CONTROL OF GLYCOSYLATED HAEMOGLOBIN (HBA1C) AMONG TYPE 2 DIABETES MELLITUS PATIENTS ATTENDING AN URBAN HEALTH CLINIC IN MALAYSIA

Diabetes mellitus is a public health problem and has become a concern to all levels of society. In Malaysia, the prevalence of diabetes mellitus had increased, from about 0.65% in early 1960s to 2 – 4% in 1980s and 14% in early 21st century. Studies had showed that glucose control is effective in preventing complications from diabetes mellitus. Level of glycosylated hemoglobin (HbA1c) is an accepted indicator of glycaemic control. A cross- sectional study was carried out to determine the level of control of HbA1c among 307 type 2 diabetes mellitus patients attending the health clinic in Bandar Tun Razak, Kuala Lumpur using validated structured questionnaires, while secondary data were obtained from patients' medical reports. Response rate for this study was 89%. Majority of type 2 diabetes mellitus patients attending the health clinic in Bandar Tun Razak were Malays (79.5%), women (61.9%) and married (77.2%), and with secondary education (49.5%). The mean age of respondents was 56.9 ± 9.5 years, median Body Mass Index (BMI) was 28.5 (IQR: 6.0) and median HbA1c was 7.4% (IQR: 2.7). About three quarter of the type 2 diabetes mellitus patients studied had poor controlled level of HbA1c ($\geq 6.5\%$). Age (p=0.047), blood pressure (systolic blood pressure p=0.049, and diastolic blood pressure p=0.011) and low density lipid level (p=0.039) had significant relationship with the level of HbA1c. Other risk factors studied had no significant relationship with the level of HbA1c. The study concluded that, there was poor glycaemic control among type 2 diabetes mellitus studied, this exposed them to complications of diabetes mellitus. It is recommended that health education activities, counselling and prevention activities are intensified and targeted to this group of patients.

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Introduction

Diabetes mellitus is a chronic disease that threatens the human well-being in every corner of the world. The World Health Organization (WHO) estimated that about 4% or 130 millions of the world's adult population contracted diabetes mellitus and this figure was expected to increase to 300 million in 25 years' time. The WHO report also predicted that the prevalence of diabetes mellitus would likely to increase the most in Asia in the coming century . The prevalence of diabetes mellitus in Malaysia also showed an increasing trend. The prevalence was noted to be only 0.65% in 1960s, about 2 - 4 % in the early 1980s and increased to about 14% in early 21st century. A study in 1998 showed the prevalence of diabetes amongst rural and semi-urban populations ranged from 7.1% to 20.3%. The

National and Health Morbidity Survey (NHMS) III reported that the national prevalence of diabetes in Malaysia at 14.9%, an increase of 6.6% as compared to NHMS II in 1996 which had a prevalence of 8.3%. The increased in the prevalence might be due to an increase in the number of elderly people, urbanization that changed lifestyles such as unhealthy diets, less physical activities and access to healthcare facilities both in urban and rural areas.

Diabetes mellitus is one of the many diseases that contributed to fatalities. Untreated and poorly controlled diabetes mellitus can cause complications and other chronic diseases such as hypertension, kidney failures, loss of eyesight, strokes and heart diseases. A study by Murci et al. (2004) showed that diabetes mellitus gave rise to high prevalence of chronic complications such as retinopathy (53%) and neuropathy (58%). Another study by Mustafa (1998) revealed that high complications rate among type 2 diabetes mellitus patients with the commonest being neuropathy (30.1%), followed by background retinopathy (23.5%), albuminuria (22.9%) and microalbuminuria (20.4%). The study also found that the longer a person suffers from diabetes, the more the complications he has.

Studies had shown that patients who maintained their blood sugar at near-normal levels might prevent or delay the complications. A United Kingdom Prospective Diabetes Study showed that a good control of blood sugar and blood pressure reduced the risks of macro vascular and micro vascular complications (Turner et al., 1996). Good blood sugar control for the past three months will be indicated by a normal level of glycosylated hemoglobin (HbA1c). HbA1c is used as an objective and precise measurement for glycemia control of diabetes mellitus. A cross-sectional study was carried out with the aim to determine the level of blood sugar control among type 2 diabetes mellitus patients using level of HbA1c as an indicator of blood sugar control. The results of the study are useful for health workers in health clinics to determine the effectiveness of various government driven campaigns to prevent complication of diabetes mellitus, and help to identify target groups of such campaign.

Methodology

A cross sectional study was carried out among type 2 diabetes mellitus patients attending the health clinic in Bandar Tun Razak, Kuala Lumpur, Malaysia. The study was carried out from July to December 2009. The sampling units were obtained from the clinic register. All registered type 2 diabetes mellitus patients who were confirmed suffering from type 2 diabetes mellitus and receiving treatment at the health clinic were included in the study. Other inclusion criteria in this study were Malaysian citizens aged 18 years old and above, who are receiving treatment for at least one year at the clinic.

Patients were interviewed by the researcher using pretested questionnaire. The components of the questionnaire include patients' information on socio-demography, medical history, treatment, complications and others medical information. Information obtained from patients was verified by comparing with patient medical record. Anthropometric measurements such as weight (kg) and height (m), and measurements of blood pressure were taken on the same day patients were interviewed. Fasting blood sample for blood investigations such as fasting blood sugar (FBS), blood cholesterol and HbA1c levels were taken on the same day. In this study, a good control of HbA1c was defined as having a level of HbA1c < 6.5%, whereas a poor control of glycosylated hemoglobin was ≥ 6.5% as recommended by Ministry of Health Clinical Practice Guidelines (CPG) for type 2 diabetes mellitus (CPG, Ministry of Health Malaysia, 2010). Ethical approvals were obtained from Ethical Committees, Faculty of Medicine and Health Sciences, University Putra Malaysia and Ethical Committee , Ministry of Health Malaysia. The

data were analyzed using the latest version of SPSS and appropriate statistical tests were carried out to determine relationships between the variables.

Results

A total of 350 patients aged 18 years old and above who were diagnosed of having type 2 diabetes mellitus and receiving treatment from the health clinic were included to participate in the study. The total number of respondents who consented and participated in the study was 307, giving a response rate of 89%.

Socio-demographic characteristics of respondents

Table 1 shows the socio-demographic characteristics of respondents. Majority of respondents were women (61.9%), Malays (79.5%) and married (77.2%). The proportions of respondents with secondary and primary level of education were 49.5% and 36.8% respectively. The mean age of the respondents was 56.9+9.5 years. The median duration of diabetes was 5.0 (IQR: 3.0) years.

Blood pressure, body mass index and bio-chemical profile of respondents

Table 2 shows the average systolic and diastolic blood pressure was 137.3±21.3 mm Hg and 75.3±10.9 mm Hg respectively. The median for body mass index (BMI), cholesterol (LDL) and fasting blood sugar of the respondents was 28.5 (IQR: 6.0), 3.3±1.0 mmol/L and 9.3 mmol/L (IQR: 6.3) respectively.

HbA1c level of Respondents

The median for HbA1c level among respondents in this study was found to be 7.4% with IQR of 2.7. Table 3 shows that 72.9% and 75.3% of male and female patients had HbA1c levels ≥ 6.5% respectively. Based on gender, the study found that only 27.1% of males had good control of HbA1c as compared to 24.7% of females. Respondents at younger age group showed higher percentage of uncontrolled HbA1c. Respondents in age ≥6.5% respectively, as compare to age group 50-59 years (72.8%) and age ≥60 years old (66.7%). With regards to education level, respondents with primary school education had better control of HbA1c (34.4%) as compared to respondents without formal education (24%), secondary level education (22.4%) and college or university level education (17.5%).

Mean duration of having type 2 diabetes mellitus for respondents with HbA1c≤6.5% was 6.1±1.37 years, whereas for those respondents with HbA1c≥6.5% was 7.0±0.78 years.

Relationship between HbA1c and risk factors of diabetes mellitus

Table 3 shows that there was a significant relationship between the level of HbA1c with respondents' mean age (p=0.047), blood pressures (systolic blood pressure p=0.049, and diastolic blood pressure p=0.011), and blood cholesterol (LDL, p=0.039). However, there was no significant relationship between the level of HbA1c with the mean period of contracting diabetes mellitus (p=0.184) and BMI (p=0.348). This study also revealed that, there was no significant relationships between the level of HbA1c with gender (p=0.655), education levels (p=0.087) and marital status (p=0.392).

Discussion

Most of the patients with type 2 diabetes mellitus attending the health clinic in Bandar Tun Razak, Kuala Lumpur did not have good control of HbA1c levels. A total of 214 patients (73%) showed poor control of HbA1c (median of HbA1c was 7.4%). The patients' level of HbA1c was higher than the recommended by the Ministry of Health Malaysia for controlled type 2 diabetes mellitus, which is $\leq$ 6.5%. Suhaiza et al. (2004), in a study among type 2 diabetes mellitus patients in Kelantan also found high proportion of patient (85.7%) had HbA1c levels more than 7.5%. In a study among 828 type 2 diabetes mellitus patients attending primary care clinic in urban and rural areas, 81.5% of the patients were found to have level of HbA1c $\geq$ 6.5% (Ruzita et al., 1996).

Bandar Tun Razak Health Clinic is located in an urban residential area of Kuala Lumpur. This study showed that, the control of HbA1c level among type 2 diabetes mellitus patients in urban area was better as compared to rural patients. Finding of this study showed that, the median of HbA1c level was 7.4% (min:6.4%, max:9.1%), as compared with the finding of a study conducted among type 2 diabetes mellitus patients from rural area in which the minimum level of HbA1c was 7.5% (Suhaiza et al., 2004). Comparing among type 2 diabetes mellitus patients from urban and rural areas, it is found that patients from urban areas had better control of HbA1c as compared to rural patients (Ruzita et al., 1996). This could be due to patients in urban areas had better access to health facilities and information as compared to those in rural areas. This contribute to better knowledge on symptoms, complications and treatment of diabetes mellitus of urban patients as compared to their counterparts in rural areas, hence better diabetic control .

Risk factors of diabetes mellitus and level of HbA1c

A numbers of factors can potentially give rise to, or exacerbate to the control of type 2 diabetes mellitus . Among the factors include age, blood pressure, blood cholesterol level, obesity, high fat, life style and socio-economic status. In this study several of these factors were studied in relation to the level of HbA1c to indicate the control of type 2 diabetes mellitus .

Age

Our study showed that, there was a significant relationship between the level of HbA1c with patient's age (p=0.047). Several studies also had shown that significant relationship between level of HbA1c and patient's age (Eid et al., 2003; Suhaiza et al., 2004). Control of diabetes was found to be better among elderly patients; as shown in this study, patients aged more than 60 years old had better control of HbA1c as compared to younger patients'. Studies among type 2 diabetes mellitus patients among Americans by Coro et al. (2004) and among Malay population in Singapore by Charumathi et al. (2009) also found that the control of HbA1c was better among older patients. In Malaysia, the retirement age is 58 years old, majority of the patients in this study were aged 60 years old and above, and 41% of them were not working. Thus, they have more time attending clinic, health campaign and receive counseling regarding their health.

Blood Pressure

Hypertension is the commonest co-morbidity with diabetes mellitus among patients in this study, there were 54.1% of respondents having hypertension as co-morbidity. The study also found that, there was significant relationship between the level of HbA1c and systolic blood pressure (p=0.049) and diastolic blood pressure

(p=0.011). Cardiovascular Diseases (CVD) are common complications of diabetes mellitus and hypertension is an important risk factors of CVD. It is also known that diabetes mellitus patients are more common to have hypertension (CPG, Ministry of Health Malaysia, 2010). As shown in. this study, blood pressures (systolic pressure and diastolic pressure) had significant relationship with the control of HbA1c.

Cholesterol level

Elevated cholesterol level is known to be one of the factors associated with uncontrolled type 2 diabetes mellitus. Several studies had indicated significant relationship between control of type 2 diabetes mellitus with high cholesterol level (Eid et al., 2003; Coro et al., 2004; Charumathi et al., 2009). This study also found a significant relationship between the levels of HbA1c and fasting LDL among type 2 diabetes mellitus patients (p=0.039). It is important to control the level of cholesterol especially the level of LDL among type 2 diabetes mellitus patients, since high level of LDL is known to be an important risk factor of myocardial infarction, renal failure and CVD.

Socioeconomic characteristics

Several studies had indicated that, there were no significant relationship between the level of HbA1c with socioeconomic characteristics of patients with type 2 diabetes mellitus , such as level of education, marital status and gender (Suhaiza et al., 2004; Ismail et al., 2000). We also found no significant relationship between the level of HbA1c with the level of education (p=0.087), marital status (p=0.392), and gender (p=0.655). Other risk factors of type 2 diabetes mellitus such as eating behavior, attitude and life style which are known to associate with the control of diabetes mellitus may contribute to this condition.

Obesity

Obesity is a risk factor that very closely associated with type 2 diabetes mellitus . The occurrence of diabetes has a significant relationship with body mass index. Turner et al. (1999) reported that the majority of diabetes mellitus patients were overweight and obese, similarly more than half of the diabetes mellitus patients in Malaysia had excess body weight (Mustaffa, 1999). However, Hartz et al. (2006) and the finding of this study showed that there were no significant relationship between the level of HbA1c with BMI (p=0.348). A probable explanation may be that majority of the respondents (73%) already having high level of HbA1c (median HbA1c =7.4%).

Duration of illness

Several studies had shown significant relationship between the controlled level of HbA1c with duration of illness (Hudon et al., 2008; Zhaolan Liu et al., 2010). However, Hartz et al. (2006) and our study showed no significant relationship between the controlled of HbA1c with duration of illness. In this study, short average duration of illness among respondents that is 5±3 years may contribute to the finding.

Conclusion

This .study revealed that 73% of the type 2 diabetes mellitus patients attending health clinic had poor diabetic control with the median HbA1c of 7.4% (IQR:2.7). The study showed that three important risk factors of type 2 diabetes mellitus had significant relationship with the control of HbA1c, they were age (p=0.047), systolic blood pressure (p=0.049) and diastolic blood pressure (p=0.011), as well as elevated level of LDL (p=0.039). Uncontrolled blood glucose level as indicated by

this study would expose patients to risk of complications of diabetes mellitus such as myocardial infarction, renal failure, vascular diseases and CVDs. It is important that prevention activities such as health education and counseling are intensified and targeted to this group of patients.

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Appendix

TABLE 1. SOCIO-DEMOGRAPHIC CHARACTERISTIC OF RESPONDENTS (N=307)

Socio-demographic characteristic	n	%
Mean age (year): 56.9 ± 9.5		
Age group:		
less than 40	13	4.2.
40 to 49	54	17.6
50 to 59	114	37.1
69 and above	126	41.0
Ethnicity:		
Malay	244	79.5
Non Malay	63	22.8
Gender:		
Male	117	38.1
Female	190	61.9
Marital Status:		
Married	237	77.2
Single	6	2.0
Divorced / Widow/ widower	64	20.8
Education Level:		
No Formal Education	25	8.1
Primary school	113	36.8
Secondary school	152	49.5
College / University	17	5.5
Occupational Status:	102	33.2
Working	205	66.8
Not Working		
Median duration of illness (year):	5.0 ± 3.0	

TABLE 2. BLOOD PRESSURE AND BIO-CHEMICAL PROFILE OF RESPONDENT (N = 307)

Variables	Value ±S.D	
Blood pressure		
Systolic blood pressure (mm/Hg)	137.3	+ 21.3*
Diastolic blood pressure (mm/Hg)	75.3	+ 10.9*
Body Mass Index (BMI)		
BMI (kg/ m2)	28.5	(IQR:6.0)#
Non Fasting Blood sugar (mmol/L)	9.3	(IQR:6.3)#
Cholesterol level		
HDL level (mmol/L)	1.2	(IQR:0.4)#
LDL level (mmol/L)	3.3	+ 1.0*

Notes: * Mean +S.D, # Median (Interquartile range)

TABLE 3. ASSOCIATION BETWEEN CONTROL OF HBA1C WITH RISK
FACTORS OF DIABETES MELLITUS, N = 307

Risk factors	Level of HbA1c		p value
	HbA1c <6.5%	HbA1c ≥6.5%	
Male : Female(%)	27.1 : 24.7[a]	72.9 : 75.3[a]	0.655
Marital status (M:S:D/W) (%)	23.9:20:25.6[a]	76.1:80:74.4[a]	0.392
Age (year) (%) <40,40-49,50-59,>=60	7.7:16.7:27.2: 33.3[a]	92.3:83.3:72.8: 66.7[a]	0.047
Educational Status (%) NFE:PS:SS:C/U	24.0:35.4:22.4: 17.4[a]	76.0:64.6:77.6: 82.4[a]	0.087
Systolic blood pressure (mm Hg)	133.4 + 4.51*	138.8 + 2.74*	0.049
Diastolic blood pressure (mm Hg)	79.5±3.55*	87.2±4.51*	0.011
LDL level (mmol/L)	3.2 + 0.20*	6.3 + 0.20*	0.039
BMI (kg/m2)	28.6 + 0.98*	29.7 + 1.37*	0.348
BMI Status (%) N:OW:OB	26.5:32.2:27.0[a]	73.5:67.7:75.7[a]	0.363
Duration of illness (year)	6.1 + 1.37	7.0 + 0.78*	0.184

Notes: * Mean, [a] Percentages, M = Married, S = Single, D/W = Divorced/Widow/Widower.
NFE=No formal education, PS=Primary school, SS=Secondary school, C/U= College/University
N=Normal, OW=Overweight, OB=Obese