patients.

3.2 Study Area

The study area were 13 Primary Care Unit at Pathumrat District, Roi-Et Province, Thailand.

3.3 Study Period

In April, 2011.

3.4 Study Population

The population of this study were 1,071 patients with type 2 diabetes mellitus who were aged 20-80 years and were referred for continuity of care more than one years from Pathumrat community hospital to Primary Care Unit at Pathumrat District, Roi-Et Province, Thailand.

3.5 Sampling Technique

From the population of this study were 1,071 with type 2 diabetes patients, 231 patients were chosen by the systematic sampling procedure was carried out at each Primary Care Unit. The type 2 diabetes patients aged 20-80 years were arranged by identification diabetes number. The sampling interval is 4.6 and then the 231 samples were selected from each Primary Care Unit (Table 6).

Table 6: The samples were chosen from 13 Primary Care Unit in Pathumrat district, Roi- Et province

Primary care unit	Type 2 patients	Sample
1. Buadaeng	210	63
2. Nongkaen	123	37
3. Sabua	34	10
4. Dorglam	64	19
5. Suanpor	79	24
6. Jantai	61	18
7. Samkhar	69	21
8. Kealeg	52	16
9. Nonsawan	117	35
10. Namkham	80	24
11. Buakhaow	58	17
12. Nongsuay	70	21
13. Tajoi	54	16
Total	**1,071**	**231**

Inclusion criteria and exclusion criteria are as follows:

Inclusion criteria

1. Being diagnosed of type 2 diabetes patients by the physicians.
2. Age 20- 80 years.
3. Having result of HbA1C after referred to Primary Care Unit more Than one year.
4. Having treatment after diagnosed by the physicians or health care providers at Primary Care Unit in Pathumrat hospital District, Roi-Et Province, Thailand.
5. Having good orientation and ability to communication orally.
6. Agreeing to participate the study.

Exclusion criteria

1. Pregnancy, because it was difficult to classify between type 2 or other type of diabetes mellitus patients.
2. Diabetes patients who are age more 80 years and loss follow up more than 6 month.

3.6 Sample & Sample size

The systematic Sampling was used to this study. The names of people aged 20-80 years were arranged by identification diabetes number. The sampling interval was 4.6 and then the 231 samples were selected in each Primary Care Unit. A simplified formula for proportions of the sample size can be used to calculate by Thorndike equation (Thorndike, 1978) as follow;

$$n = 10k+50$$

Which is valid where

n is the sample size
k is the number of independent variable

$n = 10(16) + 50$

$= 210$

Therefore, the total of sample size were 210 cases with type 2 diabetes patients who were referred from Pathumrat community hospital to 13 Primary Care Unit in Pathumrat District. This sample size included 10 percent subjects account 231 cases to prevent for data losing.

3.7 Measurement Tools

The tools of this study used to collect data was the questionnaires compose of 5 parts, as following

Part I : **Demographic characteristics questionnaire** consist of

- Age
- Gender
- Marital status
- Education
- Occupation
- Family income
- Family history
- Health insurance
- Duration of disease
- Body mass index
- Co morbidities

Part II: **Knowledge of diabetes questionnaires**, it is consist of pathogenesis, signs and symptoms, complications, treatment and self care. It had a two dimensional rating scale composed of 15 items. Each answer scored 1 point for correct answer, 0 point for incorrect answer and unknown. The total score ranged from 0-15 points. Subjects were classified into 3 groups according to the score.

The negative items are items number : 5,6,7,8,12,13

The positive items are items number : 1,2,3,4,,9,10,11,14,15

Each answer scored 1 point for correct answer, 0 point for incorrect answer and unknown. The total score ranged from 0-15 points. Subjects were classified into 3 groups (Bloom, 1956) according to the score.

Score	Meaning
1 st group (total score 0-5)	Poor knowledge

2 st group (total score 6-9)	Fair knowledge
3 st group (total score 10-15)	Good knowledge

Part III: **Health behavior** questionnaire assessed life styles including dietary control, physical activity drug compliance and family support which consists of four sections.

Section I: Dietary questionnaire assessing food consumption and its frequency. It has a two dimensional rating scale composed of 10 items. The total score ranged from 0- 30 points. Subjects were classified into 3 groups according to the tertile of the score that were poor, fair and good dietary habit.

The negative items were items number : 1,3,4,5,6,7,9,10

The positive items were items number : 2,8

These items used 4 rating scales, as shown:

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

The total score ranged from 0- 30 points. Subjects were classified into 3 groups(Bloom, 1956) according to the tertile of the score.

Score	Meaning
1 st tertile (total score 0-18)	Poor dietary habit
2 nd tertile (total score 19-23)	Fair dietary habit
3 rd tertile (total score 24-30)	Good dietary habit

Section II: Physical activity was measured by short International Physical Activity Questionnaire (IPAQ) questionnaire which was summarized according to the physical activity record (walking, moderate intensity and vigorous activities). The short form data is used to estimate total weekly physical activity by weighting the reported minutes per week within each activity category by a MET (Metabolic equivalent of task, or simply metabolic equivalent: 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 x minutes of activity x events/week

The weighted MET-minutes per week (MET-min/week) were calculated as duration x frequency per week x 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 x min x day) + (moderate METs x min x day) + (vigorous METs x min x 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
   - 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. Highly 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 3,000MET-min/week.

Section III: Drug compliance questionnaire consist of 5 items.

If answered "Yes" or "Ever" = 0 point

Answered "No" or "Never" = 1 point

The total score ranged from 0 – 5 points. The classification of drug compliance were divided into 3 levels (Bloom, 1956), as shown:

Score	Meaning
4-5	High drug compliance
3	Moderate drug compliance
0-2	Low drug compliance

Part IV: **Psychosocial questionnaires**

Section I: Psychosocial questionnaires assessed about stress use of questionnaire that the researcher setting that related to general of attitude of diabetes patients. There are compose of 5 items. Then, use Thai Stress Test (TST) that was developed by Sucheera Phattharayuttawat (Phattharayuttawat et al, 2000) having adequate construct validity, reliability, and sufficient discriminant power. The test composed of 24 items – was found to be significantly different at the .001 level between those people with mental disorders and normal people. The construct validity of this test consists of two factors: negative scales, and positive scales. The reliability coefficients for the Alpha coefficients of the Thai Stress Test total test was 0.84. The values of the two scales were from 0.83 to 0.86. The Split Half reliability coefficients of the Thai Stress Test total test was 0.88. The questionnaire was apply to detect the mental health illness in Thai community. These items used 3 rating scales, as shown:

The negative items were items number : 1,2,3,4,5,6,7,8,9,10,11,12

The positive items were items number : 13,14,15,16,17,18,19,20,21,22,23,24

These items used 3 rating scales, as shown:

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

Table 7: Matrix table for the index of TST

Negative Scales score (Sum of Item 1-12)	Positive Scales score (Sum of Item 13-24)				
	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

Source: Thai Stress Test (TST) (Phattharayuttawat, 2000)

The total score ranged from 0- 36 points. Subjects were classified into 4 groups according to the tertile of the score.

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 that are consist of 6 Items**.**

Family support that are consist of 3 Items

Always	3
Seldom	2
Never	1

The total score ranged from 1- 18 points. Subjects were classified into 3 groups(Bloom, 1956) according to the tertile of the score.

1 st tertile (total score 1-11)	Poor support
2 nd tertile (total score 12-14)	Fair support
3 rd tertile (total score 15-18)	Good support

Part V: Medical record

There was collected data of glycosylated hemoglobin (HbA1C) level from medical record of the sample who were referred to Primary Care Unit.

3.8 Validity and reliability

1. Content validity. The questionnaire were examined the content validity by dietician, thesis advisor and three experts that were;

Mr. Wachara Eamratsameekool, M.D;

Miss Piyalak Pukdesamai, (Public Health Technical Officer); and

Mrs. Lamai Changtom, (Public Health Technical Officer).

2. Questionnaire test. Try out the questionnaires for diabetes patients who were referred to the Primary Care unit at Kasetwisai hospital district, Roi-Et province and they were not the same group of sample population to use to collect data from 30 patients. After collected the data, proved the completeness of all questionnaires, put the data in SPSS Version 16.0 was used to tests reliability by Cronbach's coefficient and used KR-21 (Kuder- Richardson's Method) for testing knowledge questionnaire. Finally, modified and improved 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 = 0.74
2. Family support questionnaire and = 0.88
3. Thai Stress Test = 0.91

3.9 Data collection

1. After permission to study was given, the study was secured from the Ethical review committee Chulalongkorn University. The researcher written the letter to the Director of Pathumrat Hospital for permission to study and ask to see medical records. The study objectives and data collection procedures were explained and request assistance from the health care team and the head of the Primary Care Unit, Pathumrat district.

2. The data collection was done during the working hours of diabetic clinic at 08.00 am. to 16.00 pm. If the participants did not work up at Primary Care Unit, the researcher and assistants met and interviewed at their home.

3. The researcher was contacted with 5 nurses who had been working of diabetes clinic at Primary Care Unit, Pathumrat district. The researcher trained by face to face interviews, provide suggestions, purpose of the study and the technique how to approach participants. The interview participants using the structured questionnaire took about 30 – 35 minutes per one patient. The subjects would be asked for their consent prior to starting the interviewing. After the interview was finished, questionnaire form was then checked for data completion.

4. Participant's medical records (Which accessibility was permitted by the director of Pathumrat hospital) were filled in the questionnaire form by researcher as glycemic control level.

3.10 Data analysis

Data was analyzed using computer programs SPSS for windows (Statistical Package for Social Science for windows) version 16. Statistical significance was set at alpha=0.05 (P-value <= 0.05), 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, median and standard deviation.

2. Analytical statistics were used to describe the factors associated to glycemic control of type 2 diabetic patients by Chi-square Test, Pearson correlation and Spearman rank test and p-value were used to measure between variables.

3.11 Ethical Consideration

Ethical consent from the ethical review committee for research involving human subjected health science group, Chulalongkorn University. All subjects were informed about the objective and the process of the study. The inform consents were obtained from the participants who were eligible and agreed in the study.

CHAPTER IV

RESULTS

The sample population were type 2 diabetic patients at 13 Primary care unit, Pathumrat district, Roi Et province. The total number 307 of type 2 diabetes patients who were referred to Primary Care Unit more than one year, they were eligible and agreed to participate in this study. The data collected during April, 2011 by interviewer and assistants, the results of study were presented as following:

1. General and demographic characteristics.
2. Knowledge of diabetes.
3. Health behaviors.
4. Psychosocial factors.
5. Family support

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

1. General and demographic characteristics. (Table 8)

Age

The mean age of the subjects was 58.72 years old (SD = 9.49). The largest age group of the subjects was 51-60 years old (35.8%). The second and the third largest groups were 61-70 years old and 41-50 years old (34.9% and 17.2%). The smallest age group was 31-40 years old (2.3%).

Gender

About 77.5% of the subjects were female, whereas the minority were male (22.5%).

Table 8: Number and percentage of type 2 diabetes mellitus patients by demographic characteristics (n = 307).

Characteristics	Number	Percentage
Age (years)		
31-40	7	2.3
41-50	52	17.2
51-60	110	35.8
61-70	107	34.9
71-80	31	10.1
Mean ± SD	58.72± 9.49	
Gender		
Female	238	77.5
Male	69	22.5

Table 8: Number and percentage of type 2 diabetes mellitus patients by demographic characteristics (continued).

Characteristics	Number	Percentage
Marital status		
Single	7	2.3
Married	226	73.6
Widowed	69	22.5
Divorced	2	0.7
Separated	3	1.0
Education		
No education	8	2.6
Primary	269	87.6
Secondary	21	6.8
Diploma	3	1.0
Bachelor's degree or higher	6	2.0
Occupation		
Agriculturist	276	89.9
Housework	13	4.2
Laborer	4	1.3
Government officer	7	2.3
Other	7	2.3
Income (baths /month)		
< 4,000	214	69.7
4,001 – 5,000	33	10.7
> 5,000	60	19.5
Median = 3,000		
Min, Max = 500-50,000		
Health security Scheme		
Social security Scheme	3	1.0
The UC card	277	90.2
Right official	27	8.8
Family history of diabetes		
No	120	39.1
Yes	187	60.9
Co morbidity		
No	233	72.6
Yes	84	27.4

Table 8: Number and percentage of type 2 diabetes mellitus patients by demographic characteristics (continued).

Characteristics	Number	Percentage
Duration of diabetes (yrs.)		
< 6	184	59.9
≥ 6	123	40.1
Mean ± SD	6.24± 4.10	
Body mass index (kg/m^2)		
< 18.5	8	2.7
18.5-22.9	93	30.3
23-24.9	75	24.4
25-29.9	108	35.2
≥ 30	23	7.5
Mean ± SD	25.36 ± 3.44	

Marital status

The majority of the subjects were married (73.6%). The smaller group was widowed, single status (22.5%, 2.3%). The smallest group had separated and divorced status(1.0%, 0.7%) respectively.

Education

The majority of the subjects had completed primary school (87.6%). The smaller group had completed secondary school and had no education (6.8% and 2.6%). Bachelor degree graduates represented (2.0%) and the smallest group were diploma (1.0%).

Occupation

Most of the subjects were agriculturist (89.9%). While 4.2% were house worker. 2.3% were government officer and other, The smallest group of the subjects were laborer (1.3%).

Household Income

The largest group of the subjects had income less than 4,000 baths/month (69.7%). The second largest group of the subjects had income more than 5,000 baths/month (19.5%). The smallest group of the subjects had income between 4,001-5,000 baths/month (10.7%). The median of income was 3,000 baths/month.

Duration of diabetes

The mean of duration of diabetes was 6.24 years and SD 4.10. The largest of subjects had diabetes for less than 6 years (59.9%). The second group had diabetes for more than 6 years (40.1%).

Body Mass Index

The largest group of the subjects (35.2%) were in obese I category (BMI 25-29.9 kg/m^2). The second and third largest group of subjects (30.3% and 24.4%) were in normal range (BMI 18.5-22.9 kg/m^2) and overweight category (BMI 23-24.9 = kg/m^2), respectively. The small group of the subjects (7.5%) were in obese II category (BMI ≥30 kg/m^2) and the smallest group of the subjects were in underweight cathegory (BMI ≤ 18.5 kg/m^2). The mean duration of BMI was 25.36 kg/m^2 (SD = 3.44).

2. Glycemic control level. (Table 9)

Table 9: Proportion of type 2 diabetes mellitus patients with glycemic control level .

HbA1C level	Number	Percentage
Poor control(≥7)	227	73.9
Good Control(<7)	80	26.1
Mean± SD	8.29±1.96	

Glycemic control level

The glycemic control level of the subjects showed that the majority was poor control (73.9%) and had only a minority can achieved of glycemic control for good level (26.1. %), mean of HbA1C level was 8.29 SD 1.96.

3. Knowledge of diabetes. (Table 10)

Table 10: Number and percentage of type 2 diabetes mellitus patients by knowledge of diabetes.(n=307)

Knowledge of diabetes	Number	Percentage
Poor (score 0-9)	67	21.8
Fair (score 10-12)	153	49.8
Good (score 13-15)	87	28.3
Mean ± SD	11.04± 2.17	

Knowledge of diabetes

The largest group of the subjects had fair knowledge of diabetes (49.8%). The second largest group of subjects had good knowledge of diabetes (28.3%). The smallest group had poor knowledge of diabetes (21.8%). Mean of knowledge of diabetes was 11.04 SD 2.17.

3. Health behaviors: health behaviors consisted of dietary, physical activity and drug compliance. (Table 11)

Table 11: Number and percentage of type 2 diabetes mellitus patients by health behaviors. (n = 307)

Health behaviors	Number	Percentage
Dietary habit		
Poor (score 0-20)	160	52.1
Fair (score 21-24)	113	36.4
Good (score 25-30)	34	11.1
Mean± SD	11.04± 2.17	
Calories consumption		
Insufficient	150	48.9
Sufficient	138	45.0
Over	19	6.1

Table 11: Number and percentage of type 2 diabetes mellitus patients by health behaviors. (n = 307)(continued)

Health behaviors	Number	Percentage
Physical activity	60	19.5
Insufficiently Active	113	36.8
Sufficiently Active	134	43.6
High Active		
Drug compliance		
Low (score 0-2)	75	24.4
Moderate(score 3)	72	23.5
High (score 4-5)	160	52.1

Dietary habit

A half of the subjects had poor dietary habit (52.1%) and fair dietary habit (36.4%). The smallest group had good dietary (11.1%). When divided the calories consumption found that the subjects had nearly the proportion of insufficient and sufficient calories consumption 48.9% and 45.0% respectively.

Physical activity

About 36.8% of the subjects was in sufficiently active category, while 43.6% of the subjects was in highly active category. The smallest group of the subjects was insufficiently active category (19.5%).

Drug compliance

A half of the subjects had high drug compliance (52.1%). There was 24.4% of the subjects had low drug compliance and 23.5% had moderate drug compliance.

4. Psychosocial characteristic ; psychosocial characteristics consisted of stress and family support. (Table 12)

Table 12: Number and percentage of type 2 diabetes mellitus patients by psychosocial characteristic(n = 307)

Psychosocial characteristic	Number	Percentage
Mental stress		
Stressful	13	1.3
Mild stress	51	16.5
Normal	240	78.2
Excellent	3	1.0

Mental stress

The majority of the subjects had normal mental health (78.2%), while the minority of the subjects had mild stress (16.5%), only 1.3% were in stressful condition.

5. Family support (Table 13)

Table 13: Number and percentage of type 2 diabetes mellitus patients by family support(n = 307)

Family support	**Number**	**Percentage**
Low family support	31	10.1
Moderate family support	59	19.2
High family support	217	70.7

Family support The largest group of the subjects had high family support (70.7%). The second largest group had moderate family support (19.2%). The smallest group had low family support (10.1%).

5. The association between independent factor and glycemic control.

5.1 Demographic characteristics. (Table 14)

Table 14: The association between demographic characteristics and glycemic control.

Variable	Good controlled Number %	Poor controlled Number %	χ^2	df	*p-value*
Age					
<50	12(21.8)	43(78.2)	1.56	2	0.457
50-59	25(23.8)	80(76.2)			
≥60	43(29.3)	104(70.7)			
Gender					
Male	30(43.5)	39(56.5)	2.89	1	0.089
Female	75(31.5)	163(68.5)			
Marital status					
Married	23(28.4)	58(71.6)	0.16	2	0.681
Widowed, Divorced, Separated	80(35.4)	146(64.6)			
Education level					
≤ high school	75(25.2)	223(74.8)	4.18	1	0.055
> high school	5(55.6)	4(44.4)			
Occupation					
Agriculturist	73(26.4)	203(73.6)	0.06	1	0.803
Other	7(22.6)	24(77.4)			
Household Income					
< 4,000	56(26.2)	158(73.8)	1.54	2	0.461
4,000 – 5,000	6(18.2)	27(81.8)			
> 5,000	18(30.0)	42(70.0)			
Health security Scheme					
The UC card	72(26.0)	205(74.0)	0.06	1	0.936
Other	8(26.7)	22(73.3)			

Table 14: The association between demographic characteristics and glycemic control. (cont.)

Variable	Good controlled Number %	Poor controlled Number %	χ^2	df	*p-value*
Family history of diabetes					
No	35(29.2)	85(70.8)	2.22	1	0.172
Yes	70(37.4)	117(62.6)			
Co morbidity					
No	58(26.0)	165(74.0)	0.01	1	0.974
Yes	22(26.2)	62(73.8)			
Body Mass Index(n=291)					
Normal(18.5-22.9)	17(18.9)	73(81.1)	2.91	2	0.227
Overweight(23-24.9)	20(20.0)	49(71.0)			
Obesity(≥25)	37(28.0)	95(72.0)			

Age

The study showed that age did not significantly associated with glycemic level in type 2 diabetes mellitus patients (*p-value* = 0.457).

Gender

Gender did not significantly associated with glycemic level in type 2 diabetes mellitus patients (*p-value* = 0.089).

Marital status

Marital status was divided into 2 groups: that one composed of single, married, widowed. divorced and separated. The married group accounted for 28.4% of the good controlled group and 71.6% of poor controlled group. Marital status did not significantly associated with glycemic level in type 2 diabetes mellitus patients (*p-value* = 0.681).

Education

Education was divided into 2 groups: less than high school and higher than high school. The most of all subjects were accounted for 74.8% of poor control while 25.2% of good control had less than high school. The education did not significantly associated with glycemic level in type 2 diabetes mellitus patients (*p-value* = 0.055).

Occupation

Occupation was divided into 2 groups: agriculturist and other that were housework, laborer, government officer and other group. The agriculturist group accounted for 26.4% of the good controlled group and 74.8% of poor controlled group. The other accounted for 22.6% of the good controlled group and 77.4% of poor controlled group. The occupation did not significantly associated with glycemic level in type 2 diabetes mellitus patients (*p-value* = 0.803).

Household Income

Household Income was divided into 3 groups: the income of the sample as the cut off point: less than 4,000 baths/month, between 4,000-5,000 baths/month and more than 5,000 baths/month. The majority of poor controlled group (73.8%)

and good controlled group (26.2%) had income less than 4,000 baths/month. Income did not significantly associated with glycemic level in type 2 diabetes mellitus patients (*p-value* = 0.461).

Health security Scheme

The most of all subjects had the UC card accounted for 26.0% of good control group and 74.0% of poor control group. The Health security Scheme did not significantly associated with glycemic level in type 2 diabetes mellitus patients (*p-value* = 0.936).

Family history of diabetes

The most of all subjects had family history of diabetes for 37.4% of good control group and 73.3% of poor control group. Family history of diabetes did not significantly associated with glycemic level in type 2 diabetes mellitus patients (*p-value* = 0.172).

Co morbidity

The majority of all subjects had co morbidity accounted for 26.0% of good control group and 74.0% of poor control group. The co-morbidity did not significantly associated with glycemic level in type 2 diabetes mellitus patients (*p-value* =0.974).

Body mass index

Nearly a half(42.7%) of subjects was obesity, for 72% of poor control and 28.0% of good control group. Body mass index did not significantly associate with glycemic level in type 2 diabetes mellitus patients (*p-value*=0.227).

Duration of diabetes

Table 15: The association of duration of diabetes with glycemic control in type 2 diabetes patients.

Variable	r	*p-value*
Duration of diabetes	0.185*	0.001

**p-value*<0.05

Duration of diabetes was significantly associate with glycemic level in type 2 diabetes mellitus patients (r =0.185, *p-value* <0.001).

5.2 Knowledge of diabetes and health behaviors. (Table 16)

Table 16: The association of knowledge of diabetes and health behaviors with glycemic control in type 2 diabetes patients.

Variable	r	*p-value*
Knowledge of diabetes	- 0.021	0.710
Dietary habit	-0.220**	0.001
Total Calories	0.059	0.303
Drug compliance	-0.469**	0.001

**p-value*<0.05

Knowledge of diabetes

Knowledge of diabetes was not significantly associated with glycemic level in type 2 diabetes mellitus patients *(p-value =0.710).*

Health behaviors

Dietary habit

Dietary habit did significantly negative associated with glycemic level in type 2 diabetes mellitus patients (r =-0.220, *p-value* < 0.001). Total calories consumption per day did not significantly associated with glycemic control *(p-value=0.303)*

Drug compliance

The result that showed drug compliance did significantly negative associated with glycemic level in type 2 diabetes mellitus patients (*r =-0.469, p-value* < 0.001).

5.3 Physical activity (Table 17)

Table 17: The association between physical activity and glycemic control.

Variable	Good controlled Number %	Poor controlled Number %	χ^2	df	*p-value*
Physical activity					
Insufficiently Active	16(26.7)	44(73.3)	2.88	2	0.237
Sufficiently Active	37(32.7)	76(67.3)			
High Active	52(38.8)	83(61.2)			

Physical activity

The majority of good controlled group and poor controlled group had sufficiently active (32.7% and 67.3%). The second largest group of good controlled group and poor controlled group had high active (38.8% and 61.2%). The smallest group of good controlled group and poor controlled group had insufficiently active (26.7%) and 73.3%). Physical activity did not significantly associate with glycemic level in type 2 diabetes mellitus patients (*p-value* = 0.237).

5.4 Family support (Table 18)

Table 18: The association between family support and glycemic control by Spearman's rank test.

Variable	ρ	*p-value*
Family support	0.051	0.373

Family support

Family support was not significantly associated with glycemic level in type 2 diabetes mellitus patients (*p-value* = 0.373).

5.5 Psychosocial characteristic. (Table 19)

Table 19: The association between psychosocial characteristic and glycemic control.

Variable	Good controlled Number %	Poor controlled Number %	χ^2	df	*p-value*
Mental stress					
Normal	69(27.3)	184(72.1)	0.771	1	0.380
Mild Stress/stressful	11(20.4)	43(79.6)			

Mental stress

The majority of good controlled and poor controlled group had normal mental condition (27.3% and 72.1%). There were accounted for 79.6% of poor controlled group had mild stress and stressful condition and 20.4% for good control group. Mental stress did not significantly associated with glycemic level in type 2 diabetes mellitus patients (*p-value* = 0.380).

CHAPTER V

SUMMARY, DISCUSSION AND CONCLUSION

5.1 Summary

A cross-sectional study design was to determine factors associated with glycemic control in type 2 diabetes mellitus patients who were referred to 13 Primary Care Unit at Pathumrat District, Roi-Et Province**,** Thailand. Out of 1,071 with type 2 diabetes patients, 307 patients were chosen by the systematic sampling procedure was carried out for each Primary Care Unit. A questionnaires used to interview for collected data about the factors associated with glycemic control in type 2 diabetes mellitus patients consist of demographic characteristics, knowledge of diabetes, healthcare behavior, psychological and environment factors and collected the glycemic level from medical record. The data were collected by the researcher and health care provider team during April, 2011. The Statistic were used to analyze data composed of frequency, percentage, standard deviation, mean, median and the data were analyzed by Chi- square test, Pearson Correlation and Spearman rank test for the association between the study variables. The result that showed;

5.1.1. General and demographic characteristics.

Of the total 307 type 2 diabetes patients were included to this study that were 238 women and 69 men. The mean age of the subjects was 58.72±9.49 years old, The majority of all were married (73.6%), graduated in primary school (87.6%). The most of all were agriculturist (89.9%), household income per month 3,000 baths. A mean duration of diabetes of 6.24±4.10 years, and 60.9% had family history of diabetes, 72.6% of the subjects had no other underlying disease. The data showed that approximately 42.7% of the subjects were obese and 24.4% were overweight (mean BMI 25.36±3.44). A mean glycosylated hemoglobin (HbA1C) level was 8.2±1.96 and the proportion of patients who had good control (HbA1C <7%) was 26.1% while 73.9% of the subjects had value ≥7% that identified as poor control. After using univariate analysis the demographic characteristics was not statistically significant associated with glycemic control but duration of diabetes was significantly associated with glycemic control ($r = 0.185$, $p<0.001$). According to the study from Sihasidhi (Sihasidhi, 2006) that found 79.1% of patients had higher blood sugar level than normal standard(HbA1C>7%) while only 20.9% had normal standard, body mass index, health care access were not associated with blood sugar level. This study indicated that poor glycemic control group (40.0%) had duration of diabetes more than 6 years which was the longer duration of diabetes had degenerative conditions of insulin secretion and insulin sensitivity.

5.1.2 Knowledge of diabetes

The result that found nearly half (49.8%) of the subjects had fair knowledge of diabetes but there was no the association with glycemic control. Many subjects reported that they generally received health-related knowledge through various media including television, newspaper and health education program at the Diabetic Clinic in Primary Care Unit. Although diabetic patients had knowledge about diabetes,

they could not achieve the goals of diabetes control level . From Nitayanant's study it found that knowledge did not associate with glycemic control (Nitayanant, 2007). However, Mayurasakorn's study (Mayurasakorn et al., 2009) found that knowledge of diabetes and education level significantly associated with glycemic control. This may be explained in such a way that the education level affects one's learning ability. However, in the current study, education level did not significantly associate with glycemic control. This might be due to different education background of the majority of the subjects. Moreover, it might be also that though some may know, but they did not actually comply because of personal consumption habit.

5.1.3 Health behaviors

Dietary habit

In this study, dietary habit was found to be associated with glycemic control in type 2 diabetes mellitus patients according to the univariate analysis ($r=-0.220$, $p< 0.001$). The data showed, A half of the subjects (52.1%) had poor dietary habit, they tended to eat much glutinous rice that high carbohydrate. Furthermore, they were eat many serving of sweet fruit such as; mangos, tamarind, bananas, watermelon. Although, a half group of the subjects had fair knowledge of diabetes (49.8%) but they did not follow it because of consumption habit. The result agreed with Pinthong's studies (Pinthong, 2005) which found that dietary habit associated with glycemic control.

Drug compliance

The finding of this study showed that drug compliance was negative significantly associated with glycemic control ($r =-0.469$, $p <0.001$), that can describe the subjects who had low drug compliance they had high HbA1C level. This corresponded with the studies of Keawerd which found that self – adjustment of drug dosage associated with poor blood glucose control and the study by Mino-Leon (Mino-Leon, 2005) which found that 19% of type 2 diabetes patients were in disagreement between the dose of the anti-diabetic drug reported by the patients and in the medical record. Study of Khattap (Khattap et al., 2009) which found that no adherent to diabetes self –care management behaviors were associated with poor glycemic control, meaning that the patients who took incorrect medicine and ran out of medicine associated with poor plasma glucose control. Therefore, drug compliance is also an important factor for glycemic control.

5.1.4 Physical activity

The majority of good controlled group and poor controlled group had sufficiently active (32.7% and 67.3%). Physical activity did not significantly associated with glycemic level in type 2 diabetes mellitus patients (*p-value* = 0.237). The data from a meta-analysis of controlled clinical trials of Norman (Normal et al., 2001) was met the effects of the exercise in patients with type 2 diabetes have had partially conflicting result they suggest that exercise training reduce HbA1C by approximately 0.66%. In this study found physical activity was not significantly associated with glycemic level in type 2 diabetes mellitus patients that may describe its not clearly of pattern of physical activity.

5.1.5 Psychological characteristics

The majority of good controlled and poor controlled group had normal mental condition (27.3% and 72.1%). There were accounted for 79.6% of poor controlled group had mild stress condition and 20.4% for good control group. The proportion between normal mental condition higher than mild or stressful (82%:18%) respectively. Mental stress was not significantly associated with glycemic level in type 2 diabetes mellitus patients (*p-value* = 0.380). From the study of Shazia (Shazia et al., 2010) found that the depression was significantly associated of with newly diagnosed type 2 diabetes among adult aged between 25-60 years in Karachi, Pakistan.

5.1.6 Family support

Family support was not significantly associated with glycemic level in type 2 diabetes mellitus patients (*p-value* = 0.373). The study from Suchat and Siriluck (Suchat and Siriluck, 2005) they study about the family functioning and glycemic control of non insulin dependent diabetes mellitus at outpatients department, King Chulalongkorn Memorial hospital that found; the adherence to diabetic glycemic control was associated with higher score on family functional test, these included problem solving, communication, affective responsiveness, affective involvement and general function ($p<0.05$). The result can describe that the most of all patients were extended family and they were support them.

5.2 Discussion

The results of this study showed that 73.9 % of type 2 diabetes patients failed to control glycemic level similarly to the study of Lohsoonthorn and Jiamjarasrangsi (Lohsoonthorn and Jiamjarasrangsi, 2008)found that 62.0% of type 2 diabetes patients had HbA1C <7%. Data from Wahba and Chang (Wahba and Chang, 2007) reported that weight was not a factors associated with glycemic control and the factors associated with glycemic control in type 2 diabetes patients were older, using oral antidiabetic medication and not using insulin were more likely to achieve A1C goal. This study was also found that body mass index and health care access were not associated with blood sugar level. However, duration of diabetes was associated with glycemic control in type 2 diabetes($p<0.001$) same as the study of Oguejio (Oguejio et al., 2010) found that long duration of diabetes mellitus and peripheral neuropathy are risk factors for foot complication in Nigerians with diabetes mellitus. Diabetic subjects with long duration of diabetes (>10 years) almost always have associated peripheral neuropathy.

The result showed that nearly half (49.8%) of the subjects had fair knowledge of diabetes but there was no association with glycemic control. Many subjects reported that they generally received health-related knowledge through various media including television, newspaper and health education program at the Diabetic Clinic in Primary Care Unit. Although diabetic patients had knowledge about diabetes, they could not achieve the goals of diabetes control level. From Nitayanant's study it found that knowledge did not associate with glycemic control (Nitayanant, 2007). However, Mayurasakorn 's study found that knowledge of diabetes and education level significantly associated with glycemic control (Mayurasakorn et al., 2009). This may

be explained in such a way that the education level affects one's learning ability. However, in the current study, education level did not significantly associate with glycemic control. This might be due to different education background of the majority of the subjects. Moreover, it might be also that though some may know, but they did not actually comply because of personal consumption habit. In the current study, dietary habit had a negative correlation with glycemic control in type 2 diabetes mellitus patients according to the univariate analysis ($r = -0.220$, $p < 0.001$). The data showed that half (52.1%) of the subjects had poor dietary habit. They tended to eat much glutinous rice that contains high carbohydrate. Furthermore, they ate many servings of sweet fruit such as mangos, tamarind, bananas, and watermelon. The result is in line with Varataya's study(Varataya, 2005)which found that dietary habit associated with glycemic control. The finding of the current study showed that drug compliance was significantly negative associated with glycemic control ($r = -0.469$, $p < 0.001$). This corresponds to the study by Mino-Leon which found that 19% of type 2 diabetes patients was in disagreement between the dose of the anti-diabetic drug reported by the patients and in the medical record. The study of Khattap Khattap et al., 2009) found that no adherence to diabetes self –care management behaviors were associated with poor glycemic control, meaning that patients who took incorrect medicine and ran out of medication associated with poor plasma glucose control.

In this study, it found that physical activity was not significantly associated with glycemic level in type 2 diabetes mellitus patients. This may describe that the statement does not clearly ask for the pattern of existing physical activity. So, the experimental studies should be compared among diabetes patients instead the interview. Mental stress was not significantly associated with glycemic level in type 2 diabetes mellitus patients ($p = 0.380$). In a systematic review designed to estimate the prevalence of clinical depressed patients with type 2 diabetes, Ali and others (Ali et al., 2006) found that the prevalence of depression was significantly higher among patients with type 2 diabetes (17.6%) than those without diabetes (9.8%).

5.3 Conclusion and recommendation

This research was a cross-sectional study which had the objective to study the factors associating with glycemic control in type 2 diabetes mellitus patients attending at 13 Primary Care Unit at Pathumrat District. The sample groups were 307 diabetes mellitus patients. The data were analyzed by Chi- square test, Pearson Correlation and Spearman rank test for the association between the study variables. The result as shown: A total of 307 type 2 diabetes patients were included in the study (69 men, 238 women; mean age 58.72 ± 9.41 years. A mean glycosylated hemoglobin (HbA1C) level was 8.26% and found that HbA1C level ≥7.0% was 73.9% (n=227), duration of diabetes was mean 6.24 ± 4.21. The factor was statistically significant associated with glycemic control that were dietary habit ($r = -0.220$, $p < 0.001$) drug compliance ($r = -0.469$, $p < 0.001$) and duration of diabetes($r = 0.185$, $p < 0.001$). The demographic characteristics factors were not associated with glycemic control.

5.3.1 Recommendation on study result

5.2.1.1 The results of this study has indicated 73.9 % of type 2 diabetes patients that the unsuccessful diabetes care among patients with type 2 diabetes treated in Primary Care Unit according to the goals of diabetes . This may imply that the patients should visit the physician and the dietician in hospital for review of treatment and re-check for their blood chemistry again or every 3 month until they could control for achieve the goals of glycemic level. The ADA recommendation should perform the A1C test at least two times a year in patients who are meeting treatment goals and perform the A1C test quarterly in patients whose therapy has changed or who are not meeting glycemic goals (ADA, 2010). An alternative would be for more efficient and intensive program of type 2 diabetes patients until they could control their glycemic level. Health care team should also provide counseling service for these diabetic patients by focusing 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.

5.2.1.2 A special room should be arranged by the dietician 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.

5.3.2 Recommendation for further study

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

5.3.2.2 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.

5.3.2.3 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.

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

5.3.3 Limitation

5.3.3.1 The researcher and assistant were the public health provider while using by face to face interviewed that may be bias information. Thus, the researcher must carefully do to avoid a leading question.

5.3.3.2 The laboratory examine of glycemic control might be difference when they used the varies method. So, asking for the results by External Quality Controlled: EQC and the calibration of the laboratory instruments.

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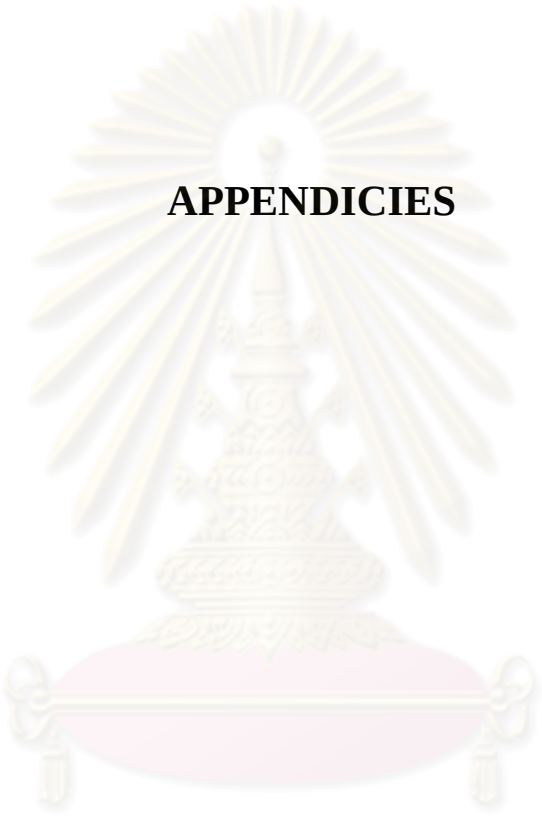
APPENDICIES



APPENDIX A

Questionnaires:

Factors associated with glycemic control in type 2 diabetes patients at Primary Care Unit, Pathumrat District, Roi-Et Province, Thailand

These questionnaires are prepare for the Master thesis entitled. The answer to this survey will be use to strategic plan of health care provider and for improve health program in diabetes care system at Pathumrat District, Roi-Et Province, Thailand. Some questions are personal but desirable answer in order to get useful information. Your answer will keep completely confidential and will not be exposing for any other purposes. Please make every effort to answer each question as honest as possible. The interview should take about 30-35 minutes. If you have any questions, please feel free to ask the interviewer.

Thank you for your answer
Niyom Pragosuntung
College of Public Health Sciences
Chulalongkorn University

Questionnaires:

Factors associated with glycemic control in type 2 diabetes patients at Primary Care Unit, Pathumrat District, Roi-Et Province, Thailand

Name……..HN……
Address……
Telephone no…….....Date of interview……..…

Part I: Demographic characteristics data

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

1. Age……years

2. Gender
   □ 1 Male □ 2 Female

3. Marital status
   □ 1 Single □ 2 Married
   □ 3 Widowed □ 4 Divorced □ 5 Separated

4. Education
   □ 1 No school education □ 2 Primary school
   □ 3 Secondary school □ 4 Diploma □ 5 Bachelor's Degree or higher

5. Occupation
   □ 1 Agriculture □ 2 Housework □ 3 Laborer
   □ 4 Government officers □ 5 Other (please specify…)

6. Family income ……bath / month

7. Health Insurance scheme.
   □ 1 Social security scheme □ 2 The UC Card
   □ 3 Rights officials. □ 4 No □ 5 Others (please specify…….)

8. Family history of diabetes
   □ 1 No □ 2 Yes

9. How long have you been diagnosed with type 2 diabetes ..…….....years

10. Body weight……kilograms Height……meter BMI……kg/m^2

11. Co-morbidities
    □ 1 No
    □ 2 Yes (please specify…1)……2)…….3)…….

Part II: Knowledge diabetes mellitus

Explanation: Please mark ✓ into the blanks

No.	Questions	Agree	Not agree	Not known
1	The most common symptoms of diabetes mellitus are frequent urination, hunger and thirst			
2	Eating too much sugar and other sweet foods is the cause of type 2 diabetes mellitus.			
3	The normal people should have fasting plasma glucose level between 70 mg/dl to 109 mg/dl.			
4	The most common symptoms of hypoglycemia are sweating, cold and shivering.			
5	Diabetic patients who have high plasma glucose level for a long time can be immunity for complications.			
6	Alcohol consumption is not associated with glycemic control.			
7	Diabetic patients should non per oral 4 hours before blood checking.			
8	Diabetic patient who received continuously treatment can be disappear complete diabetes mellitus.			
9	Diabetic patients who were cut and abrasion on diabetes heal more slowly.			
10	The most common long- term complications known to be caused by diabetes care that are cardiovascular disease, kidney failure, blindness and nerve disease.			
11	Exercise regularly for at least 3 days per week to help control blood sugar levels to be successful.			
12	Taking pills to treat diabetes can be cured.			
13	Diabetic patients who are taking antiglycemic drug and have fasting plasma glucose levels to normal can stopped the pill.			
14	Diabetic patients who didn't received continuous of diabetes care can lead to complications with the chronic renal failure.			
15	Taking care of your feet (protection, cleanliness and support) will guard against infection, injury, and other foot problems.			

Part III: Health behavior

3.1 Dietary habit

Explanation: Please mark ✓ into the blanks; how often do you eat these food items during 1 month

No.	Food items	Never	Sometime	Often	Usually
			1-3 time/month	1-3 time/week	≥4 time/week
1	The leg of a pork				
2	Lean meat (red meat), fish.				
3	Sausage E- San.				
4	Fritter Chicken, banana with fried in deep oil.				
5	Coconut cream, whole bananas boiled in coconut cream.				
6	Cake cookie, donut.				
	Bread, bakery				
7	Milk, sweet milk.				
8	Skim milk powder				
9	Coffee or Ovaltine with cream and sugar				
10	Sweet fruit; mangosteen, mango.grapes, durian, lychee, sweet Lamut.				
No.	**Food items**	**1**	**2**	**3**	**4 or more**
During 1 month, how many servings to have at your meals and snacks in these food?					
11	How many ladle of rice, cereals, and starchy vegetables (starches) do you now eat each day?				
12	How many cup of vegetables do you now eat each day?				
13	How many peaces of fruit do you now eat each day?				
14	How many cup of milk do you now have each day?				
15	How many part of meat and meat substitutes do you now eat each day?(1part=two tablespoons)				

3.2 Physical activities

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

1. During the last 7 days ,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 breath 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 days
- □ Don't know/Not sure

3. During the last 7 days, how many days did you do moderate physical activities like carrying light loads, bicycling at a regular pace, or double tennis? Do not include walking. Moderate activities refer to activities that take moderate physical effort and make you breath much 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 days
- □ Don't know/Not sure

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

- □ No walking
- □ ……days per week

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

- □ ……hours per day
- □ ……minutes per days

3.3 Drug compliance; (1 month ago)

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

1. Are you taking diabetes drug according to physician orders?
   □ Yes □ No
2. Have you ever forgotten to take your medicine?
   □ Ever □ Never
3. Are you careless not on time about taking your medicine?
   □ Yes □ No
4. When you have normal glucose level or feel better do you sometime stop taking your medicine?
   □ Ever □ Never
5. Sometime if you feel worse when you taking medicine, are you adjust of doses medicine by yourself?
   □ Ever □ Never

Part IV: Psychosocial characteristics:

4.1 Thai Stress Test

Explanation: The questions are your feelings that you may have in daily living. Please answer every questions by marking ✓ into the blanks that describe your feelings.

No.	Questions	Often	Sometime	Never
1	Do you feel lonely?			
2	Do you feel unhappy?			
3	Do you feel boring, discouraged or lose of interest to do anything?			
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?			
11	Do you feel hopeless?			
12	Do you feels that they have no value.			
13	Do you proud that you are a hero?			
14	Do you proud that you are a talented people?			
15	Do you proud that you are not obviously worse than anyone?			
16	Do you satisfy in your life?			
17	Do you feel that have more anything that you give special attention around you?			

18	Do you feel happy and satisfied with the success to do something?			
19	Do you feel motivated to do anything in your life?			
20	Do you enjoy your life when you talking to anyone around you?			
21	Do you feel that your thinking and decision is normal?			
22	Do you feel your life is hopefulness?			
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.

No.	Items	Always	Sometime	Never
1	When you have a problem in the life of your family members can provide care and consulting.			
2	You have chance to talk about your illness			
3	When you sick people in your family will take care assistance in daily living.			
4	Family person can help you when you need to go to hospital			
5	Family persons remind you on the day of appointment.			
6	People in your family care and support costs for medical treatment.			

Part V: Glycemic control levels (From OPD Card)

Glycemic control levels in type 2 diabetes patients after referred to Primary Care Unit more than 1 year.

Glycemic control	Levels	Unit
HbA1C		%

Date of record……/……/……..

Recommendation

……

……...

…….

Appendix B

แบบสัมภาษณ์

เรื่อง ปัจจัยที่มีความสัมพันธ์ต่อการควบคุมระดับน้ำตาลในเลือดของผู้ป่วยเบาหวานชนิดที่ 2 ในหน่วยบริการปฐมภูมิอำเภอปทุมรัตต์ จังหวัดร้อยเอ็ด ประเทศไทย

ชื่อ สกุล.....H.N. .....วันที่สัมภาษณ์.....

ที่อยู่.....เบอร์โทรศัพท์.....

ส่วนที่ 1 ข้อมูลส่วนบุคคล

คำชี้แจง : ผู้สัมภาษณ์บันทึกข้อมูลที่ได้รับจากการสัมภาษณ์โดยเขียนเครื่องหมาย ✓ลง ใน☐ หน้าข้อความหรือเติมคำในช่องว่าง

1. อายุ.....ปี

2. เพศ ☐ 1 ชาย ☐ 2 หญิง

3. สถานภาพสมรส

☐ 1 โสด ☐ 2 คู่ ☐ 3 หม้าย ☐ 4 หย่า ☐ 5 แยก

4. การศึกษาสูงสุด

☐ 1 ไม่ได้เรียน ☐ 2 ประถมศึกษา

☐ 3 มัธยมศึกษา ☐ 4 อนุปริญญา ปวช, ปวส. ☐ 5 ปริญญาตรี

5. อาชีพ

☐ 1 เกษตรกรรม ☐ 2 ทำงานบ้าน

☐ 3 รับจ้าง ☐ 4 รับราชการหรือรัฐวิสาหกิจ

☐ 5 อื่นๆ ระบุ.....

6. รายได้ของครอบครัวของท่าน.....บาทต่อเดือน

7. สิทธิบัตรในการรักษา

☐ 1 ประกันสังคม ☐ 2 บัตรทอง

☐ 3 เบิกได้/จ่ายตรง ☐ 4 สามัญ ☐ 5 อื่นๆ ระบุ.....

8. บุคคลในครอบครัวของท่านเคยมีประวัติเจ็บป่วยด้วยโรคเบาหวานหรือไม่

☐ 1 มี ☐ 2 ไม่มี

9. ท่านได้รับการวินิจฉัยว่าเป็นเบาหวานชนิดที่2 มานาน .....ปี.....เดือน

10. ขณะนี้ท่านมีน้ำหนัก .....กก. ส่วนสูง.....เมตร ดัชนีมวลกาย.....กิโลเมตร/ตารางนิ้ว

11. ท่านมีโรคประจำตัวอื่นหรือไม่

☐ 1 ไม่มี ☐ 2 มี ระบุ.....

ส่วนที่ 2 ความรู้เกี่ยวกับโรคเบาหวาน

คำชี้แจง : ผู้สัมภาษณ์อ่านคำถามแล้วให้ผู้ถูกสัมภาษณ์ตอบว่าใช่ หรือ ไม่ใช่ ผู้สัมภาษณ์เขียนเครื่องหมาย ✓ ลงในช่องที่ตรงกับคำตอบของผู้ให้สัมภาษณ์ตามความเป็นจริง

ลำดับที่	ข้อความ	ใช่	ไม่ใช่	ไม่ทราบ
1.	อาการที่พบบ่อยของคนที่เป็นเบาหวาน คือ ปัสสาวะบ่อย หิวบ่อย กระหายน้ำ			
2.	การรับประทานอาหารที่มีน้ำตาลมากเกินไป และอาหารรสหวานอื่นๆเป็นสาเหตุของโรคเบาหวานชนิดที่ 2			
3.	คนปกติจะมีระดับน้ำตาลในเลือด 70-109 มิลลิกรัมเปอร์เซ็นต์			
4.	อาการที่พบบ่อยของการมีภาวะน้ำตาลในเลือดต่ำมีอาการหนาวสั่น เหงื่อออก และตัวเย็น			
5.	ผู้ป่วยเบาหวาน ที่มีระดับน้ำตาลในเลือดสูงเป็นระยะเวลานานๆ จะทำให้ร่างกายมีภูมิต้านทานโรคแทรกซ้อนได้			
6.	การดื่มแอลกอฮอล์ไม่มีผลต่อการควบคุมระดับน้ำตาลในเลือด			
7.	ผู้ป่วยเบาหวานควรงดน้ำงดอาหาร 4 ชั่วโมงก่อนการเจาะเลือด			
8.	ผู้ป่วยเบาหวานถ้าได้รับการรักษาอย่างต่อเนื่องจะมีโอกาสหายขาดจากโรคได้			
9.	แผลของผู้ป่วยเบาหวานจะหายช้ากว่าคนทั่วไป			
10.	ภาวะแทรกซ้อนที่พบบ่อยของเบาหวาน ได้แก่ โรคหลอดเลือดหัวใจ ไตวาย ตาบอด และปลายประสาทอักเสบ			
11.	การออกกำลังกายเป็นประจำและถูกวิธีอย่างน้อยสัปดาห์ละ 3 วัน สามารถควบคุมระดับน้ำตาลในเลือดได้			
12.	การรับประทานยาสามารถรักษาเบาหวานให้หายขาดได้			
13.	ผู้ป่วยเบาหวานที่รับประทานยาเบาหวานจนระดับน้ำตาลในเลือดอยู่ในระดับปกติสามารถหยุดยาได้			
14.	ผู้ป่วยเบาหวานที่ไม่ได้รับการรักษาต่อเนื่องจะเป็นสาเหตุของไตวายเรื้อรัง			

15.	การดูแลเท้า(ป้องกันไม่ให้เกิดบาดแผล,ทำความสะอาดเท้า ,สวมรองเท้าที่เหมาะสม) จะป้องกันการติดเชื้อ,การบาดเจ็บ และปัญหาอื่นๆของเท้าได้			

ส่วนที่ 3 พฤติกรรมสุขภาพ

3.1 การบริโภคอาหาร

คำชี้แจง : โปรดทำเครื่องหมาย ✓ ลงในช่องว่างแต่ละข้อความ ตามที่ผู้ให้สัมภาษณ์ตอบเพียงข้อเดียว: ท่านรับประทานอาหารเหล่านี้บ่อยเพียงใดในช่วงเวลา 1 เดือนที่ผ่านมา

ประเภทอาหาร	ไม่รับประทาน	นานๆ ครั้ง	บ่อยๆ	ประจำ
		1-3 ครั้ง/เดือน	1-3 ครั้ง/สัปดาห์	≥ 4 ครั้ง/สัปดาห์
1. ขาหมู หมูสามชั้น				
2. หมูเนื้อแดง เนื้อสัน,ปลา				
3. ไส้กรอกอีสาน				
4. อาหารทอด เช่น ไก่ทอด กล้วยทอด				
5. อาหารที่มีกะทิ เช่น แกงใส่กะทิ กล้วยบวดชี				
6. อาหารที่มีเนยและแป้ง เช่น เค้ก คุกกี้ โดนัท ขนมปัง เบเกอรี่				
7. นมสด นมที่มีรสหวาน				
8. นมสดพร่องมันเนย				
9. กาแฟ โอวัลติน ที่ใส่นมข้นหวานหรือน้ำตาล				
10. ผลไม้ที่มีรสหวานมาก เช่น มะม่วงสุก องุ่น ละมุด ทุเรียน				

ในช่วงเวลา 1 เดือนที่ผ่านมา ท่านรับประทานอาหารเหล่านี้เป็นสัดส่วนมากน้อยเพียงใดในแต่ละวัน

รายการอาหาร	1 ส่วน	2 ส่วน	3 ส่วน	4 ส่วน

11. ท่านรับประทานข้าว หรืออาหารจำพวกแป้งกี่ทัพพี (1ส่วน= 1 ทัพพีตักแกง)				
12. ท่านรับประทานผักกี่ถ้วยตวง (1ส่วน= 1 ถ้วยตวง)				
13. ท่านรับประทานผลไม้กี่ส่วน (1ส่วน= 1 ลูกเล็ก, ครึ่งถ้วยตวง)				
14. ท่านรับประทานนมกี่แก้ว (1ส่วน= 240 มิลลิลิตร)				
15. ท่านรับประทานเนื้อสัตว์ อาหารทดแทนเนื้อสัตว์กี่ส่วน(1ส่วน= 2 ช้อนโต๊ะ)				

3.2 การออกกำลังกาย

คำชี้แจง : ให้ผู้สัมภาษณ์ถามคำถามต่อไปนี้ โดยทำเครื่องหมาย ✓ ลงใน □ และเติมข้อความลงในช่องว่างตามที่ผู้ให้สัมภาษณ์ตอบ

1. ในช่วง 7 วันที่ผ่านมา ท่านได้ทำกิจกรรม ที่ต้องออกแรงมาก หรือ ออกกำลังกายหนัก จนทำให้รู้สึกเหนื่อยมาก หายใจแรงและลึกหรือหัวใจเต้นเร็วและแรงมากขึ้น เช่น ขุดดิน,ยกของหนัก,เต้นแอโรบิค,ขี่จักรยานเร็วๆ,วิ่งเร็วๆ

โดยกระทำอย่างต่อเนื่องเป็นเวลาตั้งแต่ 10 นาที ขึ้นไป

□ ไม่มี (ข้ามไปถามข้อ 3)

□ มี โดย.....วัน/สัปดาห์

2. โดยเฉลี่ย ท่านใช้เวลานานเท่าใด ในการทำกิจกรรม ที่ต้องออกแรงมาก หรือ ออกกำลังกายหนัก

□ .....ชั่วโมง/วัน

□ .....นาที/วัน

□ ไม่ทราบ/ไม่แน่ใจ

3. ในช่วง 7 วันที่ผ่านมา ท่านได้ทำกิจกรรม ที่ต้องออกแรงปานกลาง หรือ ออกกำลังกายปานกลาง จนทำให้รู้สึกเหนื่อยพอประมาณหรือพอสมควร โดยหายใจแรงกว่าปกติ เช่น ยกของที่ไม่หนักมาก, กวาดบ้านถูบ้าน,ขี่จักรยานไปเรื่อยๆ,วิ่งเหยาะๆ,แบดมินตัน

โดยกระทำอย่างต่อเนื่องเป็นเวลาตั้งแต่ 10 นาที ขึ้นไป

□ ไม่มี (ข้ามไปถามข้อ 5)

□ มี โดย .....วัน/สัปดาห์

4. โดยเฉลี่ย ท่านใช้เวลานานเท่าใด ในการทำกิจกรรม ที่ต้องออกแรงปานกลางหรือออกกำลังกายปานกลาง

☐ .....ชั่วโมง/วัน

☐ .....นาที/วัน

☐ ไม่ทราบ/ไม่แน่ใจ

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

โดยเดินอย่างต่อเนื่องเป็นเวลาตั้งแต่ 10 นาที ขึ้นไป

☐ ไม่มี (ไม่ต้องถามข้อ 6)

☐ มี โดย.....วัน/สัปดาห์

6. โดยเฉลี่ย ท่านใช้เวลาในการเดินนานเท่าใด

☐ .....ชั่วโมง/วัน

☐ .....นาที/วัน

☐ ไม่ทราบ/ไม่แน่ใจ

3.3 ความร่วมมือในการรับประทานยา

คำชี้แจง : ให้ผู้สัมภาษณ์ถามคำถามต่อไปนี้ ทำเครื่องหมาย ✓ ลงในช่องว่างแต่ละข้อความ ตามที่ผู้ให้สัมภาษณ์ตอบเพียงข้อเดียว ในรอบ 1 เดือนที่ผ่านมา

1. ท่านรับประทานยาเบาหวานตามแพทย์สั่งหรือไม่

☐ ใช่ ☐ ไม่ใช่

2. ท่านเคยลืมรับประทานยาเบาหวานหรือไม่

☐ เคย ☐ ไม่เคย

3. ท่านรับประทานยาเบาหวานไม่ค่อยตรงตามเวลาหรือไม่

☐ ใช่ ☐ ไม่ใช่

4. เมื่อท่านมีระดับน้ำตาลในเลือดเป็นปกติหรือรู้สึกดีขึ้น ท่านเคยหยุดรับประทานยาเบาหวานเองหรือไม่

☐ เคย ☐ ไม่เคย

5. เมื่อท่านมีอาการผิดปกติ เนื่องมาจากการรับประทานยาเบาหวาน ท่านเคยปรับขนาดยาเองหรือไม่

☐ เคย ☐ ไม่เคย

ส่วนที่ 4 ปัจจัยทางจิตสังคม : หมวดที่ 1 ด้านความเครียด

คำชี้แจง : โปรดทำเครื่องหมาย ✓ ลงในช่องว่างแต่ละข้อความ ซึ่งแสดงระดับอาการที่เกิดขึ้นกับผู้ถูกสัมภาษณ์ ตามความเป็นจริง เพียงข้อเดียว ในช่วง 1 เดือนที่ผ่านมา

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

21.	การคิดและการตัดสินใจของท่านยังเป็นปกติเหมือนก่อน			
22.	ท่านรู้สึกว่าชีวิตนี้ยังมีความหวัง			
23.	ท่านรู้สึกมีกำลังใจที่จะปรับปรุงเปลี่ยนแปลงตนเอง ในทางที่ดีหรือก้าวหน้าขึ้น			
24.	ท่านรู้สึกว่าจิตใจของท่านเป็นปกติ			

หมวดที่ 2 ด้านแรงสนับสนุนทางครอบครัว

คำชี้แจง : ให้ผู้สัมภาษณ์ถามคำถามต่อไปนี้ ทำเครื่องหมาย ✓ ลงในช่องว่างแต่ละข้อความ ตามที่ผู้ให้สัมภาษณ์ตอบเพียงข้อเดียว ในรอบ 1 เดือนที่ผ่านมา

ลำดับที่	ข้อความ	ประจำ	เป็นบางครั้ง	ไม่เคย/ไม่มีผู้ดูแล
1.	เมื่อท่านมีปัญหาต่างๆ ในชีวิต บุคคลในครอบครัวของท่านสามารถให้การดูแล และให้คำปรึกษา			
2.	ท่านสามารถปรับทุกข์กับบุคคลในครอบครัว ในเรื่องการเจ็บป่วยของท่าน			
3.	เมื่อท่านเจ็บป่วย บุคคลในครอบครัวของท่านจะคอยดูแลช่วยเหลือในกิจวัตรประจำวัน			
4.	เมื่อท่านไปพบแพทย์ บุคคลในครอบครัวเป็นผู้พาท่านไป			
5.	บุคคลในครอบครัวจะคอยเตือนท่านเมื่อถึงวันที่แพทย์นัด			
6.	บุคคลในครอบครัวของท่าน ดูแลและช่วยเหลือค่าใช้จ่ายในการรักษาพยาบาล			

ส่วนที่ 5 : ระดับน้ำตาลในเลือด (เก็บข้อมูลจากเวชระเบียน)

ค่าระดับน้ำตาลในเลือดของผู้ป่วยเบาหวานชนิดที่ 2 ครั้งล่าสุดภายหลังส่งต่อไปรักษาต่อที่สถานีอนามัยเป็นระยะเวลามากกว่า 1 ปี

Glycemic control	Levels	Unit
HbA1C		%

ข้อมูล ณ วันที่……/……/……..

ข้อคิดเห็น/ข้อเสนอแนะ.....

……

Appendix C

Time Schedule

Research Activities	Time Frame (month in the year 2010-2011)						
	Nov 2010	Dec. 2010	Jan. 2011	Feb. 2011	Mar. 2011	April 2011	May 2011
Literature review							
Conduct draft tool for data collecting							
Content validity by experts							
Ethical Consideration							
Try out research tools							
Tools development for data collecting							
Field preparation and data collection							
Data analysis and interpretation							
Report writing							
Presentation/publication							

VITAE

Name	: Mrs. Niyom Pragosuntung
Date of Birth	: December 11, 1972
Place of Birth	: Roi – Et province, Thailand
Education Achievement	: Boromarajchonanee Nakhon Ratchasima Nursing College, 1992 - 1995 Bachelor of Science in Nursing
Research Experience	: The relationship between organize climate and satisfaction of health care provider
Position and office	: 1995 – Present: Registered Nurse Pathumrat Hospital, Roi-Et province, Thailand