**สภาวะทันตสุขภาพในกลุ่มผู้ป่วยเบาหวาน อำเภอจังหาร จังหวัดร้อยเอ็ด ประเทศไทย**

**นางนฤมล ศีรษะภูมิ**

# ORAL HEALTH STATUS IN DIABETES PATIENTS
# AT CHANGHAN DISTRICT, ROI ET PROVINCE, THAILAND

**Mrs. Narumol Srisaphum**
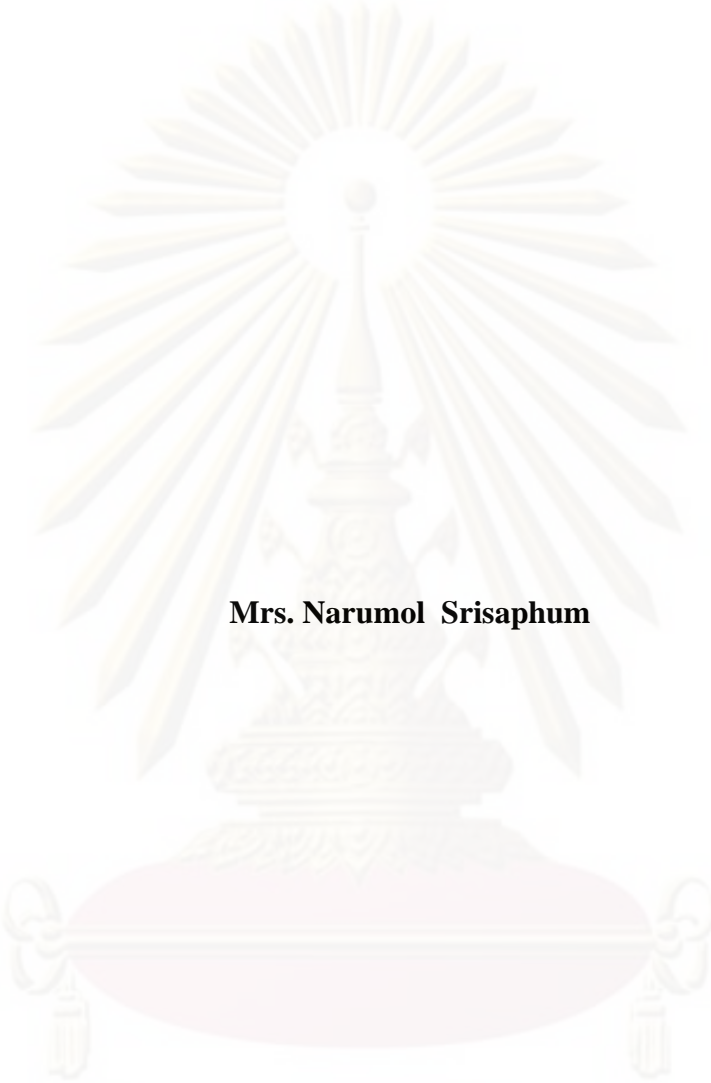
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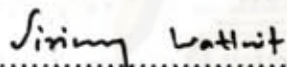
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By               Mrs. Narumol Srisaphum
Field of Study   Health Systems Development
Thesis advisor   Professor Surasak Taneepanichskul, M.D.

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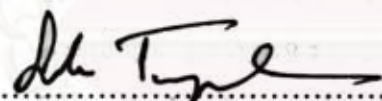
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นางนฤมล ศีรษะภูมิ: สภาวะทันตสุขภาพในกลุ่มผู้ป่วยเบาหวาน อำเภอจังหาร จังหวัด ร้อยเอ็ด. (ORAL HEALTH STATUS IN DIABETES PATIENTS AT CHANGHAN DISTRICT, ROI ET PROVINCE, THAILAND) อ.ที่ปรึกษาวิทยานิพนธ์หลัก: ศ.นพ.สุรศักดิ์ ฐานีพานิชสกุล 65 หน้า.

การศึกษาเชิงพรรณนาภาคตัดขวาง จากกลุ่มตัวอย่างผู้ป่วยเบาหวานจำนวน 256 คน แผนกผู้ป่วยนอก โรงพยาบาลจังหาร อำเภอจังหาร จังหวัดร้อยเอ็ด วัตถุประสงค์เพื่อ ศึกษาความ ชุกและปัจจัยต่างๆที่มีผลต่อการเกิดโรคฟันผุ รากฟันผุ เหงือกอักเสบ โรคปริทันต์ และการติดเชื้อ ราในช่องปากและแนะนำแผนการส่งเสริมสุขภาพ ป้องกันโรค การรักษาและการฟื้นฟูสภาวะช่อง ปากผู้ป่วยเบาหวาน อำเภอจังหาร จังหวัดร้อยเอ็ด การศึกษาครั้งนี้พบว่า ความชุกโรคฟันผุและ รากฟันผุเท่ากับร้อยละ 72.7 และ 55.5 ตามลำดับ ค่าเฉลี่ยฟันผุ ถอน อุด(SD) เท่ากับ 9.98 (8.05) ซี่/คน ความชุกโรคเหงือกอักเสบ โรคปริทันต์เท่ากับร้อยละ 91.8 ไม่พบผู้ป่วยเบาวานติด เชื้อราในช่องปาก ความสัมพันธ์ระหว่างปัจจัยส่วนบุคคล พฤติกรรมการแปรงฟัน การสูบบุหรี่ การ เคี้ยวหมากและการเกิดโรคฟันผุ รากฟันผุ เหงือกอักเสบ โรคปริทันต์โดยใช้สถิติ Chi-square พบว่า เพศ และพฤติกรรมการเคี้ยวหมาก มีความสัมพันธ์กับโรคฟันผุอย่างมีนัยสำคัญทางสถิติที่ $P - value < 0.05$ ($P - value = 0.022$ และ $0.019$ ตามลำดับ) ปัจจัยพฤติกรรมการเคี้ยวหมาก และระยะเวลาการเคี้ยวมีความสัมพันธ์กับการเกิดรากฟันผุอย่างมีนัยสำคัญทางสถิติที่ $P - value < 0.05$ ($P - value = 0.001$ และ $0.018$ ตามลำดับ) ปัจจัยด้าน อายุ พฤติกรรมการแปรงฟัน และ การใช้ไม้จิ้มฟัน มีความสัมพันธ์กับโรคเหงือกอักเสบ โรคปริทันต์อย่างมีนัยสำคัญทางสถิติ ที่ $P - value < 0.05$ ($P- value = 0.001, 0.001$ และ $0.001$ ตามลำดับ และ ไม่พบความสัมพันธ์อย่างมี นัยสำคัญทางสถิติระหว่างพฤติกรรมการสูบบุหรี่ การเคี้ยวหมากกับการเกิดโรคปริทันต์ กฎบัตร ออตาวาได้ถูกนำเสนอเพื่อเป็นแนวคิดหลักในการทำงานด้านส่งเสริมสุขภาพซึ่งสภาวะช่องปากมี ผลกระทบโดยตรงต่อสุขภาพร่างกาย วิถีการดำเนินชีวิตและคุณภาพชีวิตในผู้สูงอายุ

สาขาวิชา การพัฒนาระบบสาธารณสุข ลายมือชื่อนิสิต _Narumol Srtsaphum_

ปีการศึกษา 2552 ลายมือชื่ออาจารย์ที่ปรึกษา _____

## 5179144353:    MAJOR HEALTH SYSTEMS DEVELOPMENT
KEYWORDS:    CORONAL CARIES/ ROOT CARIES/ PERIODONTAL DISEASE/ DIABETES MELLITUS/ CHANGHAN

NARUMOL SRISAPHUM: ORAL HEALTH STATUS IN DIABETES PATIENTS AT CHANGHAN DISTRICT, ROI ET PROVINCE, THAILAND. THESIS ADVISOR: PROF. SURASAK TANEEPANICHSKUL, M.D., 65 pp.

A cross-sectional descriptive study was conducted among 256 diabetes patients in Changhan hospital, Changhan district, Roi et province, Thailand. The study had 3 objectives: (1) to describe prevalence of coronal caries, root caries, periodontal disease, oral candidiasis; (2) to identify influence factors that effect prevalence of coronal caries, root caries, periodontal disease, oral candidiasis; (3) to recommend the plan for dental health promotion, prevention, treatment and rehabilitation. Standardized dentist and interviewers by trained the way use questionnaire, internal reliability of diagnosed dental caries, periodontal disease with statistic Kappa was 0.92. Data collection was carried on November to December 2009. Face to face questionnaire and oral examination were used. Frequencies, percentages, means and standard deviations were used to describe demographic data, oral health behavior and oral status. To assess association between dependent and independent variables, Chi-square test was used.

The prevalence of coronal caries and root caries, were 72.7% and 55.5%, respectively. The mean (SD) Decayed, Missing, Filled Teeth (DMFT) was 9.98 (8.05) teeth/person. Mean (SD) Decayed teeth (DT) was 2.86 (3.40) teeth/person. Mean (SD) Missing teeth (MT) was 7.10 (7.20) teeth/person. Mean (SD) Filled teeth (FT) was 0.06 (0.42) teeth/person. 54.3 percent of diabetes patients had posterior occluded teeth equal or more than 4 pairs. The prevalence of periodontal disease was 91.8%. All of the diabetes patients in this study had not oral candidiasis. The relationship between dependent and independent variables found that gender, betel nut chewing showed a significance association with coronal caries at $P$-$value < 0.05$ ($P$-$value = 0.022, 0.019$, respectively). The relationship between betel nut chewing, duration chewing and root caries showed a significance association at $P$-$value < 0.05$ ($P$-$value = 0.001, 0.018$, respectively). Age, oral health behavior tooth brushing, use toothpick showed a significance relationship with periodontal disease at $P$-$value < 0.05$ ($P$-$value = 0.001, 0.001, 0.001$ respectively). These was no significant relationship between smoking, betel nut chewing and periodontal disease.

The available scientific evidence is particularly strong for a direct relationship between diabetes and periodontal disease. The Ottawa Charter was published to provide a set of guiding principles for health promotion. General and associated oral health conditions have a direct influence on elder people's quality of life and lifestyle. This issue is interesting for further study.

Field of Study : Health Systems Development    Student's Signature *Narumol Srisaphum*

Academic Year : 2009    Advisor's Signature

# ACKNOWLEDGEMENTS

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# LIST OF ABBREVIATIONS

ADA        American Diabetes Association

DM        Diabetes Mellitus

DMFT        Decay, Missing, Filled Teeth

DT        Decay Teeth

FT        Filled Teeth

IDDM        Insulin-Dependent Diabetes Mellitus

IFG        Impaired Fasting Glucose

IGT        Impaired Glucose Tolerance

MT        Missing Teeth

NIDDM        Noninsulin-Dependent Diabetes Mellitus

NGT        Normal Glucose Tolerance

WHO        World Health Organization

## CHAPTER I
## INTRODUCTION

**1.1 Background and significance of the problem**

Population in the world tend to increase continuous. In year 2000, the world have population about 6,067.6 million peoples and prediction in year 2025, will be have 7,851.4 million peoples. While Thai people, tend to increase also from 62.2 million peoples in year 2000 to 72.3 million peoples in year 2025. In year 2009, Thailand have population about 66.9 millions. (Ministry of Information and Communication Technology, Bureau of National Statistical Office of Thailand. 2004 ; 2009)

The world have the elderly (more over 60 year-old) about 542 million. Old female people be more than old male people, that have 300 million old female people, and 242 million old male people. In the future suppose the elderly amount in the world generally will increase. In 1995, our world have 10.6 old female percentages people and 8.4 percentages male, In 2050, the percentage of old female worldly people will enhance to be 21.4 percentages and the male are 18.6 percentages. There are countries where have the proportion of old people most in the world be Italy, Japan, Greek, German, and Switzerland. These countries have important character - the birth rate is rather low, low mortality rate and average age is high. Japan is the one country in Asia that have high proportion of the elderly, average age is 82 years old. (Concepcion and Mercedes, 1996)

Thailand, the proportion in the elderly be increase in the rate that from 10.0 percentages in year 2000 to 15.0 percentages in year 2025, while childhood people (age 0-14 year ) there are amounts is down from 30.1 percentages in year 2000 to left 24.2 percentages in year 2025. This information indicate that the structure of people changes from people childhood structure in the past is old age people or old people social will in the future. (Ministry of Information and Communication Technology, Bureau of National Statistical Office of Thailand. 2004)

In 2007, Survey of the elderly in Thailand found that old people increase 10.7 percentages - 44.6 percentages are men, and 55.4 percentages are women. The

proportion of old age people enhances almost the half of childhood people , which affect make labor force age must burden, that treating and take care old people increase.(Ministry of Information and Communication Technology, Bureau of National Statistical Office of Thailand. 2007)

From the structure of elderly changes increase quickly, elderly have average age more longer, but the deterioration of the physical and capacity in care oneself. Thus, the elderly must depend on lineage. Health policy must reinforce in health promotion, prevention, treatment and rehabilitation. In order to give old people have good quality of life.

Thai government prepares Thai social to ageing society, and set strategy in the National Elderly Plan 2 year 2002-2021. Majority, old Thai people have health problem - chronic disease or non communicable disease, which cause of disease are consuming food, behavior and lifestyle that inappropriate and stress. That disease for example high blood pressure, diabetes, heart disease and stroke. (Ministry of Information and Communication Technology, Bureau of National Statistical Office of Thailand. 2007)

The prevalence of diabetes worldwide is estimated to be 4.6% in the 20-79 year age. In 1985, an estimated 30 million people worldwide had diabetes. In a little over ten years that number has risen to 150 million peoples. The World Health Organization warns that diabetes will reach epidemic proportions with the number of people having diabetes anticipate to reach 300 million patients by 2025. The prevalence of diabetes is highest in developed countries but developing countries are expected to have the largest increase in next decade. The prevalence of diabetes in developing countries is expected to increase by 170 percentages between 1995 and 2025 compared to 41 percentages in developed countries. The rapid rise of diabetes in developing countries is associated with economic development, westernization and urbanization, all of which are contributing factors to an increasing prevalence in these countries. (Gravely, 2002)

The prevalence of diabetes for all age-groups worldwide was estimated to be 2.8 percentages in 2000 and 4.4 percentages in 2030. The total number of people with diabetes is projected to rise from 171 millions in 2000 to 366 millions in 2030. The

prevalence of diabetes is higher in men than women, but there are more women with diabetes than men. The urban population in developing countries is projected to double between year 2000 and 2030. The most important demographic change to diabetes prevalence across the world appears to be the increase in the proportion of people 65 years of age. (Wild et al., 2004)

Diabetes mellitus is also a common chronic disease with increasing burdens. (Kim, 2007) The prevalence of diabetes in Thai adult aged 35 years or older rose to 9.6 percentages during the year 2000. Frequently diabetes affects the population age 45 years and older. (Aekplakorn et al., 2003)

Thailand health profile 2005-2007 showed that non-communicable diseases, such as heart diseases, diabetes mellitus and cancer, had become the leading causes of morbidity and mortality among Thai people. Such an increasing trend results from unhealthy consumption behavior and physical inactivity, as evidently demonstrated by the following hospital admission rates. The admission rate of diabetes patients has also risen from 33.3 per 100,000 population in year 1985, 91.0 in year 1994 and 586.8 in year 2006 respectively. In 2006, Survey on risks of Thai elders, conducted by the Ministry of Social Development and Human Security, revealed that three-fourths of all elders had commonly illnesses such as hypertension, bone or joint diseases, diabetes, eye diseases and cardiovascular disease. (Ministry of Public Health, Bureau of policy and strategy, 2007)

Diabetes mellitus (DM) have result premature disability, mortality, blindness, renal disease, and non-traumatic limb amputations. DM is known that increase the risk of heart disease, cerebral and vascular disease by two – seven folds. Many of the complications of DM are preventable or can be delayed by appropriate treatment of hyperglycemia and other and cardiovascular risk factors. (Mishra, 2004)

Diabetes mellitus is a common and growing global health problem leading to several complications. Periodontal diseases are considered as the sixth complication of diabetes mellitus. Periodontitis in patients with diabetes, is more prevalence and severity than normal population. Diabetes mellitus patients increased disposition the manifestation of oral diseases like oral candidiasis which is associated with poor glycemic control and therapeutic dentures. Xerostomia may increase glucose levels in oral fluids or immune dysregulation. (Soell et al., 2007)

In 2007, The 6<sup>th</sup> National oral health survey in Thailand found that oral status in the Thai elder (60-74 years); 94.04% had tooth loss on the average 13.38 teeth/person, the means of decay tooth, missing and filled tooth be 15.85 teeth/person, 54.80% had healthy teeth $\geq$ 20 teeth, 10.47% had edentulous ridge both upper and lower jaws. Main problem of losing tooth is periodontitis condition. 84.2% had periodontitis. (Ministry of Public Health, Dental Health Division, 2007)

While dental treatment need must consider in condition that the limited resource such as budget, dentist. According to the report on dental health personnel of the Department of Health, 2005 found that majority dentist 51.11 percentages work in Bangkok. Next, the Middle, the Northeast and the North are 16.70, 11.93, 11.85 percentages respectively. The dentist : population proportion in Bangkok equals to 1:1,305, in the Northeastern equals to 1:21,120. In Roi-et province, the proportion of dentist and population equals to 1: more over 30,000. Ministry of Public Health sets standard dental serves in Primary Care Unit (PCU). Proportion dentist : population equal to 1: 12,500 (Witchavut et al., 2007)

Health profile in Roi-et province shows that the prevalence rate of diabetes patients per 100,000 population in year 2006, 2007 and 2008 equal to 1,858.59, 2,292.67 and 2,772.85, respectively. (Ministry of Public Health, Roi-et Public Health Office, 2009) At Junghan district, the prevalence rate of diabetes patients per 100,000 population in year 2006, 2007 and 2008 equal to 2,006.51, 2,161.88 and 2,601.47, respectively. (Ministry of Public Health, Junghan Hospital, 2009) From data meet that the prevalence rate of diabetes both Roi-et province and Junghan district have increase rate. Diabetes patients have dental health risk in periodontitis, decayed tooth more than normal person. And periodontal disease causes losing tooth which make problem - chewing food and decrease quality of life.

According to current information, most of the diabetes patients trend to have dental problem such dental caries, periodontal disease, early losing teeth and oral candidiasis. To solve this problem, we must know oral health status and influence factors in diabetes patients in order to set dental health promotion, prevention, treatment, rehabilitation plan and management limited resource such as budget, dentist for most effective management.

**1.2 Research questions**

1.What is the prevalence of coronal caries, root caries, periodontal disease and oral candidiasis in diabetes patients at Changhan district, Roi et province?

2.What is the influence factors of coronal caries, root caries, periodontal disease and oral candidiasis in diabetes patients at Changhan district, Roi et province?

**1.3 Objectives of study**

1.To determine prevalence of coronal caries, root caries, periodontal disease and oral candidiasis in diabetes patients at Changhan district, Roi et province.

2.To identify the influence factors affect prevalence of coronal caries, root caries, periodontal disease and oral candidiasis in diabetes patients at Changhan district, Roi et province.

3.To recommend the plan for dental health promotion, prevention, treatment and rehabilitation.

**1.4 Operational Definitions :**

**1.Diabetes Mellitus patients** means the patients who have diabetes mellitus and other systemic diseases, and take services at out-patient department, in Changhan Hospital, Changhan district, Roi et province**.**

**2.Prevalence of Diabetes mellitus patients** means the number of diabetes patients (old and new cases) divide by total diabetes patients who take service at Changhan Hospital, Changhan district, Roi et province on study period.

**3.Oral Health Status** composed of

    3.1 dental caries, missing teeth, filled teeth.

    3.2 periodontal disease means gingivitis, periodontitis.

    3.3 oral candidiasis

**4.Dental caries** means the formation of cavities in the crown and /or root surface by the action of bacteria. And filled tooth have recurrent caries.

**5.Filled tooth** means decayed tooth that have already treatment, filled with permanent restorative materials and no secondary caries.

**6.Missing tooth** means the absence of teeth from the dentition because of congenital factors, exfoliation or extraction.

**7.Periodontitis** means an inflammatory disease that affects the periodontium within the oral cavity. Signs and symptoms of disease include localized pain, alveolar bone loss, erythema, swelling, loosening of teeth or having dental pockets more than 4 mm.

**8.Gingivitis** means an inflammatory disease that affects the gingival. Common symptom are gingival bleeding, having calculus deposited.

**9.Oral health behavior** defines as cleaning oral cavity - tooth brushing, normal saline mouthrinse, smoking behavior, betel nut chewing.

**10.Controlled diabetes** defines as the fasting plasma glucose test$\leq$140 mg /dl. Prior to being tested, a person must not to eat for 12 to 14 hours. the test is usually done in the morning.

**1.5 Conceptual Framework**

**Independent variable**                                      **dependent variable**

| - gender<br>- age<br>- educated level<br>- occupation<br>- income<br>- controlled diabetes<br>- oral health behavior<br>  - tooth brushing<br>  - smoking<br>  - betel nut chewing | → | - oral health status<br>  - dental caries<br>  - missing tooth<br>  - filled tooth<br>  - periodontal disease<br>  - oral candidiasis |
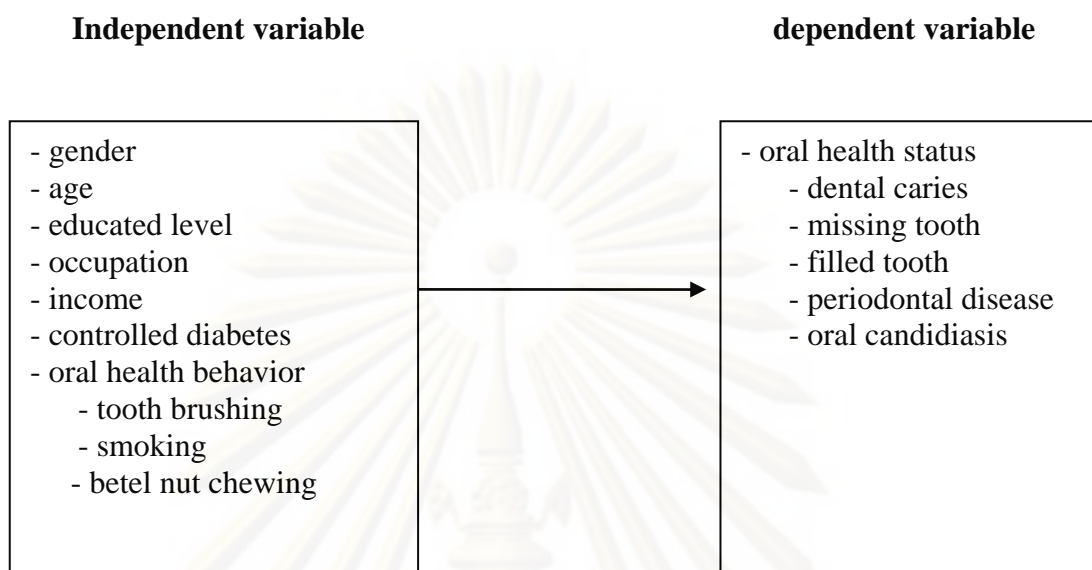
Fig.1:  Conceptual framework

**1.6 Expected Benefit**

This thesis studied about the prevalence and influence factors of dental caries area crown, root, periodontal disease and oral candidiasis in diabetes patients at Changhan district, Roi et province. Thus, results is important for further program planning implementation, that solve dental health problem in diabetes patients at Changhan district, Roi et province.

# CHAPTER  II
# LITERATURE  REVIEW

## 2.1 Diabetes Mellitus illness

Diabetes is a chronic illness that is characterized by elevated blood glucose levels and requires continuing medical care and patient self management education for prevention acute complication and reduction the risk of long-term complications. (American Diabetes Association, 2008)

## 2.2 Classification of Diabetes Mellitus

Major Types of Diabetes

### Type 1 diabetes

Results from the body's failure to produce insulin, the hormone that "unlocks" the cells of the body, allowing glucose to enter and fuel them. It is estimated that 5-10% of Americans who are diagnosed with diabetes have type 1 diabetes.

### Type 2 diabetes

Results from insulin resistance (a condition in which the body fails to properly use insulin), combined with relative insulin deficiency. Most Americans who are diagnosed with diabetes have type 2 diabetes.

### Gestational diabetes

Immediately after pregnancy, 5% to 10% of women with gestational diabetes are found to have diabetes, usually, type 2.

### Pre-diabetes

Pre-diabetes is a condition that occurs when a person's blood glucose levels are higher than normal but not high enough for a diagnosis of type 2 diabetes. There are 57 million Americans who have pre-diabetes, in addition to the 23.6 million with diabetes. (American diabetes association, 2009)

**2.3 Etiology of Diabetes Mellitus**

Diabetes mellitus arises through two distinct etiology routes :

      1. Insulin-dependent diabetes mellitus (IDDM, also known as juvenile-onset, type I, brittle, ketosis-prone, or labile diabetes) is the result of immunologically mediated destruction of the pancreatic beta cells. It is pharmaceutically characterized by the patient's requirement for exogenous insulin.

      2. Noninsulin-dependent diabetes mellitus (NIDDM, adult onset, or maturity-onset diabetes) results from insulin insensitivity and altered insulin secretion. The principle pathophysiologic defect is altered peripheral resistance of tissue to circulating endogenous insulin. In particular, the muscle and fat cells are relatively insensitive to insulin, probably because of the down-regulation or changes in, the molecular structure of insulin membrane recepters. Eventually, the tissue fail to respond to the hormone and symptoms appear. These patients have normal to elevated levels of insulin and excess glucose release by the liver. (Beaser et al., 2007)

      About 90% of patients who have diabetes mellitus have the noninsulin dependent type, and management generally involves dietary therapy or oral hypoglycemic agents. Current evidence suggest that diabetes I a multifactorial disorder associated with genetic predisposition, primary destruction of islets of Langerhans of pancrease, endocrine abnormality, iatrogenic factors, and infectious agents. The not significant factor appears to be heredity. Noninsulin-dependent diabetes has a stronger genetic basis than insulin dependent diabetes. (Beaser et al., 2007)

      Type I diabetes, which affects 10-15% of all people with diabetes, is primarily the result of the inability to produce insulin due to beta cell destruction in the pancreas. While Type I diabetes accounts for fewer individuals with diabetes, it results in a disproportionately higher frequency of diabetes related complications. Type II diabetes, affecting over 80% of those diagnosed with diabetes, results from a combination of insufficient insulin production and /or resistance of the cells of the body to actions of insulin (Registered Nurses' Association of Ontario [RNAO], 2004)

      Diabetes mellitus type I is less common (10%) from of diabetes, characterized by onset before 20 years old, thin body build, extreme thirst, ravenous hunger,

constant urination, and rapid weight loss. The pancreas of these patients produces little or no insulin. Daily injections of insulin are required to control the blood glucose levels and to prevent ketoacidosis. The condition is more severe, has greater fluctuations in blood glucose concentrations, has more complications, and results in a shorter life span than diabetes mellitus type II. About 20% of patients with type I diabetes have a positive family history for the disease. Diabetes mellitus type II is seen most frequently in obese persons after the age of 40 years. The sign and symptoms are often innocuous and longstanding before the diagnosis is made. (Beaser et al., 2007)

**2.4 Diagnosis Criteria For Diabetes Mellitus**

Criteria for diagnosis of diabetes and other categories of glucose tolerance have changed considerably during the last 20 years. Table 1 shows the current criteria for normal glucose tolerance (NGT), Impaired fasting glucose (IFG), Impaired glucose tolerance (IGT) and diabetes mellitus (DM). Criteria propose by the World Health Organization (WHO) and the American Diabetes Association (ADA) are different. The main difference between these new criteria is that the ADA does not recommend the use of an oral glucose tolerance test. The WHO defined a new subcategory of glucose tolerance, IGT, to describe subjects whose fasting glucose levels were normal but whose 2-hour postglucose challenge levels were elevated, although not diabetic. The 2 hour 75g oral glucose tolerance test was recommended as the international standard for diabetes diagnosis. The cutoff point between IGT and diabetes was based on an increased risk of developing diabetes complications, primarily retinopathy, for these subjects with diabetes. (World Health Organization, 1985 ; 1999 )

The ADA recommended that in epidemiological studies, estimated of diabetes prevalence and incidence should be based only on fasting glucose criteria. The fasting glucose criteria for diagnosis were considered by the ADA to have good reproducibility, small variability, and easy application in clinical practice. Both the ADA and WHO recommended a fasting plasma glucose concentration of 7.0 mmol/L (Genuth et al., 2003 ; The Expect Committee on the Diagnosis and Classification of Diabetes Mellitus, 1997)

Table 1:  Criteria for classification of Glucose Tolerance Status to World Health
Organization and the American Diabetes Association Criteria (Laakso, 2008)

| Glucose tolerance status | Definition | Classification criteria (mmol/L) |
|---|---|---|
| Normal glucose tolerance (NGT) | WHO(1999) ADA(1997) ADA(2003) | FPG < 6.1 and 2h PG <7.8 FPG < 6.1 FPG < 5.6 |
| Impaired fasting glucose (IFG) | WHO(1999) ADA(1997) ADA(2003) | FPG ≥ 6.1 and <7.0 and 2h PG <7.8 FPG ≥ 6.1 and <7.0 FPG ≥ 5.6 and <7.0 |
| Impaired glucose tolerance (IGT) | WHO(1999) | FPG < 7.0 and 2h PG ≥7.8 and  <11.1 |
| Diabetes mellitus (DM) | WHO(1999) ADA(1997) ADA(2003) | FPG ≥ 7.0 or  2h PG ≥11.1 FPG ≥ 7.0 FPG ≥ 7.0 |

## 2.5 Symptom of Diabetes Mellitus

Diabetes mellitus presents with varied symptom and problem. Absent or deficient levels of insulin trigger immediate tissue reactions, including decrease entry of blood glucose into tissues and elevation of blood glucose levels. The kidney are unable to absorb the excess glucose, and glucose spills over into the urine (glucosuria). Hyperglycemia elevates the intracellular osmosis pressure, resulting in osmotic diuresis. The osmosis diuresis and excess fluid accumulation in the plasma increase urinary output (polyuria) and cause night urination (nocturia). Compensation for polyuria and nocturia results in extreme thirst (polydipsia), whereas continual urinary loss of calories and inadequate cellular uptake lead to weight loss, weakness, and increase hunger (polyphagia). Lack of nutrient and caloric uptake by the tissue cause cellular starvation and an attempt of cells to supply glucose from noncarbohydrate sources. Abnormal and accelerate metabolism of amino acids and fats results in the production of ketone bodies and ketoacidosis. The combination of hyperosmolarity and metabolic acidosis leads to progressive dehydration, exaggerated breathing (Kussmaul respiration), acetone breath, depression of the patient's sensorium, cardiovascular insufficient, coma and eventual death. The symptoms of Type II

Diabetes mellitus are hunger (craving for sweets) and thirst along with pruritus and dry mouth. Patients are usually over weight, but occasionally they lose weight because of the disease. (Beaser et al., 2007)

```
        ┌─────────────────────────────┐
        │  Inadequate Insulin Activity │
        └─────────────────────────────┘
                      │
                      ▼
              ┌─────────────────┐
              │  Hyperglycemia  │
              └─────────────────┘
                      │
                      ▼
              ┌─────────────────┐
              │   Glycosuria    │
              └─────────────────┘
                      │
                      ▼
              ┌─────────────────┐
              │ Osmotic Diuresis│
              └─────────────────┘
                      │
                      ▼
         ┌──────────────────────┐
         │ Polyuria and Nocturia│
         └──────────────────────┘
                      │
                      ▼
              ┌─────────────┐        ┌─────────────┐
              │  Polydipsia │        │  Glycosuria │
              └─────────────┘        └─────────────┘
                      │                     │
                      ▼                     ▼
        ┌──────────────────────┐  ┌──────────────────────┐
        │  Lack of Metabolism  │  │    Urinary Loss      │
        │ of Ingested Nutrients│  │  Of Ingested Calories│
        └──────────────────────┘  └──────────────────────┘
                       \                 /
                        \               /
                   ┌──────────────────────┐
                   │  Hunger , Malnutrition│
                   │      Weight Loss      │
                   └──────────────────────┘
                              │
                              ▼
                       ┌─────────────┐
                       │  Polyphagia │
                       └─────────────┘
```
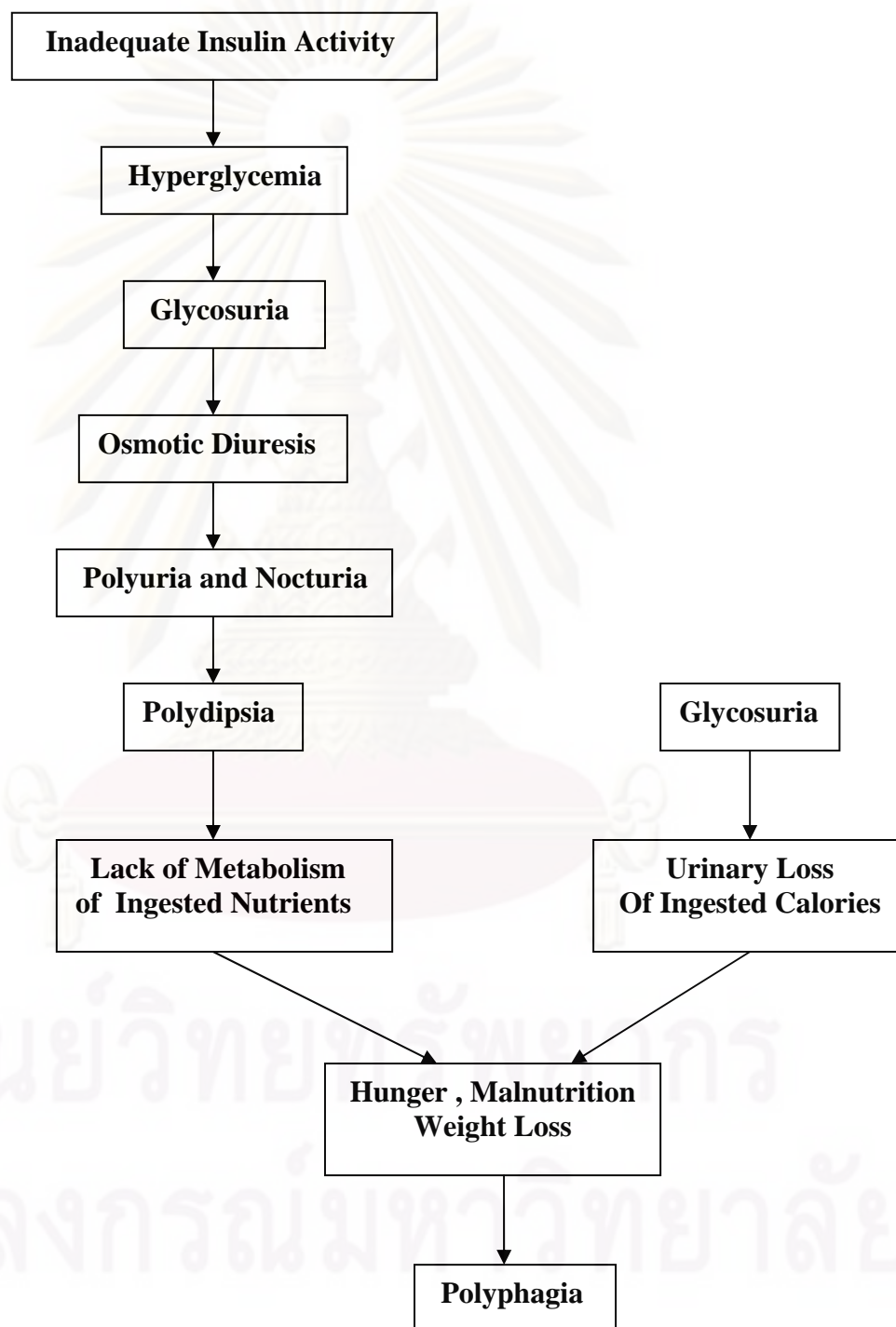
Fig.2: Physiologic reactions of inadequate insulin activity (Bricker et al., 1994)

Table 2: .Comparision of Type I and type II Diabetes (Beaser et al., 2007)

| Item | Type I Diabetes | Type II Diabetes |
|---|---|---|
| Percentages of people with Diabetes | 10% | 90% |
| Former names | Juvenile diabetes<br>Brittle diabetes<br>Insulin-dependent diabetes<br>Type I diabetes | Adult-onset diabetes<br>Stable diabetes<br>Noninsulin-dependent diabetes<br>Type II diabetes |
| Age of discovery | Usually below 40 years, but not always | Usually over 40 years, but not always |
| Condition when discovered | Usually moderate to severity illness | Often not ill at all, or having mild symptoms |
| Cause of diabetes | Reduced or absent insulin production | Insulin resistance and relative or absolute insulin secretory deficiency. Also, lack of glucagon suppression. |
| Insulin level | None to small amounts | Markedly elevated early – somewhat decrease later |
| Weight | Often thin or normal weight, often losing weight at diagnosis | Usually overweight, but 20% are normal weight |
| Acute complications | Ketoacidosis | Non-ketotic hyperosmolar hyperglycemic coma; Usually not prone to ketoacidosis |
| Usual treatment | Insulin , meal plan , exercise | Diet , exercise , if needed antidiabetes medications, Insulin |

## 2.6 Complication of Diabetes Mellitus

Diabetes is a major cause of coronary artery disease and is the leading cause of new cases of blindness and kidney disease. This damage can effect the function of many body organs and interfere with wound healing. (Canadian Diabetes Association [CDA], 1998 ; 2003 )

DM group had a higher prevalence and incidence of microvascular and macrovascular complications at all time points compared with controls. Patients with DM were at increased risk for all lower extremity complications, particularly those requiring surgical intervention gangrene, debridement and amputation. Cardiovascular complications were a leading cause of morbidity, with 57.6% of the DM group diagnosed as having heart failure compared with 34.1% of the controls.(Bethel et al., 2007)

National Health Examination Survey III, Thailand, 2004 showed that diabetes mellitus accounted for a total disability-adjusted life year (DALY) loss of 3.1% in men and 6.4% in women. The burden of this condition will likely rise steadily in the future. (Porapakkham et al., 2004)

The clinical course of diabetes mellitus is variable. Some diabetes deteriorate rapidly, with a course complicated by episodes of ketoacidosis. Ketoacidosis and hepatic and renal disease occur less frequently in type II diabetes than in type I. Other have vascular manifestations that affect the large and small blood vessels and produce end-organ diseases. These complications include atherosclerosis (coronary artery disease), retinopathy, renal failure, peripheral forms of neuropathy, autonomic insufficiency, and susceptibility to infection. The most reliable indicator of the tendency to complications is the duration of the disease and the persistence of elevated blood glucose and cholesterol levels. Microangiopathy and macroangiopathy are two hallmark complications of diabetes mellitus. Diabetic patients may have psychologic alterations brought about by blood glucose levels. A decrease in blood glucose can precipitate a sudden change in mood, whereas an increase fatigue and malaise. In addition, patients may be depressed or discouraged, and /or uncomfortable because of their physical state. (Bricker et al., 1994)

Hypoglycemia is the most common acute complication of insulin-dependent diabetes. It results from the imbalance of glucose and insulin in the blood. This condition usually develop when patient injects a normal dose of insulin but then forgets to eat a meal, thus, excess insulin circulates in the blood, compared to reduced amounts of blood glucose. Initial manifestation of hypoglycemia are weakness, trembling, hunger, sweating, tachycardia, anxiety and confusion. As the condition worsens, patient becomes combative. Without treatment, the condition progress to a

severe state - unconsciousness, sweating, hypotension, and hypothermia. Treatment is rapidly glucose taken by mouth or intravenous glucose. (Bricker et al., 1994)

## 2.7 Oral Manifestrations

Periodontal disease, often referred to as the sixth complication of diabetes mellitus, is caused by infection of the subgingival layer, and it is highly common among diabetic patients with poor metabolic control. Beginning as a common, low-level infection called gingivitis, when it is left untreated it may reach advanced stages rapidly. And the consequences can range from loss of alveolar bone and attachment loss, ongoing infection and inflammation. In fact, several studies have demonstrated that patients with type 1 diabetes and chronic marginal metabolic control of the disease have more extensive and severe periodontal disease than patients who maintain rigorous control of their diabetes. (Diabetes Dentists, 2009)

Dyslipidemia and hyperglycemia are major risk factors for cardiovascular disease (CVD) and diabetes mellitus (DM). In recent years, some evidences have been presented that periodontal disease is associated with an increased risk of CVD and DM, in terms of the impact on systemic condition. Chronic inflammation, resulted from periodontal disease, had been declared part of insulin resistance and atherosclerosis, as such inflammatory response appear to participate in progression of metabolic disorders. The results indicated that hyperglycemia and dyslipidemia may be associated with periodontitis and the periodontal infection may impair metabolic control in older adults. (Kungsadalpipob, 2006)

Gingivitis and periodontitis are the most common periodontal disease. In US approximately 50 percentages of the population in all age group exhibit reversible gingival inflammation. Moderate or severe periodontitis affecting approximately 5-15 percentages of any population. The biologic link between diabetes and periodontal disease supports diabetes mellitus and persisting hyperglycemia leading to an exaggerated immuno-inflammatory response to the periodontal pathogenic bacterial challenge, resulting in more rapid and severe periodontal tissue destruction. (Taylor and Borgnakke, 2008)

The relationship between diabetes and dental caries has been investigated, but no clear association has been clarified. It is important to note that patients with diabetes are susceptible to oral sensory, periodontal and salivary disorders, which could increase their risk of developing new and recurrent dental caries. Oral candidiasis are commonly found in adult with diabetes with cigarette smoking, use of dentures and poor glycemic control. (Ship, 2003)

Cigarette smoking is considered as one of the most important life style risk factors for periodontitis - more clinical attachment loss and more alveolar bone loss have been observed in smoking than in non-smoking patients. (Heens et al., 2009)

Preventive behaviors like brushing, flossing, and periodic dental visit, which have a positive correlation with better periodontal health. (Mirza et al., 2007)

Diabetes has an increased predisposition to the manifestation of oral diseases like candidiasis which is associated with poor glycaemic control and therapeutic dentures. This predisposition also contributes to xerostomia, which may be due to increased glucose levels in oral fluids or immune dysregulation. (Soell et al., 2007)

Xerostomia (dry mouth) is a usually associated with uncontrolled diabetes mellitus. Dehydration of the oral tissue can increase the risk of the development of oral candidiasis and dental caries. Altered subgingival flora have been described in diabetes and may be the result of immunologic or saliva changes. Patients with diabetes mellitus have an accentuated response to plaque. Gingiva be hyperplastic, erythema, and acute fulminating gingival abscess can occur. Excessive periodontal bone loss, tooth mobility, and early tooth loss can also be associated with diabetes mellitus. (Iben and Phlelan, 2000)

Slow wound healing and increased susceptibility to infection occur as a result of the immunologic changes and defective collagen production. Early identification of oral infection is important. Infection aggravates diabetes because it often results in the loss of blood glucose controlled. Therefore elimination of infection is extremely important in diabetes patients. Antibiotic medication, calculus and plaque removal, effective oral hygiene care – tooth brushing, and adequate nutrition are especially important in the management of the diabetes patients. (Iben and Phlelan, 2000)

**2.8 Dental Management**

Patients with poorly controlled diabetes mellitus have risk of developing oral complications because of their susceptibility to oral infection, and likely will require supplemental antibiotic therapy. Antibiotic coverage may help prevent impaired and delayed wound healing. Orofacial infections require close monitoring. (Ship, 2003)

Principle of dental management of diabetics (Cawson et al., 2002)

-Time treatment to avoid disturbance of routine insulin administration or meals

- local anesthesia for routine dentistry–the amount of adrenaline(epinephrine) in local anesthetic solutions has no significant effect on the blood sugar

- Sedation can be given if required

- Dental operations under general anesthesia should only be carried out in hospital under expert supervision

- Deal with any diabetic complications ; susceptibility to infection, candidiasis periodontal disease, dry mouth, hypoglycemic coma

- Manage hypoglycemic coma

**2.9 Diabetic Emergencies**

Hyperglycemia (blood glucose level 300 to 600 mg/dl) generally develops more slowly, usually being manifested in patients with uncontrolled diabetes mellitus. As this condition, the individual becomes disoriented and take rapidly, deep breaths, may have an acetone odor. Hypotension and loss of consciousness ensue. Treatment consists of emergency medical service for hospital transport, basic life support, maintenance of an airway, provision 100% oxygen, and intravenous fluid. (Wilson and Kornman, 2003)

Insulin shock (hypoglycemia) is characterized by confusion sweating, nausea, tachycardia, cold and clammy skin, belligerent behavior, and loss of conscious if untreated. Treatment should be rendered immediately and should consist of orally administered carbohydrates such as orange juice, candy, or soft drink with sucrose where possible. Dextrose may also be administered intravenously or glucagons (1 mg) given intramuscularly. The patient should be observed closely until stabilized (Wilson and Kornman, 2003)

# CHAPTER III
# RESEARCH METHODOLOGY

## 3.1 Research design

The study design was descriptive cross-sectional study. The objectives for study were to determine the prevalence of dental caries area crown, root, periodontal disease and oral candidiasis in diabetes patients at Junghan district, Roi-et province, Thailand, to identify the influence factors which may affect prevalence of dental caries area crown, root, periodontal disease and oral candidiasis. And to recommend the plan for dental health promotion, prevention, treatment and rehabilitation.

## 3.2 Study population

The population of this study was diabetes patients who came to take service follow appointment in diabetes clinic, out-patient department, Junghan hospital, Junghan district, Roi-et province.

Junghan hospital is community hospital, 30 beded size. Location is far from Roi-et municipality about 10 kilometers. There are population in Junghan district estimately 47,000 peoples in responsibility.

## 3.3 Study period

Data collection was done on November 18 – December 4, 2009.

## 3.4 Sample size

According to the population, the Diabetes patients in out patients at Junghan hospital who came to take service follow appointment approximately 560 people. Then, calculating method of Taro Yamane : 1973. His formula has been set as follow

$$n = \frac{N}{1 + Ne^2}$$

When,   n =  sample size

N = population size

e = the error of sampling, this study allows the error of sampling on 0.05

The sample size shows as follow :

$$n \quad = \quad \frac{560}{1+ 560\,(0.05)^{2}} \quad = \quad 233.3$$

Then, add 10% for missing data,   233 + 23.3 = 256.3

Therefore sample size in this study was the diabetes patients who came to take service follow appointment at diabetes clinic, out-patient department, Junghan hospital amount 256 peoples.

## 3.5 Sampling  Method

The simple random sampling method was applied to choose diabetic patients who had odd number card. These patients were invited participate in the study.

## 3.6 Inclusion criteria

Diabetic patients both male and female who had age more than 40 years old, could help oneself and allowed to interview and oral examination.

## 3.7 Exclusion criteria

Diabetic patients who had age under 40 years old, could not help oneself or not allowed to interview, oral examination, pregnancy, or incomplete questionnaire.

## 3.8 Variable

- **Independent variable :**

- gender

- age

- educated level

- occupation

- income

- controlled diabetes

- oral health behavior

    - tooth brushing

    - smoking

    - betel nut chewing

- **dependent variable** : oral health status

    - dental caries

    - missing tooth

    - filled tooth

    - periodontal disease

    - oral candidiasis

## 3.9 Instrument and measurement

1. Questionnaire had 2 parts

Part I : General Information

Data showed general characteristic of individual patient such as gender, age, educated level, occupation, income, controlled diabetes, duration diabetes.

Part II : Oral health behavior adapted from Ministry of public health which used in The 6th Oral Health Survey, Thailand 2007. Data showed the way cleaned his oral cavity, smoking, betel nut chewing.

2. Oral Health Examination Form adapted from WHO (Oral Health Survey : Basic Method 4th Edition 1997)

3. Instrument for oral examination :

    - plain mouth mirror

    - WHO periodontal probe

    - cotton plier

    - alcohol 70%

**3.10 Method of data collection**

The process of data collection as follow:

**Preparation stage :**

1.Preparation the questionnaire, equipment for oral examination – plain mouth mirror, WHO periodontal probe, cotton plier, alcohol 70%

2.Standardize interviewer :

The interviewers were trained to understand the questionnaire, the way for data collection.

3.Standardize dentist :

Only one Dentist (researcher) diagnosed diabetes patients' oral cavity. The internal reliability of diagnosis dental caries, periodontal disease by recheck diabetes patients' oral cavity 10% of sample size.

**Operation stage :**

1.The researcher introduced myself, explained the objective for this research, asked for permission and the patient signed to attend the research.

2.Staff interviewed diabetes patients for general information and oral health behavior data.

3.The researcher (only one dentist) diagnosed diabetes patients' oral cavity for data collection part III

4.Researcher checked the complete data.

5.Data collection was carried on November 18 – December 4, 2009.

**3.11 Data Analysis**

Data was coded and entered by using Microsoft excel 2003 software. Then data analysis was done by using SPSS version 17 software.

**Statistical technique** was descriptive statistic.

- Frequency distribution, amount, mean, percentage, standard deviation were used to describe the general characteristic, oral health behavior.

- Chi-square was used to test the association between influence factors - gender, age, educated level, occupation, income, controlled diabetes, oral health

behavior such as tooth brushing, smoking, betel nut chewing and coronal caries, root caries, periodontal disease, oral candidiasis.

## 3.12 Validity and Reliability

Validity : Questionnaire and oral health survey form was checked the validity by 4 professors.

Reliability : The internal reliability of diagnosis dental caries, periodontal disease by recheck diabetes patients' oral cavity 10% of sample size. Analysis internal reliability with statistic Kappa. Result, Kappa was 0.92, indicated that internal reliability was high belief.

## 3.13 Limitation

This study was cross-sectional survey. The sample size was selected by probability, not all of diabetes patients in Changhan hospital. Limited time was also limitation.

## 3.14 Ethical Considerations

The study was submitted to the Ethic in Research Committee, Chulalongkorn University. Purpose of the study was explained to diabetes patients who were inclusion criteria, consented and signed in this research.

# CHAPTER IV
# RESEARCH RESULTS

This study was descriptive cross-sectional study about the prevalence of coronal caries, root caries, periodontal disease and oral candidiasis in diabetes patients at Changhan district, Roi et province. And identification the influence factors - gender, age, occupation, income, education level, diabetes controlled, duration diabetes, oral health behavior, tooth brushing, smoking, betel nut chewing that might affect prevalence of coronal caries, root caries, periodontal disease and oral candidiasis. In our study, data collection from 256 diabetes patients who came to take service follow appointment at diabetes clinic, out-patient department, Changhan hospital, Changhan district, Roi et province. The measurement tool was questionnaire and oral examination which had 3 parts :

Part I : General Information - gender, age, education level, occupation, income per month, health insurance, medical history, fasting plasma glucose, duration diabetes.

Part II : Oral health behavior **-** the way clean oral cavity, smoking, betel nut chewing. This questionnaire adapted from Ministry of public health which used in The 6th Oral Health Survey, Thailand 2007.

Part III : Oral health examination**,** adapted from WHO (Oral Health Survey : Basic Method 4th Edition 1997)

Data was analysed with the computer software, SPSS version 17. The finding were divided into 6 sections.

1. Distribution of demographic characteristics of population.

2. Distribution of oral health behaviors.

3. Oral health status of diabetes patients – prevalence of coronal caries, root caries, periodontal disease, mean DMFT, percentage of posterior occluded teeth < 4 pairs

4. Association between general characteristics, oral health behavior and coronal caries in diabetes patients.

5. Association between general characteristics, oral health behavior and root caries in diabetes patients.

6. Association between general characteristics, oral health behavior and periodontal disease in diabetes patients.

All diabetes patients had not oral candidiasis, then could not analyse data.

## 4.1 Distribution of demographic characteristics of population

Among 256 diabetes patients, 164 persons were female (64.1%). The average age (SD) was 60.79 (9.14) years old. Education level, the majority 88.3 percent studied in primary school. 75.4 percent diabetes patients were farmer and their income were less than 5,000 baht/month (92.58%). 83.2 percent used 30-baht card. 62.1 percent of diabetes patients had other systemic disease such as hypertension, heart disease. 62.1 percent could controlled diabetes and 66.4 percent had duration diabetes less than 10 years. (Table 3)

Table 3: Distribution of demographic characteristics of population

| Characteristics | Number | Percentage |
|---|---|---|
| **Gender (n=256)** | | |
| Male | 92 | 35.9 |
| Female | 164 | 64.1 |
| **Age (n=256)** | | |
| 41-50 years | 36 | 14.1 |
| 51-60 years | 87 | 34.0 |
| 61-70 years | 91 | 35.5 |
| ≥70 years | 42 | 16.4 |
| Mean (S.D.) = 60.79 (9.14) | | |
| min.- max. =41- 86 years | | |
| **Education level (n=256)** | | |
| Illegible | 3 | 1.2 |
| Primary school | 226 | 88.3 |
| Secondary school | 18 | 7.0 |
| Occupation training | 3 | 1.2 |
| Bachelor degree | 3 | 1.2 |

| Characteristics | Number | Percentage |
|---|---|---|
| **Education level** | | |
| graduate | 3 | 1.2 |
| **Occupation (n=256)** | | |
| Farmer | 193 | 75.4 |
| General worker | 11 | 4.3 |
| Government employee | 8 | 3.1 |
| Employee | 2 | 0.8 |
| Private business | 9 | 3.5 |
| Retired | 33 | 12.9 |
| **Income per month (n=256)** | | |
| ≤ 5,000 baht | 237 | 92.58 |
| > 5,000 baht | 19 | 7.42 |
| **Health insurance (n=256)** | | |
| Universal coverage (30 baht)         Government | 213 | 83.2 |
| officer welfare | 36 | 14.1 |
| Social security | 2 | 0.8 |
| No | 5 | 2.0 |
| **Medical history (n=256)** | | |
| Diabetes Mellitus | 97 | 37.9 |
| Diabetes Mellitus and other systemic disease | 159 | 62.1 |
| **Controlled diabetes (n=256)** | | |
| Yes | 159 | 62.1 |
| No | 97 | 37.9 |
| **Duration diabetes (n=256)** | | |
| ≤ 10 years | 170 | 66.4 |
| > 10 years | 86 | 33.6 |

**4.2 Distribution of oral health behaviors**

This study showed that 93.0 percent of diabetes patients cleaned the oral cavity used tooth brush, 50.4 percent used toothpicks. 93.0 percent brush the teeth in morning. While 64.8 percent did before bedtime. And almost of the diabetes patients (96.1%) did not brush after meals. As well as, Smoking behavior in diabetes patients showed that there were 25 diabetes patients smoking cigarettes (9.77%). 80.0 percent of this group smoked more than 10 years. and 80.0 percent smoked less than 10 rolls/day. Betel nut chewing behavior was notified that 40 diabetes patients chewed betel nut (15.6%). 72.2 percent of diabetes patients took dental service at government hospital. (Table 4)

Table 4: Distribution of oral health behaviors

| Characteristics | Number | Percentage |
|---|---|---|
| **Method clean oral cavity:** | | |
| **Tooth brushing (n=256)** | | |
| No | 18 | 7.0 |
| Yes | 238 | 93.0 |
| **Antiseptic mouth rinse (n=256)** | | |
| No | 227 | 88.7 |
| Yes | 29 | 11.3 |
| **Finger rub (n=256)** | | |
| No | 239 | 93.4 |
| Yes | 17 | 6.6 |
| **Toothpick (n=256)** | | |
| No | 127 | 49.6 |
| Yes | 129 | 50.4 |
| **Salt solution (n=256)** | | |
| No | 187 | 73.0 |
| Yes | 69 | 27.0 |

| Characteristics | Number | Percentage |
|---|---|---|
| **Time tooth brushing:** | | |
| **Morning (after wake up) (n=256)** | | |
| No | 18 | 7.0 |
| Yes | 238 | 93.0 |
| **After meal (n=256)** | | |
| No | 246 | 96.1 |
| Yes | 10 | 3.9 |
| **Before bedtime (n=256)** | | |
| No | 90 | 35.2 |
| Yes | 166 | 64.8 |
| **Not brush (n=256)** | | |
| No | 238 | 93.0 |
| Yes | 18 | 7.0 |
| **Smoking (n=256)** | | |
| No | 231 | 90.2 |
| Yes | 25 | 9.8 |
| **Duration smoking (n=25)** | | |
| $\leq 10$ years | 5 | 20.0 |
| $> 10$ years | 20 | 80.0 |
| **Quantity smoking (n=25)** | | |
| $\leq 10$ rolls/day | 20 | 80.0 |
| $> 10$ rolls/day | 5 | 20.0 |
| **Betel nut chewing (n=256)** | | |
| No | 216 | 84.4 |
| Yes | 40 | 15.6 |
| **Duration chewing (n=40)** | | |
| $\leq 10$ years | 20 | 50.0 |
| $> 10$ years | 20 | 50.0 |

| Characteristics | Number | Percentage |
|---|---|---|
| **Visit dentist in these year (n=256)** | | |
| No | 118 | 46.1 |
| Yes | 138 | 53.9 |
| **Chief complain:** | | |
| **Toothache or discomfort (n=256)** | | |
| No | 143 | 55.9 |
| Yes | 113 | 44.1 |
| **Tooth mobility (n=256)** | | |
| No | 130 | 50.8 |
| Yes | 126 | 49.2 |
| **Bleeding on brushing or mouth odor (n=256)** | | |
| No | 253 | 98.8 |
| Yes | 3 | 1.2 |
| **Dental caries or tooth cavity (n=256)** | | |
| No | 199 | 77.7 |
| Yes | 57 | 22.3 |
| **Calculus (n=256)** | | |
| No | 236 | 92.2 |
| Yes | 20 | 7.8 |
| **Check up (n=256)** | | |
| No | 249 | 97.3 |
| Yes | 7 | 2.7 |
| **Dental service at:** | | |
| **Government hospital (n=256)** | | |
| No | 70 | 27.3 |
| Yes | 186 | 72.7 |
| **Private dental clinic (n=256)** | | |
| No | 220 | 85.9 |
| Yes | 36 | 14.1 |

| Characteristics | Number | Percentage |
|---|---|---|
| **Dental service at** | | |
| **Health center (n=256)** | | |
| No | 247 | 96.5 |
| Yes | 9 | 3.5 |

### 4.3 Oral health status of diabetes patients

Oral health status of diabetes patients in Changhan district found that prevalence of coronal caries and root caries were 72.7% and 55.5%, respectively. The prevalence of periodontal disease was 91.8%.

Table 5: The prevalence of dental caries and periodontal disease

| Oral status | Number | Percentage |
|---|---|---|
| **Coronal caries (n=256)** | | |
| No | 70 | 27.3 |
| Yes | 186 | 72.7 |
| **Root caries (n=256)** | | |
| No | 114 | 44.5 |
| Yes | 142 | 55.5 |
| **Periodontal disease (n=256)** | | |
| No | 21 | 8.2 |
| Yes | 235 | 91.8 |

The mean DMFT (SD) was 9.98 (8.05) teeth/person. Mean DT (SD) was 2.86 (3.40) teeth/person. Mean MT (SD) 7.10 (7.20) teeth/person. And mean FT (SD) was 0.06 (0.42) teeth/person. Data indicated dental service (filled teeth) was very low rate, But tooth lossing was high rate. (Table 6)

Table 6: Distribution of mean Decay, Missing, Filling Teeth (DMFT)

| Oral status | Mean (S.D.) |
|---|---|
| **Mean DMFT** | 9.98 (8.05) |
| Decay  teeth (DT) | 2.86 (3.40) |
| Missing teeth (MT) | 7.10 (7.20) |
| Filled teeth (FT) | 0.06 (0.42) |

54.3 percent of diabetes patients had posterior occluded teeth equal / more than 4 pairs, Then patients in these group no needs denture for chewing food.

Table 7: Distribution of posterior occluded teeth

| Oral status | Number | Percentage |
|---|---|---|
| **Posterior occluded teeth (n = 256)** | | |
| < 4 pairs | 117 | 45.7 |
| ≥  4 pairs | 139 | 54.3 |

## 4.4 Association between general characteristics, oral health behavior and coronal caries in diabetes patients

Using Chi-square, the association between general characteristics (gender, age, education level, work, income, health insurance, medical history, controlled diabetes, duration diabetes), oral health behavior (tooth brushing , smoking, betel nut chewing), and coronal caries showed (Table 8) that, gender and betel nut chewing were significant association with coronal caries at $P\text{-value} < 0.05$ ($P\text{-value} = 0.022$ and 0.019, respectively). But there were no significant association between age, education level, work, income, health insurance, medical history, controlled diabetes, duration diabetes, tooth brushing, smoking and coronal caries.

Table 8: Association between general characteristics, oral health behavior and coronal
caries

| Variable | Caries free number(%) | caries number(%) | $\chi^2$ | P - value |
|---|---|---|---|---|
| **Gender (n = 256)** | | | | |
| male | 33(35.9) | 59(64.1) | 5.254 | **0.022** |
| female | 37(22.6) | 127(77.4) | | |
| **Age (n = 256)** | | | | |
| 40 - 60 years | 35(29.9) | 82(70.1) | 0.717 | 0.397 |
| > 60 years | 35(25.2) | 104(74.8) | | |
| **Education level (n = 256)** | | | | |
| under graduate | 69(27.6) | 181(72.4) | 0.353 | 1.000 |
| graduate | 1(16.7) | 5(83.3) | | |
| **Work (n = 256)** | | | | |
| Yes | 62(27.8) | 161(72.2) | 0.183 | 0.668 |
| No | 8(24.2) | 25(75.8) | | |
| **Income (n = 256)** | | | | |
| ≤ 5,000 baht | 66(27.8) | 171(72.2) | 0.409 | 0.523 |
| > 5,000 baht | 4(21.1) | 15(78.9) | | |
| **Health insurance (n = 256)** | | | | |
| 30-baht card | 56(26.3) | 157(73.7) | 0.707 | 0.400 |
| other | 14(32.6) | 29(67.4) | | |
| **Medical history (n = 256)** | | | | |
| diabetes | 28(28.9) | 69(71.1) | 0.182 | 0.670 |
| diabetes and other | 42(26.4) | 117(73.6) | | |
| **Controlled diabetes(n = 256)** | | | | |
| Yes | 43(27.0) | 116(73.0) | 0.019 | 0.890 |
| No | 27(27.8) | 70(72.2) | | |
| **Duration diabetes (n = 256)** | | | | |
| ≤ 10 years | 44(25.9) | 126(74.1) | 0.544 | 0.461 |
| > 10 years | 26(30.2) | 60(69.8) | | |

| Variable | Caries free number(%) | caries number(%) | $\chi^2$ | P - value |
|---|---|---|---|---|
| **Tooth brushing (n=256)** | | | | |
| No | 9(50.0) | 9(50.0) | 5.002 | 0.050 |
| Yes | 61(25.6) | 177(74.7) | | |
| **Antiseptic mouth rinse (n=256)** | | | | |
| No | 59(26.0) | 168(74.0) | 1.845 | 0.174 |
| Yes | 11(37.9) | 18(62.1) | | |
| **Finger rub (n=256)** | | | | |
| No | 64(26.8) | 175(73.2) | 0.579 | 0.415 |
| Yes | 6(35.3) | 11(64.7) | | |
| **Toothpick (n=256)** | | | | |
| No | 36(28.3) | 91(71.1) | 0.128 | 0.721 |
| Yes | 34(26.4) | 95(73.6) | | |
| **Salt solution (n=256)** | | | | |
| No | 53(28.3) | 134(71.7) | 0.348 | 0.555 |
| Yes | 17(24.6) | 52(75.4) | | |
| **Time tooth brushing:** | | | | |
| **Morning (n=256)** | | | | |
| No | 6(33.3) | 12(66.7) | 0.350 | 0.586 |
| Yes | 64(26.9) | 174(73.1) | | |
| **After meal (n=256)** | | | | |
| No | 68(27.6) | 178(72.4) | 0.282 | 0.732 |
| Yes | 2(20.0) | 8(80.0) | | |
| **Before bedtime (n=256)** | | | | |
| No | 23(25.6) | 67(74.4) | 0.223 | 0.636 |
| Yes | 47(28.3) | 119(71.7) | | |
| **Not brush (n=256)** | | | | |
| No | 61(25.6) | 177 (74.4) | 5.002 | 0.050 |
| Yes | 9(50.0) | 9(50.0) | | |

| Variable | Caries free number(%) | caries number(%) | $\chi^2$ | P - value |
|---|---|---|---|---|
| **Smoking (n=256)** | | | | |
| No | 11(44.0) | 14(56.0) | 3.869 | 0.049 |
| Yes | 59(25.5) | 172 (74.5) | | |
| **Duration smoking (n=25)** | | | | |
| ≤ 10 years | 4(80.0) | 1(20.0) | 3.287 | 0.133 |
| > 10 years | 7(35.0) | 13(65.0) | | |
| **Quantity smoking (n=25)** | | | | |
| ≤ 10 rolls/day | 10(50.0) | 10(50.0) | 1.461 | 0.341 |
| > 10 rolls/day | 1(20.0) | 4(80.0) | | |
| **Betel nut chewing (n=256)** | | | | |
| No | 17(42.5) | 23(57.5) | 5.481 | **0.019** |
| Yes | 53(24.5) | 163(75.5) | | |
| **Duration chewing (n=40)** | | | | |
| ≤ 10 years | 6(30.0) | 14(70.0) | 2.558 | 0.110 |
| > 10 years | 11(55.0) | 9(45.0) | | |

## 4.5 Association between general characteristics, oral health behavior and root caries in diabetes patients

The association between general characteristics (gender, age, education level, work, income, health insurance, medical history, controlled diabetes, duration diabetes) oral health behavior (tooth brushing , smoking, betel nut chewing) and root caries using Chi-square test showed (Table 9) that there were no significant association between gender, age, education level, work, income, health insurance, medical history, controlled diabetes, duration diabetes, tooth brushing , smoking and root caries. But the relation between betel nut chewing and duration chewing had significance association at *P-value* < 0.05 (*P-value* = 0.001 and 0.018 respectively).

Table 9: Association between general characteristics, oral health behavior and root caries

| Variable | Caries free number(%) | caries number(%) | $\chi^2$ | P - value |
|---|---|---|---|---|
| **Gender (n = 256)** | | | | |
| male | 41(44.6) | 51(55.4) | 0.000 | 0.993 |
| female | 73(44.5) | 91(55.5) | | |
| **Age (n = 256)** | | | | |
| 40 - 60 years | 59(50.4) | 58(49.6) | 3.033 | 0.082 |
| > 60 years | 55(39.6) | 84(60.4) | | |
| **Education level (n = 256)** | | | | |
| under graduate | 112(44.8) | 138(55.2) | 0.312 | 0.695 |
| graduate | 2(33.3) | 4(66.7) | | |
| **Work (n = 256)** | | | | |
| Yes | 100(44.8) | 123(55.2) | 0.068 | 0.794 |
| No | 14(42.4) | 19(57.6) | | |
| **Income (n = 256)** | | | | |
| ≤ 5,000 baht | 107(45.1) | 30(54.9) | 0.491 | 0.483 |
| > 5,000 baht | 7(36.8) | 12(63.2) | | |
| **Health insurance (n = 256)** | | | | |
| 30-baht card | 95(44.6) | 118(55.4) | 0.002 | 0.960 |
| other | 19(44.2) | 24(55.8) | | |
| **Medical history (n = 256)** | | | | |
| diabetes | 39(40.2) | 58(59.8) | 1.183 | 0.277 |
| diabetes and other | 75(47.2) | 84(52.8) | | |
| **Controlled diabetes(n = 256)** | | | | |
| Yes | 71(44.7) | 88(55.3) | 0.003 | 0.960 |
| No | 43(44.3) | 54(55.7) | | |
| **Duration diabetes (n = 256)** | | | | |
| ≤ 10 years | 75(44.1) | 95(55.9) | 0.035 | 0.851 |
| > 10 years | 39(45.3) | 47(54.7) | | |

| Variable | Caries free number(%) | caries number(%) | $\chi^2$ | P - value |
|---|---|---|---|---|
| **Tooth brushing (n=256)** | | | | |
| No | 11(61.1) | 7(38.9) | 2.155 | 0.142 |
| Yes | 103(43.3) | 135(56.7) | | |
| **Antiseptic mouth rinse (n=256)** | | | | |
| No | 99(43.6) | 128(56.4) | 0.685 | 0.408 |
| Yes | 15(51.7) | 14(48.3) | | |
| **Finger rub (n=256)** | | | | |
| No | 106(44.4) | 133(55.6) | 0.047 | 0.828 |
| Yes | 8(47.1) | 9(52.9) | | |
| **Toothpick (n=256)** | | | | |
| No | 52(40.9) | 75(59.1) | 1.312 | 0.252 |
| Yes | 62(48.1) | 67(51.9) | | |
| **Salt solution (n=256)** | | | | |
| No | 82(43.9) | 105(56.1) | 0.130 | 0.718 |
| Yes | 32(46.4) | 37(53.6) | | |
| **Time tooth brushing:** | | | | |
| **Morning (n=256)** | | | | |
| No | 11(61.1) | 7 (38.9) | 2.155 | 0.142 |
| Yes | 103(43.3) | 135(56.7) | | |
| **After meal (n=256)** | | | | |
| No | 111(45.1) | 135(54.9) | 0.890 | 0.519 |
| Yes | 3(30.0) | 7(70.0) | | |
| **Before bedtime (n=256)** | | | | |
| No | 41(45.6) | 49(54.4) | 0.059 | 0.808 |
| Yes | 73(44.0) | 93(56.0) | | |
| **Not brush (n=256)** | | | | |
| No | 103(43.3) | 135(56.7) | 2.155 | 0.142 |
| Yes | 11(61.1) | 7(38.9) | | |

| Variable | Caries free number(%) | caries number(%) | $\chi^2$ | P - value |
|---|---|---|---|---|
| **Smoking (n=256)** | | | | |
| No | 12(48.0) | 13(52.0) | 0.135 | 0.713 |
| Yes | 102(44.2) | 129(55.8) | | |
| **Duration smoking (n=25)** | | | | |
| ≤ 10 years | 4(80.0) | 1(20.0) | 2.564 | 0.160 |
| > 10 years | 8(40.0) | 12(60.0) | | |
| **Quantity smoking (n=25)** | | | | |
| ≤ 10 rolls/day | 11(55.0) | 9(45.0) | 1.963 | 0.322 |
| > 10 rolls/day | 1(20.0) | 4(80.0) | | |
| **Betel nut chewing (n=256)** | | | | |
| No | 27(67.5) | 13(32.5) | 10.125 | **0.001** |
| Yes | 87(40.3) | 129(59.7) | | |
| **Duration chewing (n=40)** | | | | |
| ≤ 10 years | 10(50.0) | 10(50.0) | 5.584 | **0.018** |
| > 10 years | 17(85.0) | 3(15.0) | | |

## 4.6 Association between general characteristics, oral health behavior and periodontal disease in diabetes patients

In table 10, the association between general characteristics (gender, age, education level, work, income, health insurance, medical history, controlled diabetes, duration diabetes) oral health behavior (tooth brushing , smoking, betel nut chewing) and periodontal disease (gingivitis, periodontitis) by Chi-square test showed that age had a significance association with peridontal disease at *P-value* < 0.05 (*p-value* = 0.001). Oral health behavior tooth brushing, use toothpick had significance relation with periodontal disease at *P-value* < 0.05 (*p-value*= 0.001 and 0.001, respectively) No significance relation between variable gender, education level, work, income, health insurance, medical history, controlled diabetes, duration diabetes, smoking, betel nut chewing and periodontal disease.

Table 10: Association between general characteristics, oral health behavior and periodontal disease

| Variable | Healthy periodontium number(%) | Periodontal disease number(%) | $\chi^2$ | P - value |
|---|---|---|---|---|
| **Gender (n = 256)** | | | | |
| male | 11(12.0) | 81(88.0) | 2.687 | 0.101 |
| female | 10(6.1) | 154(93.9) | | |
| **Age (n = 256)** | | | | |
| 40 - 60 years | 2(1.7) | 115(98.3) | 12.067 | **0.001** |
| > 60 years | 19(13.7) | 120(86.3) | | |
| **Education level (n = 256)** | | | | |
| under graduate | 21(8.4) | 229(91.6) | 0.549 | 1.000 |
| graduate | 0 | 6(100.0) | | |
| **Work (n = 256)** | | | | |
| Yes | 18(8.1) | 205(91.9) | 0.040 | 0.740 |
| No | 3(9.1) | 30(90.9) | | |
| **Income (n = 256)** | | | | |
| ≤ 5,000 baht | 21(8.9) | 216(91.1) | 1.834 | 0.380 |
| > 5,000 baht | 0 | 19(100.0) | | |
| **Health insurance (n = 256)** | | | | |
| 30-baht card | 15(7.0) | 198(93.0) | 2.269 | 0.135 |
| other | 6(14.0) | 37(86.0) | | |
| **Medical history (n = 256)** | | | | |
| diabetes | 4(4.1) | 93(95.9) | 3.451 | 0.063 |
| diabetes and other | 17(10.7) | 142(89.3) | | |
| **Controlled diabetes(n = 256)** | | | | |
| Yes | 13(8.2) | 146(91.8) | 0.000 | 0.984 |
| No | 8(8.2) | 89(91.8) | | |

| Variable | Healthy periodontium number(%) | Periodontal disease number(%) | $\chi^2$ | P - value |
|---|---|---|---|---|
| **Duration diabetes (n = 256)** | | | | |
| $\leq 10$ years | 10(5.9) | 10(5.9) | 3.619 | 0.057 |
| $> 10$ years | 11(12.8) | 11(12.8) | | |
| **Tooth brushing (n=256)** | | | | |
| No | 6(33.3) | 12(66.7) | 16.238 | **0.001** |
| Yes | 15(6.3) | 223(93.7) | | |
| **Antiseptic mouth rinse (n=256)** | | | | |
| No | 18(7.9) | 209(92.1) | 0.199 | 0.716 |
| Yes | 3(10.3) | 26(89.7) | | |
| **Finger rub (n=256)** | | | | |
| No | 18(7.5) | 221(92.5) | 2.157 | 0.153 |
| Yes | 3(17.6) | 14(82.4) | | |
| **Toothpick (n=256)** | | | | |
| No | 18(14.2) | 109(85.8) | 11.929 | **0.001** |
| Yes | 3(2.3) | 126(97.7) | | |
| **Salt solution (n=256)** | | | | |
| No | 17(9.1) | 170(90.9) | 0.726 | 0.394 |
| Yes | 4(5.8) | 65(94.2) | | |
| **Time tooth brushing:** | | | | |
| **Morning (n=256)** | | | | |
| No | 2(11.1) | 16(88.9) | 0.217 | 0.649 |
| Yes | 19(8.0) | 219(92.0) | | |
| **After meal (n=256)** | | | | |
| No | 21(8.5) | 225(91.5) | 0.930 | 1.000 |
| Yes | 0 | 10(100.0) | | |

| Variable | Healthy periodontium number(%) | Periodontal disease number(%) | $\chi^2$ | *P - value* |
|---|---|---|---|---|
| **Before bedtime (n=256)** | | | | |
| No | 8(8.9) | 82(91.1) | 0.087 | 0.768 |
| Yes | 13(7.8) | 153(92.2) | | |
| **Not brush (n=256)** | | | | |
| No | 15(6.3) | 223(93.7) | 16.238 | **0.001** |
| Yes | 6(33.3) | 12(66.7) | | |
| **Smoking (n=256)** | | | | |
| No | 3(12.0) | 22(88.0) | 0.530 | 0.442 |
| Yes | 18(7.8) | 213(92.2) | | |
| **Duration smoking (n=25)** | | | | |
| ≤ 10 years | 0 | 5(100.0) | 0.852 | 1.000 |
| > 10 years | 3(15.0) | 17(85.0) | | |
| **Quantity smoking (n=25)** | | | | |
| ≤ 10 rolls/day | 3(15.0) | 17(85.0) | 0.852 | 1.000 |
| > 10 rolls/day | 0 | 5(100.0) | | |
| **Betel nut chewing (n=256)** | | | | |
| No | 5(12.5) | 35(87.5) | 1.162 | 0.342 |
| Yes | 16(7.4) | 200(92.6) | | |
| **Duration chewing (n=40)** | | | | |
| ≤ 10 years | 2(10.0) | 18(90.0) | 0.229 | 1.000 |
| > 10 years | 3(15.0) | 17(85.0) | | |

# CHAPTER V
# DISCUSSION

This study was descriptive cross-sectional study about the prevalence of coronal caries, root caries, periodontal disease, and oral candidiasis in diabetes patients at Changhan district, Roi et province. And identification the influence factors - gender, age, occupation, income, education level, diabetes controlled, oral health behavior, tooth brushing, smoking, betel nut chewing that might affect the prevalence of coronal caries, root caries, periodontal disease, and oral candidiasis. In our study, data collection from 256 diabetes patients who came to take service follow appointment at diabetes clinic, out - patient department, Changhan Hospital, Roi et province. Majority were female (64.1%), average age (SD) was 60.79 (9.14) years old. 88.3 percent had primary school. 75.4 percent were farmer and low income less than 5,000 baht/month (92.58%). 83.2 percent used 30-baht card. 62.1 percent of diabetes patients had other systemic disease such as hypertension, heart disease. 62.1 percent could controlled diabetes and 66.4 percent had duration diabetes less than 10 years.

Oral health status of diabetes patients in Changhan district met that prevalence of coronal caries, root caries were 72.7% and 55.5%, respectively. This education was similar the diabetes patients in southern, Thailand. The prevalence of coronal caries and root caries were 83.8% and 40.0%, respectively. Type 2 diabetic patients compared with non-diabetic subjects had a higher prevalence of root surface caries but the prevalence of coronal caries was not significantly different. (Hintao et al., 2007)

The mean DMFT (SD) in diabetes patient, Changhan district was 9.98 (8.05), mean MT (SD) = 7.10 (7.20), mean FT(SD) = 0.06 (0.42). The study in Tehran, Iran met that diabetes patients had mean DMFT (SD) = 12.9 (6.1), mean MT (SD) = 5.0 (4.3), mean FT (SD) = 6.5 (4.4) (Bakhshandeh et al., 2008) From this data showed that diabetes patients in Junghan district, Roi-et province had dental health problem like diabetes patients in Iran. The mean FT showed diabetes patients took few dental service aspect prevention oral disease - such as filling teeth, annual oral health check

up. Thus should give the knowledge about oral health care, oral disease aspect oral health promotion, prevention and treatment oral disease. In order to reduce tooth lossing rate which effect to chew food and quality of life.

There are many literatures about diabetes and oral manifestation. The relationship between diabetes and dental caries has been investigated, but no clear association has been clarified. Salivary dysfunction (Xerostomia or dry mouth), which could increase risk of developing new and recurrent dental caries. Xerostomia can cause oral discomfort especially for patients with therapeutic dentures. The risk for oral candidiasis is markedly higher than in healthy individuals. (Ship, 2003; Soell et al., 2007) But, all diabetes patients in this study had not oral candidiasis.

No significance relation between oral health behavior and dental caries at 95% confidence level. Factors for caries development included the traditional elements for example Streptococcus mutans level, strong teeth (enamel), fluoride application, carbohydrate or sugar intake, salivary flow, salivary pH, oral behavior. (Ship, 2003)

The prevalence of periodontal disease in diabetes patients in our study was 91.8%. Factor age had significance association with periodontal disease at 95% confidence level. ($P$-value = 0.001) High prevalence of periodontal disease similar the study by Hintao et al., 2007 revealed that prevalence of periodontal disease was 98.1%, deeper periodontal pocket, more attachment loss, more bleeding on probing and a higher prevalence of generalized chronic periodontitis and severe periodontitis than non-diabetic subject. Li et al. studied oral health of diabetes patients at Beijing Gucheng, Chaina met that metabolic disease had a poor periodontal condition and periodontal inflammation was associated with metabolic disease (Li et al., 2009). Tanwir revealed that the patients with diabetes had fewer teeth, poor oral hygiene, expressed as an increased number of sites with plaque and more periodontitis as compared to a control group without diabetes. (Tanwir, 2008) There is a bidirectional interrelationship between diabetes and periodontal disease. Therapy of periodontal infection contributes to a positive glycemic control management. Diabetics have an increased predisposition to the manifestation of oral diseases. (Soell et al. (2007); Mealey and Oates (2006) Available data obtain from several studies strongly suggest diabetes as a risk for gingivitis and periodontitis.

Our study showed 93.0 percentages of diabetes patients cleaned oral cavity by tooth brushing, 3.9 percentages tooth brushing after meal. Study by Hin tao et al., 2007 met that diabetes patients in southern, Thailand clean oral cavity - tooth brushing twice per day was 83.3 percentages. But Mirza, 2007 studied 240 diabetes patients at Lahore, Pakistan showed that 22 percentages of diabetes patients cleaned oral cavity by tooth brushing twice per day, 2 percentages of participants brushed their teeth three time a day. (Mirza et al., 2007)

In this study, there was no association between coronal caries, root caries, periodontal disease and the diabetes-related variables including duration of DM, controlled diabetes which results according to study by Hin tao et al.(2007); Bridges et al.(1996).

Oral behavior– both tooth brushing and use toothpick had significance association with periodontal disease at *P-value*<0.05 (*P-value* = 0.001) Many studies had shown that the risk factors most directly associated with increases in prevalence and severe periodontal disease are (1) gender, with men experiencing greater levels than woman; (2) socioeconomic status, with higher education and income associated with lower levels; (3) number of teeth, with more teeth per person associated with greater severity; (4) smoking, with heavy smoking associated with greater severity; (5) age, with older adult exhibiting more loss of attachment than younger adult; (6) Diabetes mellitus and (7) poor oral hygiene, a number of bacteria pathogenic was also risk factors for periodontal disease. (Wilson and Kornman, 2003).

Strength knowledge by review literatures, smoking and types 1 and 2 diabetes are well-established risk factors for periodontal disease, whereas the etiologic microorganisms *P. gingivalis*, *T. forsythia* and *A. actinomycetemcomitans* are risk indicators. (Van Dyke and Dave, 2005) Tomar and Asma, 2000 studied about two population-based epidemiologic studies found that periodontitis is more common in smokers than nonsmokers. The number of cigarettes smoked per day is an important determinant of risk, doubling the risk for those in the lowest use category and increasing it sixfold in the subgroup smoking more than thirty cigarettes per day. Former smokers have lower rates of periodontitis than continuing smokers. (Tomar and Asma, 2000) Chatrchaiwiwatana and Ratanasiri (2009) revealed the relationship between tobacco smoking and periodontitis among rural northeastern Thai people.

This evident showed that tobacco smoking is a risk indicator for periodontitis and that tobacco smoking, which is directly associated with periodontitis among these populations, could enhance the possibility of increasing periodontitis and tooth extraction. (Chatrchaiwiwatana and Ratanasiri, 2009) But in our study, no significance association between smoking and coronal caries, root caries, periodontal disease. Result from this study controversy because there was few samples - 25 persons who smoke cigarette.

Betel nut chewing had significant association with dental caries (crown) at *P-value* < 0.05 (*P-value* = 0.019). The relationship between betel nut chewing, duration chewing and root caries had significance association at *P-value* (*P-value* = 0.001 and 0.018, respectively). But there were no significance relationship between betel nut chewing and periodontal disease. The results in this study was different from Chatrchaiwiwatana (2006) which studied the relationship between betel quid chewing and oral diseases in Khon Kaen province, Thailand. The results of Chatrchaiwiwatana (2006) showed that betel quid chewing may reduce dental caries, it was directly related to periodontitis and enhanced the possibility of increasing tooth loss. While the result our study found a small number of sample (40 persons) had been chewing betel nut.

The reasons that betel quid chewing diminishes dental caries are given as: 1) mechanical cleansing due to abrasive properties of betel quid chewing, 2) increased salivary buffer capacity, 3) high pH of lime in betel quid chewing neutralizes acid formation, 4) ion effect of calcium inhibits enamel dissolution, 5) betel film covers the enamel preventing acid attack, 6) high fluoride content of betel quid and 7) anti-cariogenic effect of etheric oils present in betel quid. (Moller, Pindborg and Effendi, 1977)  An effect of quid chewing on periodontium, i.e. the occurrence of periodontal pockets, gingival lesions and gum recession also had a higher incidence in quid chewers than in non-chewers. (Parmar et al., 2008)

# CHAPTER VI
# CONCLUSION AND RECOMMENDATIONS

## 1. Conclusion

This research was descriptive cross-sectional study about oral health status, influence factors of coronal caries, root caries, periodontal disease, lossing teeth and oral candidiasis in diabetes patients at Junghan district, Roi-et province. The population of this study was 256 diabetes patients who took for services follow appointment in November 18 – December 4, 2009 at diabetes clinic, out-patient department, Junghan hospital. The simple random sampling technic was applied to choose diabetic patients. Inclusion criteria; diabetes patients both male and female who had age more than 40 years old, could help oneself and allowed to interview and oral examination, no pregnant. Independent variables were gender, age, occupation, income, education, controlled diabetes, duration diabetes, oral health behavior; tooth brushing, smoking, betel nut chewing. And dependent variables were oral health status; dental caries area crown, root, missing tooth, filled tooth, periodontal disease, oral candidiasis. Measurement tool in this study was questionnaire oral behavior and oral health examination which adapted from WHO and Ministry of public health which use in The 6th Oral Health Survey, Thailand 2007. And equipments for oral examination were plain mouth mirror, WHO periodontal probe. Standardize interviewer; the interviewers were trained to understand the questionnaire. Standardize dentist; Only one dentist (researcher) examined diabetes patients' oral cavity. The internal reliability of diagnosis dental caries, periodontal disease. Analysis internal reliability with statistic Kappa was 0.92. Data analysis; statistical technique was descriptive statistic. Frequencies distribution, amounts, means, percentages, standard deviations were used to describe the general characteristic, oral health behavior. Chi-square was used to test the association between influence factors and oral disease (dental caries area crown, root, periodontal disease). The study was submitted to the Ethic in Research Committee, Chulalongkorn University.

The research found that majority were female (64.1%), average age (SD) was 60.79 (9.14) years old. 88.3 percent studied primary school. 75.4 percent were farmer.

Most of them had low income less than 5,000 baht/month (92.58%). 83.2 percent used 30-baht card. 62.1 percent of diabetes patients had other systemic disease such as hypertension, heart disease. 62.1 percent could controlled diabetes and 66.4 percent had diabetes symptoms less than 10 years.

93.0 percent of diabetes patients clean the oral cavity by tooth brushing, 50.4 percent used toothpicks. 93.0 percent brush the teeth in morning, 64.8 percent tooth brushing before bedtime. And majority of diabetes patients (96.1%) did not brush after meals. Smoking behavior in diabetes patients met that there were 25 diabetes patients smoke cigarettes (9.77%). 80.0 percent of these group smoked more than 10 years. and 80.0 percent smoked less than 10 rolls/day. Betel nut chewing behavior met that 40 diabetes patients chew betel nut (15.6%). 72.2 percent of diabetes patients take dental service at government hospital.

Oral health status of diabetes patients in Changhan district found that prevalence of coronal caries and root caries, were 72.7% and 55.5%, respectively. The mean DMFT (SD) was 9.98 (8.05) teeth/person. Mean DT (SD) was 2.86 (3.40) teeth/person. Mean MT (SD) was 7.10 (7.20) teeth/person. And mean FT (SD) was 0.06 (0.42) teeth/person. 54.3 percentages of diabetes patients had posterior occluded teeth equal/more than 4 pairs.

The prevalence of periodontal disease was 91.8%. All diabetes patients in this study had not oral candidiasis.

The association between general characteristics (gender, age, education level, work, income, health insurance, medical history, controlled diabetes, duration diabetes) oral health behavior (tooth brushing , smoking, betel nut chewing) and coronal caries, root caries, periodontal disease found that gender, betel nut chewing had significant association with coronal caries at $P\text{-}value < 0.05$ ($P\text{-}value = 0.022$ and 0.019, respectively). The relationship between betel nut chewing, duration chewing and root caries had significance association at $P\text{-}value < 0.05$ ($P\text{-}value = 0.001$ and 0.018, respectively). Age, oral health behavior tooth brushing, use toothpick had significance relation with periodontal disease at $P\text{-}value < 0.05$ ($p\text{-}value = 0.001$, 0.001 and 0.001, respectively). No significant association between smoking and periodontal disease.

**2. Recommendation**

**Oral health programs for older people**

Clinical intervention

As for other age groups, use of fluoride is effective in prevention of dental caries in elderly. Topical application and mouthrinsing with fluorides are shown to reduce the number of root surface caries lesions, both in active old-age people. Rinsing with a chlorhexidine solution tends to reduce gingival inflammation, pocket depth, and incidence of denture stomatitis. Clinical studies suggest that oral health education for elderly patients is effective. A randomized clinical trial for older periodontal patients revealed that group-based behavior modification intervention helped patients improve their self-care skills such as brushing and flossing, and reduced gingival bleeding.

Community-based health promotion and oral disease prevention

Oral health programs have been designed to improve the oral health status of the elderly. For example, an oral health care program established for residents of nursing homes, the program demonstrated a reduction in the number of teeth with decay and periodontal treatment need, reduced prevalence of denture stomatitis, and improved denture hygiene. Some programs focused on education of care givers for improved oral health status of elderly, and tried to break down practical, informational, and psychological barriers to caregivers' provision of oral care for residents. The program aimed at empowerment and self-care capacity building of older people and enhanced their attitudes, knowledge and oral hygiene practices, and in addition increased their use of dental health services. In many developed countries today, It is essential to increase the involvement of other health professionals and caregivers in oral health education and promotion programs for older people in order to overcome the barriers in oral health service utilization, to improve self-care capacity in oral health and provide for a healthy diet and nutrition amongst the elderly. The WHO Oral Health Program encourages national oral health planners to strengthen the implementation of systematic oral health programs oriented towards better oral health and quality of life for older people. (Petersen and Yamamoto, 2005)

WHO's role and responsibilities in health research are underpinned by several principles. These include a commitment to using knowledge gained from appropriate

review of existing research that may contribute to improving health, generating essential tools, and evaluating the quality and usefulness of interventions, methodologies, and programs; to strengthening the role and functioning of co-sponsored research programs, in areas that are of particular significance to developing countries and for which coordinated global action is required. (Petersen, 2009)

To strengthen the formulation or adjustment of policies and strategies for oral health and its integration in national and community health programs, particular emphasis should be laid on the elements, for example, promotion of oral health among older people, aiming at advancing oral health, general health and well-being into old age through a life-course perspective in health promotion, integrated disease prevention and emphasis on age-friendly primary health care. The Sixtieth World Health Assembly (WHA60.17) emphasize the need to incorporate programs for promotion of oral health and prevention oral disease into programs for the integrated prevention and treatment of non-communicable disease, which has been highlighted in the Eleventh General Program of Work 2006-2015. (Petersen, 2008)

Effective evidence-base preventive approaches are needed to address oral health problem. The Ottawa Charter was published to provide a set of guiding principles for health promotion. Health Promotion Action are outlined:

Build Healthy Public Policy

Health promotion goes beyond health care. It puts health on the agenda of policy makers in all sectors and at all levels, directing them to be aware of the health consequences of their decisions and to accept their responsibilities for health.

Create Supportive Environments

Changing patterns of life, work and leisure have a significant impact on health. The way society organizes work should help create a healthy society. Health promotion generates living and working conditions that are safe, stimulating, satisfying and enjoyable. The protection of the natural and built environments and the conservation of natural resources must be addressed in any health promotion strategy.

Strengthen Community Actions

Health promotion works through concrete and effective community action in setting priorities, making decisions, planning strategies and implementing them to achieve better health. At the heart of this process is the empowerment of communities

their ownership and control of their own endeavours. This requires full and continuous access to information, learning opportunities for health, as well as funding support.

Developed Personal Skills

Health promotion supports personal and social development through providing information, education for health, and enhancing life skills. Enabling people to learn, throughout life, to prepare themselves for all of its stages and to cope with chronic illness and injuries is essential. This has to be facilitated in school, home, work and community settings.

Reoriented Health Services

The responsibility for health promotion in health services is shared among individuals, community groups, health professionals, health service institutions and governments. The role of the health sector must move increasingly in a health promotion direction, beyond its responsibility for providing clinical and curative services. Health services should support the needs of individuals and communities for a healthier life. Reorienting health services also requires stronger attention to health research as well as changes in professional education and training. This must lead to a change of attitude and organization of health services which refocuses on the total needs of the individual as a whole person. (Watt, 2005)

Accordingly, Thai government prepares Thai social to ageing society, and set strategy in the National Elderly Plan 2 year 2002-2021. (Ministry of Information and Communication Technology, Bureau of National Statistical Office of Thailand. 2007)

From the study finding, diabetes patients had dental health problem i.e. dental caries, periodontal disease. The available scientific evidence is particularly strong for a direct relationship between diabetes and periodontal disease. General and associated oral health conditions have a direct influence on elder people's quality of life and lifestyle, which is interesting for further study.

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**APPENDICIES**

## APPENDIX A

## ORAL EXAMINATION AND QUESTIONNAIRE FORM
## CHANGHAN HOSPITAL, CHANGHAN DISTRICT,
## ROI ET PROVINCE, THAILAND

Form code…………

Examiner…………………………… Interviewer………………………….

Date…………………………........ Time…………………………………...

**PART I General Information**

1. Name…………………………………………….. HN. ……………………..

2. Gender

   ☐ 1.Male

   ☐ 2.Female

3. Age ………………years old

4. Fasting plasma glucose …………………. mg/dl

5. Education

   ☐ 1.Cannot read or write

   ☐ 2.Primary school

   ☐ 3.Secondary school

   ☐ 4.Occupation training

   ☐ 5.Bachelor degree

   ☐ 6.Upper bachelor degree

   ☐ 7.Other(specify)…………………………

6. Occupation

   ☐ 1.Farmer

   ☐ 2.General worker

   ☐ 3.Government employee

   ☐ 4.Employee

   ☐ 5.Private business

   ☐ 6.retired

☐ 7.Other(specify)................................

7. Income per month

        ☐ 1.Under 3,000 baht

        ☐ 2. 3,001-5,000 baht

        ☐ 3. 5,001-10,000 baht

        ☐ 4. More than 10,000 baht

8. Health insurance

        ☐ 1.Universal coverage (30 baht)

        ☐ 2.Government officer welfare

        ☐ 3.Social security

        ☐ 4. Not have

9. Medical history

        ☐ 1. Diabetes Mellitus

        ☐ 2. Diabetes Mellitus and Hypertension

        ☐ 3. Diabetes Mellitus and Heart disease

        ☐ 4. Diabetes Mellitus and others (specify)……………….

10. How long do you have Diabetes Mellitus?

        ☐ 1. Less than 5 years

        ☐ 2. 5-10 years

        ☐ 3. More than 10 years

**PART II  Oral health behavior**

11. Which method do you clean your oral cavity? (can answer more than 1 choice)

        ☐ 1. Tooth brushing

        ☐ 2. Antiseptic mouth rinse

        ☐ 3. Finger rub

        ☐ 4. Dental floss

        ☐ 5. Toothpick

        ☐ 6. Interproximal brush

        ☐ 7.Salt solution mouthrinse

        ☐ 8. Other(specify)................................

12. Which time do you brush your teeth?  (can answer more than 1 choice )

      ☐ 1. Morning (after wake up)

      ☐ 2. After meal

      ☐ 3. Before bedtime

      ☐ 4. Not brush

13. Do you smoking?

      ☐ 1.Yes  (please answer NO.14)

      ☐ 2. No

14. How many years do you smoking and how many rolls per day?

      …………………… years

      ……………………roll / day

15. Do you chewing betel nut?

      ☐ 1.Yes  (please answer NO.16)

      ☐ 2. No

16. How many years do you chewing betel nut?

      ………………… years

17. Do you visit dentist in these year?

      ☐ 1. No

      ☐ 2. Yes

      ☐ 3. Can not remember

18. What is the chief complain that you visit dentist? (can answer more than 1 choice)

      ☐ 1.Toothache or discomfort

      ☐ 2.Tooth mobility

      ☐ 3.Bleeding on brushing or mouth odor

      ☐ 4.Dental caries or tooth cavity

      ☐ 5. Calculus

      ☐ 6. have abnormal in oral cavity

      ☐ 7. Check up

      ☐ 8. Dentist appointment

19. Where do you go to visit dentist? (can answer more than 1 choice )

      ☐ 1.Government hospital

      ☐ 2.Private dental clinic

☐ 3. Health center

☐ 4. Other(specify)...............................

## PART III  ORAL  EXAMINATION
## DENTITION STATUS

|        | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 |
|--------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Crown  |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Root   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |

|        | 48 | 47 | 46 | 45 | 44 | 43 | 42 | 41 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 |
|--------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Crown  |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Root   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |

**Crown**

0  Sound

1  Decayed

2  Filled, with decayed

3  Filled, no decayed

4  Missing, any other reason

5  Bridge abutment, crown

6  Unerupted tooth

T  Trauma (Fracture)

**Root**

0  Sound

1  Decayed

2  Filled, with decayed

3  Filled, no decayed

8  Unexposed root

9  Not record

**COMMUNITY PERIODONTAL INDEX (CPI)**

| 17/16 | 11 | 26/27 |
|-------|----|-------|
|       |    |       |
|       |    |       |
| 47/46 | 31 | 36/37 |

| | | |
|---|---|---|
| 0 | Healthy | 5 Calculus with bleeding |
| 1 | Bleeding | 9 Not recorded |
| 2 | Calculus | |
| 3 | Pocket 4-5 mm | |
| 4 | Pocket 6 mm. or more | |

**PROSTHETIC STATUS**        **POSTERIOR**

**OCCLUSAL PAIRS**

| Upper | Lower |
|-------|-------|
|       |       |

| Right | Left |
|-------|------|
|       |      |

0   No prosthesis

1   Bridge

2   More than one bridge

3   Partial denture

4   Both bridge(s) and partial denture(s)

5   Full denture

9   Not recorded

**PROSTHETIC NEED**

| Upper | Lower |
|-------|-------|
|       |       |

0   No prosthesis needs

1   Need for one-unit prosthesis

2   Need for multi-unit prosthesis

3   Need for full prosthesis (replacement of all teeth)

4   Need to repair denture

9   Not to repair denture

**ORAL CANDIDIASIS STATUS**

☐ Yes

☐ No

# APPENDIX  B

## แบบบันทึกการตรวจฟันและแบบสัมภาษณ์พฤติกรรมทันตสุขภาพ ผู้ป่วยเบาหวาน

## โรงพยาบาลจังหาร  อำเภอจังหาร  จังหวัดร้อยเอ็ด

ผู้ตรวจ......................................... ผู้สัมภาษณ์......................................... หมายเลข.........................

วันที่ ...................................     เวลา...................................

ส่วนที่ 1 ข้อมูลทั่วไป

1. ชื่อ...................................................     HN..........................................

2. อายุ.........................ปี

3. ระดับน้ำตาลในเลือด ...........................mg / dl

4. เพศ              1.ชาย                    2.หญิง

5. ระดับการศึกษา       1.ไม่ได้เรียน              2.ประถมศึกษา              3.มัธยมศึกษา

                        4.ปวช. / ปวส.           5.ปริญญาตรี              6.สูงกว่าปริญญาตรี

                        7.อื่นๆ ระบุ................................

6. อาชีพ              1.เกษตรกร              2.รับจ้าง / ผู้ใช้แรงงาน      3.รับราชการ / รัฐวิสาหกิจ

                        4.พนักงานบริษัท         5.ค้าขาย                 6.ไม่ได้ทำงาน

                        7.อื่นๆ ระบุ................................

7. รายได้เฉลี่ยต่อเดือน       1. ต่ำกว่า 3,000 บาท              2. 3,001 - 5,000 บาท

                        3. 5,001 - 10,000 บาท           4. มากกว่า  10,000 บาท

8. สิทธิการรักษาพยาบาล      1.บัตรประกันสุขภาพทั่วหน้า (30 บาท)      2.เบิกได้

                        3.ประกันสังคม                          4.จ่ายเงินเอง

9. ประวัติโรคประจำตัว       1.โรคเบาหวาน

                        2.โรคเบาหวาน และความดันโลหิตสูง

                        3.โรคเบาหวาน และโรคหัวใจ

4.โรคเบาหวาน และโรคอื่นๆ ระบุ.............................................

10. ป่วยเป็นโรคเบาหวานมากี่ปี     1.น้อยกว่า 5 ปี

           2. 5- 10 ปี

           3.มากกว่า 10 ปี

**ส่วนที่ 2  ข้อมูลพฤติกรรมทันตสุขภาพ**

11. ท่านทำความสะอาดช่องปากด้วยวิธีใด (ตอบได้มากกว่า 1 ข้อ)

    1.แปรงฟัน      2.บ้วนปากด้วยน้ำยาบ้วนปาก     3.ใช้มือถูฟัน     4.ใช้ไหมขัดฟัน

    5.ใช้ไม้จิ้มฟัน     6.ใช้แปรงซอกฟัน           7.อมเกลือ      8.อื่นๆ ระบุ..............

12. ท่านแปรงฟันช่วงเวลาใด (ตอบได้มากกว่า 1 ข้อ)

    1.หลังตื่นนอนตอนเช้า             2.หลังอาหารทุกมื้อ

    3.ก่อนนอน             4.ไม่ได้ทำ

13. ท่านสูบบุหรี่หรือไม่     1.สูบ ตอบข้อ 14     2.ไม่สูบ

14. ถ้าท่านสูบบุหรี่     1.สูบมานาน.................ปี

          2.ปริมาณการสูบเฉลี่ย ................มวน / วัน

15. ท่านเคี้ยวหมากหรือไม่     1.เคี้ยว ตอบข้อ 16     2.ไม่เคี้ยว

16. ถ้าท่านเคี้ยวหมาก  เคี้ยวมานาน...................ปี

17. ในรอบปีที่ผ่านมา ท่านไปหาหมอฟันบ้างหรือไม่

    1.ไม่เคย      2.เคยไป     3.จำไม่ได้

18. ท่านไปหาหมอฟันเพราะอะไร (ตอบได้มากกว่า 1 ข้อ)

    1.มีอาการปวดฟัน หรือ เสียวฟัน          2.ฟันโยก เคี้ยวอาหารไม่ได้

    3.มีเลือดออกเวลาแปรงฟัน หรือมีกลิ่นปาก     4.ฟันผุ หรือมีจุดดำบนตัวฟัน

    5.มีหินปูนที่ตัวฟัน              6.มีสิ่งผิดปกติในช่องปาก

    7.ต้องการไปตรวจสุขภาพช่องปาก       8.หมอฟันนัด

19.ท่านไปหาหมอฟันที่ไหนบ้าง (ตอบได้มากกว่า 1 ข้อ)

   1.โรงพยาบาลรัฐ                         2.คลินิกเอกชน

   3.สถานีอนามัย                         4.อื่นๆ ระบุ.......................................

**ส่วนที่ 3 ข้อมูลการตรวจช่องปาก**

DENTITION STATUS

|       | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 |
|-------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Crown |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Root  |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |

|       | 48 | 47 | 46 | 45 | 44 | 43 | 42 | 41 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 |
|-------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Crown |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Root  |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |

| Crown | |
|---|---|
| 7 | Sound |
| 8 | Decayed |
| 9 | Filled, with decayed |
| 10 | Filled, no decayed |
| 11 | Missing, any other reason |
| 12 | Bridge abutment, crown |
| 13 | Unerupted tooth |
| T | Trauma (Fracture) |

| Root | |
|---|---|
| 4 | Sound |
| 5 | Decayed |
| 6 | Filled, with decayed |
| 7 | Filled, no decayed |
| 8 | Unexposed root |
| 9 | Not record |

COMMUNITY PERIODONTAL INDEX (CPI)

| 17/16 | 11 | 26/27 |
|-------|----|-------|
|       |    |       |
|       |    |       |
| 47/46 | 31 | 36/37 |

0   Healthy

1   Bleeding

2   Calculus

3   Pocket 4-5 mm.

4   Pocket 6 mm. or more

5   Calculus with bleeding

9   Not recorded

PROSTHETIC STATUS

| Upper | Lower |
|-------|-------|
|       |       |

POSTERIOR OCCLUSAL PAIRS

| Right | Left |
|-------|------|
|       |      |

0   No prosthesis

1   Bridge

2   More than one bridge

3   Partial denture

4   Both bridge(s) and partial denture(s)

5   Full denture

9   Not recorded

PROSTHETIC NEED

| Upper | Lower |
|-------|-------|
|       |       |

0   No prosthesis needs

1   Need for one-unit prosthesis

2   Need for multi-unit prosthesis

3   Need for full prosthesis (replacement of all teeth)

4   Need to repair denture

9   Not to repair denture

ORAL CANDIDIASIS STATUS  :  ☐ Yes

☐ No

# CURRICULUM  VITAE

| | |
|---|---|
| **Name** | : Mrs. Narumol  Srisaphum |
| **Age** | : 36 years old |
| **Date of Birth** | : 5 November 1973 |
| **Place of Birth** | : Bangkok, Thailand |
| **Education** | : Bachelor degree of Dentistry, Khon Kaen University |
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