# Prevalence of Chronic Kidney Disease in Type 2 Diabetes in Primary Health Care Unit of Udon Thani Province, Thailand

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***Objective:*** *To determine the prevalence of chronic kidney disease (CKD) in Type 2 diabetes and risk factors of decreased kidney function in Type 2 diabetes at primary health care unit of Udon Thani province.*
***Material and Method:*** *A descriptive cross-sectional study, cluster random sampling method was conducted from April to August 2007. Seven hundred and sixteen patients were enrolled. Medical histories, physical examinations, and blood tests for glucose, creatinine, total cholesterol, and triglyceride after 9-12 hours fasting were collected. The definition and classification of CKD are classified according to K/DOQI guideline 2002.*
***Results:*** *The mean age of the diabetic patients was 58.70 $\pm$ 9.83 years ranged from 30 to 92 years old. The mean duration of diabetes was 5.53 $\pm$ 4.62 years, the majority (82.41%) had diabetes less than 10 years. More than half (51.82%) were obese (BMI $\geq$ 25 kg/m$^2$). Most of them (89.39%) had universal coverage health assurance. According to the ADA guideline 2006, the target systolic blood pressure, diastolic blood pressure, fasting plasma glucose, total cholesterol, and triglyceride level could be achieved 55.45, 52.93, 36.31, 33.66, and 45.65% respectively. The prevalence of CKD stage 3 to 5 were 27.09 and 25.28% by using C-G and MDRD formulae respectively. The duration of diabetes, diabetes with history of hypertension, triglyceride level, and diabetic retinopathy were significant independent risk factors of the presence of decreased kidney function processed by logistic regression analysis.*
***Conclusion:*** *The present study demonstrated the clinical characteristic and the prevalence of decreased kidney function in type 2 diabetes in a primary health care setting. Intensive and optimal treatment of diabetes to slow the progression of long-term complications should be effectively managed by a disciplinary team.*

***Keywords:*** *Chronic kidney disease, Prevalence, Type 2 Diabetes, Thai*

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Chronic Kidney Disease (CKD) is a major public health problem worldwide including Thailand. It cannot be cured. Furthermore, the management of CKD is costly. Especially when affected patients end up to be end stage renal disease (ESRD), the average dialysis expenditures are 250,000-300,000 baht per year[1]. The estimated incidence rate of ESRD in Thai population is 300 per million meanwhile there were new cases around 14,060 in 2005[2].

Nephropathy is one of the most serious microvascular complications of diabetes. At least 40% of diabetic patients worldwide developing chronic kidney disease and over 10% developing ESRD[3]. Diabetic kidney disease (DKD) is the major cause of ESRD. Sirivongs reported diabetes mellitus was found 62% in patients whose serum creatinine was between 2-4 mg/dl[4].

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Since 2006 the International Society of Nephrology (ISN) and International Federation of Kidney Foundations (IFKF) established a World Kidney Day on the second Thursday in March each year[5]. The message to broadcast was "Early detection and prevention of CKD". In Udon Thani province, corresponded to the policy of the Nephrology Society of Thailand, early detection and prevention program was focused on diabetic and hypertensive patients since 2006. According to the public health and universal health care coverage policy, screening for diabetes in a population above 40 years old and diabetic risk groups were performed in Primary Health Care Unit (PCU). The incidence of diabetes is increasing each year. Patients in communities prefer to visit PCU for avoiding of overcrowding from the outpatient department in Udon Thani Hospital. Patients with chronic complications or uncontrolled clinical or metabolic outcomes were indicated to refer for intensive treatments to slow the progression of complications or for optimal assessments and treatments.

The purpose of the present study was to determine the prevalence of CKD in Type 2 diabetes and to identify independent risk factors associated with the presence of decreased kidney function in diabetes in primary health care unit of Udon Thani.

## Material and Method

### *Inclusion criteria*

Type 2 diabetic patients with or without hypertension in Muang district of Udon Thani province and visited regularly in PCU who might have referred in/out central hospital according to the diabetes treatment guideline.

### *Exclusion criteria*

Type 2 diabetic patients in Muang district who visited other hospitals or private medical care clinics and who had co-diagnosis of urinary stones.

A descriptive cross-sectional study was conducted between April and August 2007. The sample size was calculated by using the following formula, with a 95% confident interval. Prevalence (P) was derived from a pilot study in 2006, decreased kidney function in diabetes was found 35%, d was expected 10% of P.

$$N = (Z_{\alpha/2})^2 P (1-P) / d^2$$

The sample size was at least 714 subjects. Cluster random sampling method was used. The thirty-one Primary Health Care Units (PCUs) in Muang district were divided to six zones according to the geographic and supervised areas. There were six PCUs randomly selected from six zones. Seven hundred sixteen study subjects were included. Their medical histories were interviewed and physical examinations include body weight, height, waist circumference, blood pressure and palpation of dorsalis pedis pulse were measured by nurse practitioners. Capillary blood samples by finger pricks were assessed for glucose, creatinine, total cholesterol and triglyceride after 9-12 hours fasting. Blood tests were determined by desktop-analyzer (Reflotron® Plus). They were not measured for HbA1c and urine micro-albumin due to some limitations. The fundoscopic examinations were done by photographing during dilated pupils, they were interpreted first by a practiced physician and then ophthalmologist respectively. The recent usage of medications such as hypoglycemic agents, antihypertensive agents, lipid lowering agents and aspirin were retrieved from medical records.

### *Definition*

The definition and classification of CKD followed the Kidney Disease Outcomes Quality Initiative (K/DOQI) guideline 2002[6]. Estimated glomerular filtration rate (GFR) was calculated using the Modification of Diet in Renal Disease (MDRD) study equation. [$GFR = 186.3 \times (SCr)^{-1.154} \times (age)^{-0.203}$ (x 0.742 if female)]. Creatinine clearance was estimated by the Cockcroft-Gault formula (C-G formula). [CCr = {(140 - age) x body weight (kg) / 72 x SCr} x 0.85 for female].

Body surface area (BSA) was calculated by an equation,

$$BSA = \sqrt{\frac{weight(kg) \times Height(cm)}{3600}}$$

Body Mass Index (BMI) was defined as body weight (kg) / height $(m)^2$. Normal BMI for Asian was 18.5-22.99 $kg/m^2$, BMI $\geq$ 23 $kg/m^2$ was defined as overweight and BMI $\geq$ 25 $kg/m^2$ was obesity[7].

Waist circumference was measured in centimeter (cm) at upright position over umbilicus during full expiration. Asian male > 90 cm, female > 80 cm was defined as abdominal obesity[7].

### *Statistical analysis*

All data were analyzed by descriptive statistics, expressed in number, percentage, mean $\pm$ standard deviation (SD). The statistical associations between the variables were assessed by logistic regression analysis and comparison of percentage between groups was made with the Chi-square test. A p-value $< 0.05$ was considered statistically significant.

## Results

Seven hundred and sixteen diabetic patients were enrolled from 6 primary health care units in Muang district of Udon Thani province, including 542 females (75.70%) and 174 males (24.30%). Their mean ages were 58.70 ± 9.83 years, ranged from 30 to 92 years old, with 69.39% of them aged between 50 - 69 years old. The mean duration of diabetes was 5.53 ± 4.62 years and most of them (43.72%) had had diabetes for 1-4.9 years, and 30.17% for 5-9.9 years. Meanwhile the majority of them (82.41%) had diabetes less than 10 years (Table 1, 2).

The mean body weight, height, and BMI were 61.81 ± 11.14 kg, 155 ± 7 cm, and 25.57 ± 4.24 kg/m$^2$ respectively. Half of them (51.82%) were obese; over weight and normal BMI accounted for 19.69% and 28.49%. Abdominal obesity was noted in 39.66% of males and 72.88% of females. Current cigarette smoking was observed in 4.89%. Most of the patients (89.39%) had universal coverage health assurance (Table 1, 2).

The clinical and metabolic outcomes of these patients, composed of mean systolic, diastolic blood pressure (SBP, DBP) and fasting plasma glucose (FPG) were 129.0 ± 44.3 mmHg, 77.4 ± 24.6 mmHg and 148.2 ± 43.8 mg/dl respectively. The percentage of patients who achieved treatment goal according to the American Diabetes Association (ADA) guideline 2006[8] were 55.45, 52.93, and 36.31% respectively. The lipid profile, mean total cholesterol, and triglyceride levels were 225.4 ± 52.7 and 183.3 ± 104.9 mg/dl respectively. Achievement to treatment target was 33.66 and 45.65% (Table 3, Fig.1).

According to K/DOQI guideline, patients with decreased kidney function were defined as the presence of GFR < 60 ml/min/1.73 m$^2$ using C-G and MDRD formulae which were found in 27.09 and 25.28% respectively. The prevalence of ESRD was 0.84%, equally for both formulae (Table 4).

If the decreased kidney function was defined as elevated serum creatinine ≥ 1.4 mg/dl for male or ≥ 1.2 mg/dl for female, CKD was found 32.96% in diabetic patients (Table 5).

To study the association between risk factors and the presence of decreased kidney function, eight independent risk factors were entered to the logistic regression analysis; these variables were duration of diabetes, history of hypertension, smoking status, BMI, waist circumference, cholesterol level, triglyceride level, and the presence of diabetic retinopathy. The result of analysis showed that duration of diabetes, history of hypertension, triglyceride levels and diabetic

**Table 1.** Epidemiologic data of the diabetic patients (n = 716)

| | Mean ± SD | Range |
|---|---|---|
| Age (yr) | 58.70 ± 9.83 | 30-92 |
| Male | 59.45 ± 9.50 | 32-86 |
| Female | 58.46 ± 9.93 | 30-92 |
| Duration (yr) | 5.53 ± 4.62 | 1 mo-30 |
| Body weight (kg) | 61.81 ± 11.14 | 35-110 |
| Height (cm) | 155.00 ± 7.00 | 139-182 |
| Body mass index (kg/m$^2$) | 25.57 ± 4.24 | 15.63-48.89 |

**Table 2.** Epidemiologic data of the diabetic patients (n = 716)

| | | Number | Percent |
|---|---|---|---|
| Gender | | | |
| Male | | 174 | 24.30 |
| Female | | 542 | 75.70 |
| Age distribution (yr) | | | |
| | 30-39 | 18 | 2.52 |
| | 40-49 | 95 | 13.27 |
| | 50-59 | 267 | 37.26 |
| | 60-69 | 230 | 32.13 |
| | 70-79 | 99 | 13.83 |
| | ≥ 80 | 7 | 0.98 |
| Duration (yr) | | | |
| | < 1 | 61 | 8.52 |
| | 1-4.9 | 313 | 43.72 |
| | 5-9.9 | 216 | 30.17 |
| | 10-14.9 | 91 | 12.71 |
| | 15-19.9 | 20 | 2.79 |
| | ≥ 20 | 15 | 2.09 |
| Body mass index (kg/m$^2$) | | | |
| Total | < 23 | 204 | 28.49 |
| | 23-24.99 | 141 | 19.69 |
| | ≥ 25 | 371 | 51.82 |
| Male (n = 175) | < 23 | 48 | 27.59 |
| | 23-24.99 | 42 | 24.14 |
| | ≥ 25 | 84 | 48.28 |
| Female (n = 547) | < 23 | 156 | 28.78 |
| | 23-24.99 | 99 | 18.27 |
| | ≥ 25 | 287 | 53.95 |
| Waist circumference (cm) | | | |
| Male (n = 175) | > 90 | 69 | 39.66 |
| Female (n = 547) | > 80 | 395 | 72.88 |
| > 90 if M and > 80 if F (n = 716) | | 464 | 64.80 |
| Smoking status | | | |
| Non-smoking | | 609 | 85.06 |
| Ex-smokers | | 72 | 10.06 |
| Current smoking | | 35 | 4.89 |
| Health assurance | | | |
| Universal coverage | | 640 | 89.39 |
| Government employed | | 69 | 9.64 |
| Social security | | 7 | 0.98 |

**Table 3.** Clinical and metabolic outcomes of the diabetic patients (n = 716)

| | Mean | SD |
|---|---|---|
| Systolic blood pressure (mmHg) | 129.0 | 44.3 |
| Diastolic blood pressure (mmHg) | 77.4 | 24.6 |
| Fasting plasma glucose (mg/dl) | 148.2 | 43.8 |
| Total Cholesterol (mg/dl) (n = 710) | 225.4 | 52.7 |
| Triglyceride (mg/dl) (n = 712) | 183.3 | 104.9 |
| GFR* C-G (ml/min/1.73 $m^2$) | 80.86 | 32.04 |
| GFR** MDRD (ml/min/1.73 $m^2$) | 81.99 | 31.46 |

* Calculated by the Cockcroft-Gault formular
** Calculated by the modified diet in renal disease study equation

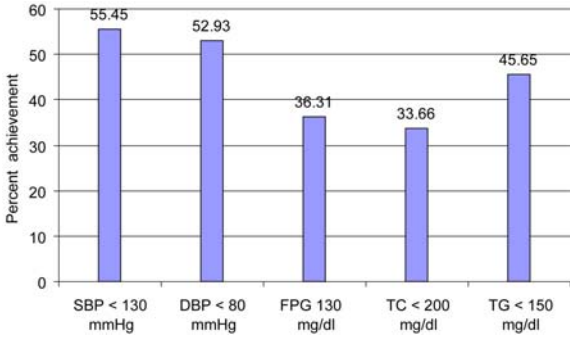


**Fig. 1** Clinical and metabolic outcomes in diabetes patients (n = 716)

**Table 4.** Prevalence and staging of CKD classified by K/DOQI in the diabetic patients (n = 716)

| Stage | GFR (ml/min/ 1.73 $m^2$) | C-G | | MDRD | |
|---|---|---|---|---|---|
| | | Number | Percent | Number | Percent |
| 1 | ≥ 90 | 262 | 36.59 | 276 | 38.55 |
| 2 | 60-89 | 260 | 36.31 | 259 | 36.17 |
| 3 | 30-59 | 165 | 23.04 | 152 | 21.23 |
| 4 | 15-29 | 23 | 3.21 | 23 | 3.21 |
| 5 | < 15 | 6 | 0.84 | 6 | 0.84 |
| 3-5 | < 60 | 194 | 27.09 | 181 | 25.28 |

**Table 5.** Prevalence of CKD defined as elevated serum creatinine in the diabetic patients

| | Number | Percent |
|---|---|---|
| Serum creatinine (mg/dl) | | |
| Male ≥ 1.4 (n = 174) | 95 | 54.59 |
| Female ≥ 1.2 (n = 542) | 141 | 26.02 |
| ≥ 1.4 if M and ≥ 1.2 if F | 236 | 32.96 |
| ≥ 2 | 28 | 3.91 |

retinopathy were significantly associated with the presence of decreased kidney function at p-value < 0.05.

When analyzed with Chi-square test, the outcome of the association between these variables corresponded to logistic regression analysis. The prevalence of decreased kidney function increased in association with the longer duration of diabetes: 11.5% within < 1 year, 22.0% within 1 to 4 years, 26.4% within 5 to 9 years, 35.2% within 10 to 14 years, 50.0% within 15 to 19 years, and 40.0% within ≥ 20 years duration respectively with statistical significant. (p 0.001) (Table 6)

The prevalence of decreased kidney function in diabetics with hypertensive patients was significantly higher than diabetics without hypertension (34.3% vs. 20.8% at p 0.001) (Table 7).

The percentage of decreased kidney function in diabetics with the optimal triglyceride level group (< 150 mg/dl) was 21.5% while in the high triglyceride level group ( ≥ 150 mg/dl) was 28.4%, the difference was statistically significant (p 0.035) (Table 8).

In the present study, only 585 patients (81.70%) had fundoscopic assessments. The prevalence of retinopathy was 15.21% (of 585). The percentage of decreased kidney function in the diabetic retinopathy group was significantly higher than patients without retinopathy (38.2% vs. 23.2% at p 0.003) (Table 9).

The other diabetic complications were foot ulcer at 3.38% and absence of dorsalis pedis pulse at 1.80% (Table 10, 11).

The treatment prescriptions in the present study, the majority of patients were taking oral hypoglycemic agent(s), while 3.91% needed insulin therapy and non-pharmacologic treatment group was noted at 6.84% (Table 12).

The data of antihypertensive drug(s) therapy are shown in Table 12, the diabetic patients received ACEI/ARB (Angiotensin converting enzyme inhibitors/ Angiotensin receptor blockers) therapy were at 25%, received aspirin at 5.03% and lipid lowering agent at 10.75%. 37.14% of diabetic patients with CKD stage 3-4 received ACEI/ARB therapy. The clinical and metabolic outcomes as well as ACEI/ARB therapy in these subgroups are shown in Fig. 2.

**Table 6.** Number and prevalence (%) of decreased kidney function (MDRD formula) according to the duration of diabetes (n = 716)

| | < 1 year | 1 to 4 yr | 5 to 9 yr | 10 to 14 yr | 15 to 19 yr | ≥ 20 yr | p-value |
|---|---|---|---|---|---|---|---|
| Number of decreased kidney function (%) | 7/61 (11.5) | 69/313 (22.0) | 57/216 (26.4) | 32/91 (35.2) | 10/20 (50.0) | 6/15 (40.0) | 0.001* |

* $p < 0.05$

**Table 7.** Number and percentage (%) of decreased kidney function (MDRD formula) according to diabetes without and diabetes with hypertension (HT) (n = 716)

| | Diabetes without HT | Diabetes with HT | p-value |
|---|---|---|---|
| Number of decreased kidney function (%) | 99/477 (20.8) | 82/239 (34.3) | 0.001* |

* $p < 0.05$

**Table 8.** Number and percentage (%) of decreased kidney function (MDRD formula) according to the level of triglyceride (n = 712)

| | Triglyceride < 150 mg/dl | Triglyceride ≥ 150 mg/dl | p-value |
|---|---|---|---|
| Number of decreased kidney function (%) | 70/325 (21.5) | 110/387 (28.4) | 0.035* |

* $p < 0.05$

**Table 9.** Number and percentage (%) of decreased kidney function (MDRD formula) according to the presence of diabetic retinopathy (n = 585)

| | Absence of diabetic retinopathy | Presence of diabetic retinopathy | p-value |
|---|---|---|---|
| Number of decreased kidney function (%) | 115/496 (23.2) | 34/89 (38.2) | 0.003* |

* $p < 0.05$

**Table 10.** Frequency of other assessments in the diabetic patients (n = 716)

| | Number | Percent |
|---|---|---|
| Fundoscopic examination | 585 | 81.70 |
| Foot examination | | |
| Inspection for ulcer | 710 | 99.16 |
| Palpation of dorsalis pedis pulse | 668 | 93.30 |

**Table 11.** Prevalence of other complications in the diabetic patients

| | Number | Percent |
|---|---|---|
| Diabetic retinopathy | 89 | 15.21 |
| Acute foot ulcer | 24 | 3.38 |
| Absent of foot pulse | 10 | 1.80 |

## Discussion

The selected six PCUs were distributed in urban and developing rural communities in Muang district of Udon Thani province, which is in the north-east part of Thailand. The characteristics of these diabetic patients showed that most of them were obese and over weight (71.51%) and 64.80% had abdominal obesity. The percentage of obese and over weight were

**Table 12.** Treatment prescription in the diabetic patients

| | Number | Percent |
|---|---|---|
| Non of anti-diabetic agent | 49 | 6.84 |
| Insulin therapy (with/without oral agent) | 28 | 3.91 |
| Oral anti-diabetic agent(s) | | |
| 1 agent | 310 | 43.30 |
| 2 agents | 343 | 47.91 |
| 3 agents | 11 | 1.54 |
| Oral antihypertensive agent(s) | | |
| None | 429 | 59.92 |
| 1 agent | 157 | 21.93 |
| 2 agent | 95 | 13.27 |
| 3 agents | 27 | 3.77 |
| 4 agents | 8 | 1.12 |
| ACEI/ARB therapy in all diabetes (n = 716) | 179 | 25.00 |
| ACEI/ARB therapy in diabetes with antihypertensive drugs treatment group (n = 287) | 179 | 62.37 |
| ACEI/ARB therapy in CKD stage 3 & 4 (n = 175) | 65 | 37.14 |
| Aspirin therapy in all diabetes | 36 | 5.03 |
| Lipid-lowering agent(s) therapy in all diabetes | 77 | 10.75 |

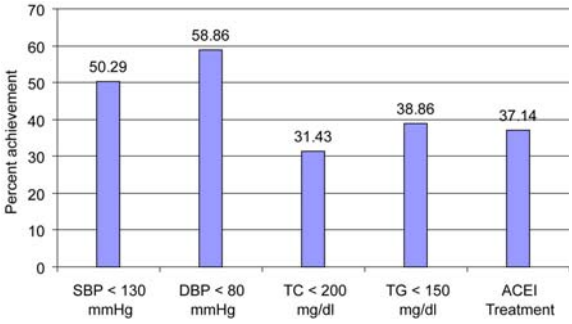


**Fig. 2** Clinical and metabolic outcomes in diabetes with CKD stage 3 & 4 (n = 175)

higher than diabetic patients in the survey studied by Nitiyanant in 2001, which studied at 37 urban primary health care clinics in four regions of Thailand (63.5%)[9]. The mean age and higher proportion of females in this present study were similar to Nitiyanant's study (mean age 58.2 $\pm$ 11.3 years, female 72.17%). However, the diabetes duration was a little less (5.53 $\pm$ 4.62/ one month -30 vs. 6.2 $\pm$ 4.0/2-42 years). Half of them (52.24%) experienced diabetes less than 5 years; it was the impact of public health policy and performance of PCUs for screening diabetes in populations age above 40 years and diabetic risk groups for a few years. For overcoming the previous problem that one-fifth of newly diagnosed diabetic patients already had microvascular complications[10].

In the present study, initial screening for urine micro-albumin was not measured due to some limitation of PCUs. The diagnosis of microalbuminuria need to be positive in at least two of three samples within a 3 to 6 months period. However, evidence for the usefulness of estimated GFR alone as a screening test for CKD in diabetes is less secure. Many patients with diabetes and CKD may have elevated or high-normal GFRs, particularly in the early years after diagnosis. Estimated GFR alone can only detected CKD stage 3 or worse[11].

In the present study, the prevalence of CKD stage 3-5 in diabetic patients were found 27.09% and 25.28% by C-G and MDRD formulae respectively.

Chittinandana reported that the prevalence of CKD in a Thai adult population stage 3-5 was 7.5% and 3.1% by C-G and MDRD formulae respectively[12]. The present study showed that the prevalence of CKD in diabetes was 3.7 and 8.4 - fold higher than the general population.

Domrongkitchaiyaporn reported the prevalence of decreased kidney function in the Electricity Generating Authority of Thailand (EGAT) employees increased from 1.7% in 1985 to 6.8% in 1997 by MDRD equation[13]. The prevalence of impaired renal function varied from 0.22 to 8% among several countries. These variations might depend on population characteristics and study methods[13].

Until now, it has not been conducted which formula is considered to be validated for estimation of

GFR in a Thai population. Kaitwatcharachai concluded that the performance of the C-G and MDRD equations were suboptimal for renal function assessment in Thai healthy adults[14]. Creatinine production and tubular secretion were varied with age, sex, race and nutritional status. In obese subjects, creatinine production rate related to the body weight is less than normal weight subjects. Using serum creatinine to calculate GFR by C-G formula may be higher than normal[15].

These diabetic subjects were mostly obese and over weight, the accuracy of measured GFR might be affected. The different laboratory methods in measurement of serum creatinine also affect GFR calculated by both equations[15]. In the present study, SCr level was derived from capillary blood, using desktop-analyzer, which was applied to the context of PCUs.

It was known that there were many risk factors and promoting factors that were associated with the presence of CKD such as diabetes mellitus, hypertension, age > 60 years, family history of CKD, obesity, dyslipidemia, smoking, high protein and phosphate diet[16] as well as hyperuricemia[13].

Chittinandana found a significantly higher body weight, BMI, fasting plasma glucose, and triglyceride level in the CKD group when compared with the non-CKD group either using the C-G or MDRD formula[12].

Domrongkitchaiporn reported that systolic hypertension (> 159 mmHg), hyperuricemia (> 6.29 mg/dl) and elevated BMI (BMI > 24.9 kg/m$^2$) were independent risk factors for future development of decreased kidney function in Thai population, compared with subjects with systolic BP < 140 mmHg, serum uric acid < 4.5 mg/dl and BMI 20.8 to 22.8 kg/m$^2$ with adjusted odds ratio of 2.57, 1.82 and 1.68[13]. The authors did not study uric acid level in these diabetic patients.

The present study showed that the longer duration of diabetes, diabetes with a history of hypertension, hypertriglyceridemia (≥ 150 mg/dl) and diabetic retinopathy were significantly associated with the presence of decreased GFR (< 60 ml/min/1.73 m$^2$) using the MDRD equation. Age and sex were not included as independent risk factors when applied with logistic regression analysis because of the presence of these factors in the MDRD formula.

There are several studies about the association between risk factors and microalbuminuria. In Buranakitjaroen's study, age, sex, BMI, level of BP, FPG, HbA1c, SCr and LDL/HDL were not associated with microalbuminuria but the prevalence of microalbuminuria increased significantly in relation with the duration of diabetes, 35.5% within 1-5 years, 50% within > 5-10 years and 63.2% within > 10 years[17].

In Chiowanich's study, obesity, age and dyslipidemia were independent risk factors for the presence of microalbuminuria in females; while age, hypertension, and dyslipidemia were independent risk factors in male patients[18].

Ngarmukos reported that factors associated with diabetic nephropathy were age, duration of diabetes, male sex, smoking, systolic blood pressure, HbA1c, hypercholesterolemia, hypertriglyceridemia, and low HDL-cholesterol and the presence of diabetic retinopathy[19].

If the decreased kidney function was defined as elevated serum creatinine ≥ 1.4 mg/dl for male and ≥ 1.2 mg/dl for female[20], which were simple figures suitable for primary health care personnel. This present data showed 32.96% of diabetic patients had decreased kidney function, which was more than the percentage that was defined by measuring GFR (< 60 ml/min/1.73 m$^2$) around 6-8%. When SCr ≥ 2 mg/dl was indicated to refer to specialists or nephrologists for special interventions[20], the present study found 3.91%, similar to the prevalence of CKD stage 4-5 ( GFR < 30 ml/min/1.73 m$^2$) (4.05% both by C-G and MDRD equations).

In Nitiyanant survey studied at primary care clinics, diabetic patients with elevated SCr > 2 mg/dl was found 7.2%[9]. While compared to the study in tertiary care medical centers, the prevalence of elevated SCr > 2 mg/dl was 8.3%[21], which was twice higher than this present study.

In this study, 25% of diabetic patients received ACEI/ARB therapy, while in diabetic with antihypertensive drug(s) treatment groups, ACEI/ARB were prescribed and accounted for 62.37%. Regarding Nitiyanant's study, ACEI usage was 38% of the prescribed treatment. The NKF-K/DOQI guideline 3 recommends hypertensive people with diabetes and CKD stage 1-4 should be treated with an ACEI or an ARB, and the target blood pressure should be < 130/80 mmHg[11]. In the present study, CKD stage 3-4 subgroups (175 cases) received ACEI/ARB 37.14% and achieved target SBP, DBP at 50.29%, 58.86% respectively.

There is evidence that progression of decreased kidney function could be prevented or delayed with proper and intensive interventions, such as intensive glycemic control, tight blood pressure control and lower lipid level to target as well as modified diet intake behavior. All of them are challenge factors that need to be managed effectively for slowing

progression to ESRD and reducing cardiovascular events. Intensive and optimal treatment of diabetes to slow the progression of long-term complications should be effectively managed by a disciplinary team. Nearly 1% of these diabetic patients were ESRD and most of them were universal coverage welfare group, proper management for the present situation was also an important issue to consider.

**Conclusion**

The prevalence of CKD stage 3-5 (GFR < 60/ml/min/1.73 $m^2$) in type 2 diabetes patients at PCUs of Udon Thani province were 27.09% and 25.28% when using C-G and MDRD equations respectively. ESRD in diabetes were 0.84% equally by both formulae. While the prevalence of elevated serum creatinine level, male ≥ 1.4 mg/dl or female ≥ 1.2 mg/dl was 32.96%, ≥ 2 mg/dl was 3.91%. The diabetes duration, diabetes with history of hypertension, triglyceride level and diabetic retinopathy were significantly associated with the presence of decreased kidney function.

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## *ความชุกของโรคไตเรื้อรังในผู้ป่วยเบาหวานชนิดที่ 2ในหน่วยบริการปฐมภูมิ จังหวัดอุดรธานี*

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***วัตถุประสงค์****: เพื่อศึกษาความชุกของโรคไตเรื้อรังในผู้ป่วยเบาหวานชนิดที่ 2 และศึกษาปัจจัยเสี่ยงที่สัมพันธ์กับภาวะไตเสื่อมของผู้ป่วยเบาหวาน ในหน่วยบริการปฐมภูมิ จังหวัดอุดรธานี*

***วัสดุและวิธีการ****: เป็นการศึกษาเชิงพรรณนาแบบภาคตัดขวาง ศึกษาผู้ป่วยเบาหวานจำนวน 716 คน ในระหว่างเดือนเมษายนถึงเดือนสิงหาคม พ.ศ. 2550 โดยวิธี cluster random sampling ผู้ป่วยทุกรายได้รับการซักประวัติ ตรวจร่างกาย และตรวจเลือด เพื่อวัดระดับน้ำตาล creatinine ไขมัน cholesterol และ triglyceride กำหนดคำนิยามและการแบ่งระยะของโรคไตเรื้อรังตามแนวทางของ K/DOQI 2002*

***ผลการศึกษา****: กลุ่มตัวอย่างเบาหวานมีอายุเฉลี่ย 58.70 $\pm$ 9.83 ปี อายุระหว่าง 30-92 ปี ระยะเวลาป่วยเป็นเบาหวานเฉลี่ย 5.53 $\pm$ 4.62 ปี, ส่วนใหญ่ (82.41%) ป่วยน้อยกว่า 10 ปี มากกว่าครึ่งของกลุ่มตัวอย่าง (51.82%) มีภาวะอ้วน (ดัชนีมวลกาย $\geq$ 25 กก./ม.$^2$) ผู้ป่วยส่วนใหญ่ใช้สิทธิหลักประกันสุขภาพถ้วนหน้า (89.39%) ผู้ป่วยสามารถควบคุมระดับความดันโลหิต systolic, diastolic, ระดับน้ำตาล, cholesterol, triglyceride ได้ตามเกณฑ์ของสมาคมเบาหวานแห่งสหรัฐอเมริกา ได้ร้อยละ 55.45, 52.93, 36.31, 33.66 และ 45.65 ตามลำดับ พบความชุกของโรคไตเรื้อรังระยะที่ 3-5 ในผู้ป่วยเบาหวานร้อยละ 27.09 และ 25.28 โดยใช้สมการของ C-G และ MDRD ตามลำดับ เมื่อวิเคราะห์ความสัมพันธ์โดยวิธี logistic regression พบว่า ระยะเวลาป่วย ประวัติมีความดันโลหิตสูงร่วม ระดับ triglyceride และภาวะแทรกซ้อนทางตา เป็นปัจจัยเสี่ยงต่อการเกิดภาวะไตเสื่อมอย่างมีนัยสำคัญทางสถิติ*

***สรุป****: การศึกษานี้แสดงลักษณะทางคลินิกและความชุกของโรคไตเรื้อรังในผู้ป่วยเบาหวานชนิดที่ 2 ในระดับบริการปฐมภูมิ การรักษาผู้ป่วยเบาหวานอย่างเข้มงวดและเหมาะสม สามารถชะลอการเกิดภาวะแทรกซ้อนระยะยาวได้ ซึ่งต้องอาศัยการมีส่วนร่วมของทีมสหสาขาวิชาชีพ*