DETERMINE THE RISK FACTORS ASSOCIATED WITH THE OCCURRENCE OF CHRONIC COMPLICATIONS AMONG TYPE 2 DIABETES MELLITUS
(Study In Type 2 Diabetes Mellitus/NIDDM Patients at Kudus District Hospital)

FAKTOR RISIKO YANG BERHUBUNGAN DENGAN KEJADIAN KOMPLIKASI KRONIS PADA PASIEN DIABETES TYPE 2
(Studi Tipe Diabetes Melitus Tipe 2/Pasien NIDDM di Rumah Sakit Kabupaten Kudus)

Lintang Dian Saraswati, Praba Ginanjar
Faculty of Public Health, Diponegoro University, Semarang

ABSTRAK

Diabetes melitus tipe 2 merupakan masalah dunia dan menjadi beban kesehatan dikarenakan jumlah pasien yang terus meningkat. Di kabupaten Kudus, prevalensinya nomor dua terbesar untuk penyakit tidak menular. Komplikasi kronis merupakan keluaran utama dari perjalanan penyakit diabetes mellitus tipe 2, yang mengurangi kualitas hidup pasien, menambah beban sistem pelayanan kesehatan dan meningkatkan angka kematian karena diabetes. Penelitian ini bertujuan untuk menentukan faktor risiko kejadian komplikasi kronis pada pasien diabetes tipe 2. Desain studi kasus kontrol dengan jumlah kasus 40 pasien NIDDM dengan komplikasi kronis dan 40 kontrol pasien NIDDM tanpa komplikasi kronis, yang didapat dari Rumah Sakit Umum Daerah Kudus. Data dianalisis menggunakan Chi Square dengan 95% Confidence Interval (CI) dan risiko dihitung menggunakan Odds Ratio (OR). Hasil menunjukkan faktor risiko komplikasi kronis antara lain lama mengalami NIDDM lebih dari 10 tahun (OR=4.622; 95% CI=1.24-17.226), kurangnya aktivitas fisik/olahraga (OR=4.636; 95% CI=1.593-13.494), pengobatan diabetes yang tidak teratur (OR=3.273; 95% CI=1.211-8.844), ketidakpatuhan diet diabetes (OR=6.667; 95% CI=2.44-18.212), dan stres (OR=3.77; 95% CI=1.205-11.789)**.** Disarankan agar pasien NIDDM melakukan aktivitas fisik/olahraga secara teratur, patuh pada pengobatan diabetes dan diet, dan menguatkan kesehatan mental agar tidak mudah stres.

Kata kunci: lama DM, aktivitas fisik, komplikasi kronis, diabetes tipe 2
***Kesmasindo**, Volume 7(1) Juli 2014, Hal 21-21*

INTRODUCTION

Type 2 diabetes mellitus up to now is a disease which is considered dangerous. Various epidemiological studies indicate a trend of increasing incidence and prevalence of type 2 diabetes in all over the world. Basically metabolic disorders in the type 2 diabetes not only lead to interference with the carbohydrate metabolism but also lipid and protein metabolism (Perkeni, 2006). Several studies have shown that type 2 diabetes mellitus that is not controlled will lead to the onset of complications. The higher the blood sugar levels, the higher the risk of complications and vice versa (Copeland *et al*, 2005). A report from United Kingdom Prospective Diabetes Study (UKPDS) indicates that most major chronic complications in patients with type 2 diabetes mellitus are cardiovascular disease, stroke, diabetic ulcers, retinopathy, and diabetic nephropathy

(UKPDS, 1995). Approximately 2.5 million people or 1.3% of the total population of Indonesia every year die from complications (Perkeni, 2006).

Patients with type 2 diabetes mellitus in Kudus District tend to increase. Type 2 diabetes mellitus is an illness of non infectious diseases with the second highest prevalence in Kudus District (Dinkes Kabupaten Kudus, 2010). The rising incidence of type 2 diabetes mellitus will significantly increase the incidence of all chronic complications of type 2 diabetes mellitus (ADA, 2006). Research on factors that predicted to be the occurrence of complications associated with chronic in people with type 2 diabetes mellitus are the modifiable risk factors (stress status, regularity of treatment, smoking habits, as well as compliance with diet and physical exercise) and risk factors that cannot be changed (longer suffering from diabetes mellitus and age) are still highly rarely done in Indonesia and has never been done in Kudus District.

METHODOLOGY

Type of research was an analytic observational epidemiologic research using case-control study design. In this study, the case group was a type 2 DM patient who experience chronic complications while the control group was patient with type 2 diabetes mellitus who do not experience chronic complications. The independent variables in this study were duration suffer from type 2 diabetes mellitus, stress, regular treatment of DM, DM diet compliance, smoking habits, and physical exercise. The dependent variable in this study was the status of chronic complications in patients with type 2 diabetes mellitus, and confounding variables were age of onset. Population studies were all patients with type 2 diabetes mellitus, either have (cases) or not having (control) chronic complications in Kudus District Hospital. Minimum sample size in each group was 40 respondent was taken from case control sample size formula with significance 90% ($Z\alpha$ =1.96), power 80% ($Z\beta$ =0.842), proportion of exposed group (duration of type 2 diabetes mellitus over 10 years, less physical activity (exercise), irregular diabetic medication, stress and irregular DM diet) among control group (did not have non chronic complication) or it is often called P_2 was 20% (table 1. Total sample amounted to 80 people (40 cases and 40 control) taken with a non-probability purposive sampling method sampling which meets inclusion and exclusion criteria (Wright *et al*, 2002., Khuwaja *et al*, 2004., Sulaiman *et al*, 2010). All data were collected by interviewing the research variables directly to the respondent based on the questionnaire had been prepared. Data were analyzed using Chi Square Test with 95% Confidence Interval (CI) and the risk was calculated using the Odds Ratio (OR).

Table 1. Minimum Sample Size with Zα =1.96, Zβ =0.842, P_2 = 20% using *Odds Ratio*

Risk factors	Author	*Odds Ratio* (OR)	Estimation of n
Duration suffer from DM > 10 years	Hastuti, 2008[8]	11.3	8.7 ≈ 9
Less activity	Hastuti, 2008[8]	5.4	18.5 ≈ 19
Incompliance DM diet	Hastuti, 2008[8]	11.2	8.88 ≈ 9
Stress	Sulaiman et al, 2000[9]	3.38	39.7 ≈ 40
Incompliance DM medication	Wright et al, 2002[10]	3.4	39.7 ≈ 40
Smoking	Khuwaja et al, 2000[11]	4.01	29.86 ≈ 30

1. RESULT AND DISCUSSION

Overview Characteristics of Respondents

Percentage of sex of respondent (males and female) was comparable both on cases and control group. The most percentage of age group of respondent was the age group between 50-54 years. Half of the respondents were well educated up to university level. The most percentage of occupation was unemployment (Table 2). The greatest percentage of types of chronic complications was hypertension and nephropathy (Table 3).

Table 2. Characteristics of NIDDM Patients In Kudus District Hospital

Variables	Non Chronic Complication		Chronic Complication	
	n (40)	%	n (40)	%
Sex				
-Male	21	52.5	20	50.0
-Female	19	47.5	20	50.0
Age (years)				
40-44	4	10.0	5	12.5
45-49	7	17.5	4	10.0
50-54	11	27.5	13	32.5
55-59	7	17.5	3	7.5
60-64	7	17.5	6	15
>65	4	10.0	9	22.5
Education level				
Elementary	2	5.0	4	10.0
Junior High School	6	15.0	6	15.0
Senior High School	8	20.0	14	35.0
University	24	60.0	16	40.0

Table 3. Type of Chronic Complications Among NIDDM Patients In Kudus District Hospital with Chronic Complication/Case Group

Variables	n (40)	%
Macrovascular	14	17.5
Microvaskular	15	18.8
Others	11	13.8

2. **Physical Exercise is important to Reduce the Risk of Chronic Complications in Patients with Type 2 DM**

Patients with DM who did not regularly perform physical exercise (sports) had 4.6 times greater risk for developing chronic complications as compared with patients with type 2 diabetes mellitus who exercise regularly (Table 4). The results were consistent with previous research conducted at the Dr. Moewardi Hospital at Surakarta by Hastuti which said that the lack of physical exercise was a risk factor for diabetic ulcers (diabetic ulcers) with OR of 5.4 (p = 0.028, 95% CI = 2.4 to 42.4) (Hastuti, 2008).

Physical exercise is one of the cornerstones of management of DM. Current physical activity recommendations for people with DM is a combination of aerobic exercise and resistance exercise. American Diabetic Association and the American College of Sports Medicine recommend aerobic exercise for 150 minutes of exercise a week and moderate-heavy exercise performed at least 3 days a week. Average physical exercise was an aerobic workout with weights of 40-60% of physical strength of the patients (Despande *et al*, 2008)

The results showed that the type of exercise often carried out by the respondents were walking, jogging, and aerobics, especially in elderly patients with DM. Exercise is meant to burn calories, so that blood glucose can be used for energy, and it will reduce levels of blood glucose level (Medical Science Sports Exercise, 2010)

3. Incompliance DM Diet Would Be More at Risk to Get Chronic Complications

The patients with DM who do not adhere to the diet DM will be at risk 6.6 times when compared with the chronic complications of type 2 DM patients who compliance to the diet DM (Table 4). The research was supported by a previous study conducted at Dr. Moewardi Hospital at Surakarta, by Hastuti which stated that non-dietary DM was a risk factor for diabetic ulcers (diabetic ulcers) with an odds ratio of 11.2 (p = 0.0001, 95% CI = 3.3 to 38.4) (Hastuti, 2008).

Compliance with the diet DM is an important effort to control blood glucose levels, cholesterol, and triglyceride levels close to normal so as to prevent chronic complications in patients with type 2 diabetes mellitus. Compliance on DM Diet has a very important function of maintaining a normal weight, lowering systolic and diastolic blood pressure, lowers blood glucose levels, improve the lipid profile, increase insulin receptor sensitivity and improve blood coagulation system. In the implementation of the diet in patients with diabetes mellitus there are 3 errors that become problems include lack of knowledge, forget in time carry out a proper diet, and lack of commitment in the implementation diet (Purba dkk, 2010)

4. **After over 10 Years, Type 2 DM patients were Exposed to the Risk of Complications Chronic**

Selection DM for 1-5 year old as a reference to determine relationship between the duration of DM to the occurrence of chronic complications of DM due to the duration suffer from DM over 5 years was a risk factor for chronic complications in patients with DM type 2 (Khuwaja, 2004). The Patients with DM who had suffered from type 2 DM for more than 10 years had a risk of chronic complications affected 4.6 times as compared with patients who had suffered from type 2 diabetes for 1-5 years (Table 4). The results were consistent with previous research conducted at the Dr. Moewardi Hospital in Surakarta that long-suffering of DM $\geq$ 10 years was a risk factor for diabetic ulcers (diabetic ulcers) with an odds ratio 11.3(Hastuti, 2008)

Duration of DM is a risk factor for almost all types of chronic complications in patients with type 2 diabetes. The longer duration of DM means that DM patients likely to be exposed to greater risk of chronic complications. The duration of suffering from diabetes mellitus is the most significant cause of vision damage in patients with type 2 diabetes. 90% of blindness caused by retinopathy in patients with type 2 diabetes can be prevented if identified and treated early. The emergence of chronic complications such as nephropathy in patients with type 2 diabetes is low on the duration of the first 10 to 15 years suffering from type 2 diabetes. However, it increase rapidly until a maximum time duration of type 2 diabetes mellitus (more or less for about 18 years) and after that will reduce (Deshpande, 2008)

5. **Patients with Type 2 Diabetes Who Incompliance on**

Treatment Have Greater Risk of Chronic Complications

Patients with DM who do not compliance the treatment of diabetes mellitus will have greater risk (3.2 times) to get chronic complications if it is compared with patients with type 2 diabetes mellitus who take medication regularly (Table 4).

Pharmacological interventions can be conducted if the intervention in terms of lifestyle is not enough to successfully control blood glucose levels. Pharmacological treatment should be based on the degree of hyperglycemia and the nature of the drug anti hyperglycemic, including effectiveness in lowering blood sugar, durability in controlling blood glucose, side effects, contraindications, the risk of hypoglycemia, and the appearance of complications diabetes (Harper *et al*, 2008)

Oral therapy anti hyperglycemic is an effective method for controlling glucose levels in people with type 2 diabetes mellitus, so it can reduce the risk of micro vascular and macro vascular complications. The relationship between medication compliance with the conditions of people with DM is increasing apparently. Some studies show an association between diabetes medication adherences with metabolic control. So, increased treatment compliance would make a better metabolic control, thus reducing the risk of complications in patients DM (Lau and Nau, 2004)

6. Stress Can Increase the Risk of Chronic Complications in Patients with Type 2 DM

The patients with DM who had a stress were exposed 3.7 times to get chronic complications compared with patients with type 2 diabetes mellitus who do not stress (Table 4). These results supported previous research that had been done on the relationship between mental health, diabetes management and the occurrence of complications. Previous studies had concluded that depression has a tendency toward poor DM management. Based on a meta-analysis of 27 investigations, de Groot *et al*, 2001 suggested a significant relationship between depression and various complications of diabetes, including retinopathy, nephropathy, neuropathy, macro vascular complications and sexual dysfunction.

There was evidence that depression can be a problem in managing diabetes mellitus effectively. Gonzales *et al*, 2007 stated that when stress can cause a rise in blood sugar, then the stress can also cause people to ignore

sports or prefer unhealthy food. DM patients with higher depression scores showed higher an oral anti diabetic medication in adherence rates, less to do physical exercise, more unhealthy dietary behaviors, and lack of control glucose.

7. No Relationship between Smoking Habit with the Appearance of Chronic Complications in Patients with Type 2 DM

The results of this study contrast with cross-sectional surveys conducted by Khuwaja *et al*, 2004 on 672 patients with type 2 diabetes mellitus in Pakistan, which showed that smoking patients with type 2 diabetes mellitus had four times greater risk for developing diabetic ulcers compared with patients with type 2 diabetes who did not smoke Khuwaja *et al*, 2004)

Although smoking is known as a trigger of cardiovascular disease, but in this study found only 40% in subjects (21.2% active smoking and 18.8% had never smoked but had stopped). It can be concluded that the absence of a relationship between cigarette smoking with the appearance of chronic complications in patients with type 2 diabetes because the majority of respondents did not have the habit of smoking (60%) (Table 4). The habit of smoking is usually more common in males than females. A reason that could explain the low proportion of smoking in this study is the comparison of the number of research subjects which is male (51.2%) and a woman (48.8%) is almost the same.

Table 4. Related Factors Of The Occurrence Of Chronic Complications Among Type 2 Diabetes Mellitus (NIDDM) Patients In Kudus District Hospital

Variable	Complications		Without Complications		p value	OR	95% CI
	n (40)	%	n (40)	%			
Duration suffer from DM							
- 1-5 years	9	22.5	16	40.0		1(ref)	
- 6-10 years	18	45.0	19	47.5	0.324	1.684	0.595-4.767
- > 10 years	13	32.5	5	12.5	0.019	4.622	1.24-17.226
Exercises					0.003	4.636	1.593-13.494
- Regular	34	85.0	22	55.0			
- Irregular	6	15.0	18	45.0			
Regular Treatment of DM					0.017	3.273	1.211-8.844
- not compliance	18	45.0	8	20.0			
- compliance	22	55.0	32	80.0			
DM Diet Compliance					0.0001	6.667	2.44-18.212
- not compliance	25	62.5	8	20.0			
- compliance	15	37.5	32	80.0			
Stress Status					0.018	3.77	1.205-11.789
- stress	14	35.0	5	12.5			
- disstress	26	65.0	35	87.5			
Smoking Habits							
- Not smoking	23	57.5	25	62.5		1(ref)	
- Used to smoke but had stopped	6	15.0	9	22.5	0.59	0.725	0.223-2.354
- smoking	11	27.5	6	15.0	0.234	1.993	0.634-6.26

CONCLUSION

Duration of type 2 diabetes mellitus over 10 years, less physical activity (exercise), irregular diabetic medication, stress and irregular DM diet were risk factors of the occurrence of chronic complications in patients with type 2 diabetes mellitus. It is suggested for type 2 diabetes patients to implement physical activity (exercise) regularly, adhere to the diabetic medication, implement diabetic diet obediently, and manage mental health.

REFERENCE

Perkumpulan Endokrinologi Indonesia. Konsensus Pengelolaan dan Pencegahan Diabetes Melitus Tipe 2 di Indonesia 2006. Jakarta: PB. PERKENI, 2006

Copeland KC, Becker D, Gottschalk M & Hale D. Type 2 diabetes in children and adolescents: risk factors, diagnosis, and treatment. *Clinical Diabetes*. 2005; vol 23 (4): 181-185

UKPDS. Overview of six years therapy of type 2 diabetes: a progressive disease. *U.K. Prospective Diabetes Study Group*. 1995; vol. 16 (44): 1249–1258

Rumah Sakit Umum Daerah Kabupaten Kudus. Laporan Rekam Medis Penyakit DM tahun 2008-2010. Kudus: RSUD Kabupaten Kudus, 2011

American Diabetes Association. ADA Position Statement: Standard of medical care in diabetes 2006. *the American Diabetes Association: Diabetes Care*. 2005; vol. 29 (1): S4-S42

Hastuti RT. Faktor-Faktor Risiko Ulkus Diabetika Pada Penderita Diabetes Mellitus (Studi Kasus di RSUD Dr. Moewardi Surakarta). Tesis tidak diterbitkan. Semarang: Program Pasca Sarjana UNDIP, 2008

Sulaiman N, Hamdan A, Tamim H, Mahmood DA, & Young D. The prevalence and correlates of depression and anxiety in a sample of diabetic patients in Sharjah, United Arab Emirates. *BMC Family Practice*. 2010; vol 11: 80

Wright A, Burden ACF, Paisey RB, Cull CA, Holman RR. Sulfonylurea inadequacy. *Diabetes Care*. 2002; vol 25 (2): 330–336

Khuwaja AK, Rafique G, White F, Azam SI. Macrovascular complications and their associated factors among persons with type 2 diabetes in Karachi, Pakistan-a Multi-Center Study. *J Pak Med Association*. 2004; vol 54 (2): 60-66

Deshpande AD, Harris-Hayes M, Schootman M. Epidemiology of diabetes and diabetes-related complications. *American Physical Therapy Association*. 2008; vol 88 (11): 1254-1264

Medical Science Sports Exercise. Rekomendasi Aktivitas Fisik bagi Penderita Diabetes. (Online). 2010. (http://www.exomedindonesia.com/informasi-kedokteran-popular-galeri-kesehatan/informasi-kesehatan/2010/12/24/rekomendasi-aktivitas-fisik-bagi-penderita diabetes, diakses tanggal 27 April 2011)

Purba MB, Rahayu ES, Sinorita H. Dukungan keluarga dan jadwal makan sebelum edukasi berhubungan dengan kepatuhan jadwal makan pasien diabetes melitus (DM) tipe 2 rawat jalan yang mendapat konseling gizi di RSUD Kota Yogyakarta. Jurnal Gizi Klinik Indonesia. 2010; vol 7(2):74-79

Harper W, Hanna A, Woo V, Dawson KG, Yale JF, MacCallum L, Clement M, Simpson S & Hopkins M. Pharmacologic management of type 2 diabetes. *Canadian Journal of Diabetes*. 2008; vol. 32 (1): S53-S61

Lau DT & Nau DP. Oral antihyperglycemic medication nonadherence and subsequent hospitalization among

individuals with type 2 diabetes. *Diabetes Care*. 2004; vol. 27 (9): 2149–2153

de Groot M, Anderson RJ, Freedland KE, Clouse RE, Lustman PJ. Association of depression and diabetes complications: a meta-analysis. *Psychosom Medicine*. 2001; vol 63: 619-630

Gonzalez J, Safren S, Cagliero E, Wexler D, Delahanty L, Wittenberg E, Blais M, Meigs J, Grant R. Depression, self-care, and medication adherence in type 2 diabetes: relationships across the full range of symptom severity. *Diabetes Care*. 2007; vol.30 (9): 2222-2227