Risk factors, knowledge and health status in diabetic patients

Syed S. Habib, MBBS, FCPS, Mohammad Aslam, MBBS, PHD.

ABSTRACT

Objective: This study aimed to assess the prevalence of risk factors, knowledge and awareness in Pakistani patients with type 2 diabetes mellitus (DM).

Methods: We studied 120 DM patients at the Diabetes Center in Rawalpindi, Pakistan, from February 2001 to July 2001. Structured questionnaires, clinical and laboratory assessments were used to determine the prevalence of dyslipidemia, glycemic control, hypertension, self monitoring of blood glucose, treatment for hyperglycemia, smoking and modes of diagnosis. The patient's knowledge was assessed as regards to the laboratory investigations and treatment of DM that they are receiving. Fasting blood samples were analyzed for serum total cholesterol, triglycerides, low-density lipoprotein cholesterol (LDL-C), high-density lipoprotein cholesterol (HDL-C), glucose and glycosylated hemoglobin (HbA1c).

Results: It was found that 46.7% of subjects had poor glycemic control (HbA1c >7.5%). There was a higher prevalence of obesity (body mass index >30) in females (30%) as compared to males (11.4%). Approximately 56.7% of subjects had moderate to high-risk levels of serum total cholesterol, LDL-C 66.7%, HDL-C 46.7% and triglycerides 16.7%. Prevalence of hypertension was 48.3% (41.7% had systolic and 28.3% had diastolic hypertension). Approximately 46% of hypertensive subjects were unaware of their hypertension. The prevalence of hypertension was higher in patients who had a positive family history of DM. On regression analysis, poor glycemic control (raised HbA1c levels) was positively related with total cholesterol (coefficient correlation [r] = 0.24) ($p<0.05$) and LDL-C [r = 0.28] ($p<0.05$) levels and negatively related with HDL-C [r = 0.49] ($p<0.0001$).

Conclusion: There is a high prevalence of poor glycemic control and atherogenic dyslipidemia in Pakistani patients with type 2 DM. Most of these diabetics have poor knowledge of their disease and are unaware of its complications.

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Diabetes is a chronic illness that requires continuing medical care and education to prevent acute complications and to reduce the risk of long-term complication.[1] Poor glycemic control is the most common cause of hospital admissions in diabetics.[2] More than 135 million people worldwide had diabetes mellitus (DM) in 1995, which are approximately 4% of the global population. Approximately 300 million people are expected to have the disease by 2025 (5.4%). Urban dwellers are more likely to have the disease than rural inhabitants.[3] Diabetes mellitus is considered coronary heart disease equivalent[4] and those with diabetes who never had a heart attack have the same risk as someone who had a previous heart attack but does not have diabetes. A person with diabetes who has already had a heart attack is at the greatest risk of all.[5] The major risk factors in DM are hyperglycemia, dyslipidemia and hypertension. Diabetic dyslipidemia is characterized by elevated levels of very low-density lipoproteins cholesterol

From the Department of Physiology (Habib), College of Medicine, King Saud University, Riyadh, *Kingdom of Saudi Arabia* and the Department of Physiology (Aslam), Army Medical College, Rawalpindi, *Pakistan*.

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Address correspondence and reprint request to: Dr. Syed S. Habib, Department of Physiology (29), College of Medicine, PO Box 2925, Riyadh 11461, College of Medicine, King Saud University, Riyadh, *Kingdom of Saudi Arabia*. Tel. +966 (1) 4682080. Fax. +966 (1) 4671046. E-mail: shahidhabib44@hotmail.com

(VLDL-C), low density lipoprotein cholesterol (LDL-C) and lower levels of high density lipoproteins cholesterol (HDL-C), often referred to as the lipid triad.[6] Good glycemic control (HbA1c <7%) is achieved in less than half of individuals with type 2 DM.[7] Significant knowledge and skills deficits have been found in 50-80% of diabetic patients.[8] The modern treatment of diabetes not only requires pharmacologic therapy but also health education by the doctors and health workers. It is the patient himself who takes the treatment given by the physician and performs self-monitoring of blood sugar for its smooth control.[9] Diabetes education has changed the health belief, compliance and metabolic control of patients.[10] Patient and professionals knowledge deficits regarding diabetes have been reported. Knowledge deficits in professionals are also one of the causes of patient's knowledge deficits.[11] In one of the studies results showed that, diabetics found it easy to acquire the manual skills, but had learning difficulties with the skills that required problem solving and making decisions, such as adaptation of doses of insulin.[12] The physician has been suggested to act as a teacher and a tutor.[13] Learned behavior rapidly changes overtime in diabetics and loses its benefits and therefore, continuous efforts are needed.[14] Diabetes self-management education has been found very effectively in improving the health status of diabetics with poor glycemic control.[15] This study aimed to assess the prevalence of risk factors, knowledge and awareness in Pakistani patients with type 2 DM.

Methods. This study was carried out at the Diabetes Center, Armed Forces Institute of Pathology, Rawalpindi, Pakistan from February 2001 to July 2001. The study population consisted of 120 type 2 diabetic patients. Seventy patients were males and 50 were females. Patients recruited in this study belonged to the middle class community of Rawalpindi city. This study was approved by the Army Medical College Ethics Review Board. All were diagnosed cases of type 2 DM. Structured questionnaires were used to assess the patient's knowledge of their disease, laboratory investigations, self-monitoring of blood glucose, smoking habit, modes of diagnosis and treatment of DM that they are receiving. Clinical and laboratory assessments were used to determine the prevalence of dyslipidemia, poor glycemic control, hypertension and treatment for hyperglycemia. The clinical information, date of diagnosis and medical history was obtained by chart review (**Appendix 1**) and patient interview by one of the authors (Habib). American Diabetes Association recommends the diagnosis of DM based on fasting and casual (random) blood glucose levels. In cases of doubt, oral glucose tolerance test is recommended.[1] The height of patients was measured in centimeters with shoes off and weight was measured in kilograms in indoor clothing. Body mass index (BMI) was calculated by the following formula; body mass index (BMI) = body weight in kilograms/height in meters,[2] systolic blood pressure (SBP) and diastolic blood pressure (DBP) were recorded in sitting position in the right arm in mm Hg, by mercury sphygmomanometer. World Health Organization-International Society of Hypertension (WHO-ISH) criteria was used for diagnosis of hypertension[16] Fasting blood samples were analyzed for serum total cholesterol, triglycerides, LDL-C, HDL-C, and glucose and glycosylated hemoglobin (HbA1c). All the tests were run in duplicate and the average of 2 readings was taken as the final result. We assessed the percentage of patients falling into desirable, borderline and high-risk categories according to the criteria lay down by Adult Treatment Panel III of American Medical Association (**Table 1**).[4] The prevalence of glycemic control was assessed based on HbA1c levels. Patients with HbA1c levels up to 7.5% were regarded as having good glycemic control and those having values above 7.5% were considered as having poor glycemic control.

Data analysis. The data was analyzed by computer software program Statistical Package for Social Sciences Version 10. Descriptive characteristics and lipid profile of the study patients were calculated as median ± SD for continuous variables and as percentages for categorical variables. Categorical variables were compared between various groups using Chi-square test. Linear regression analysis was determined between glycemic control, BMI, SBP, DBP and lipid profile.

Results. Descriptive characteristics and lipid profile of diabetic patients including sex, age, BMI, duration of diabetes, SBP, DBP, HbA1c, fasting glucose and lipid profile are summarized in **Table 2**. Percentage distribution of BMI into desirable, overweight and obese categories was calculated based on gender. There was a higher prevalence of obesity (BMI >30) in females (30%) as compared to males [11.4%] (**Table 3**). Chi square test revealed a significant difference ($p<0.05$) between males and females. Regression analysis revealed a significant relationship of BMI with SBP ($r = 0.37$) ($p<0.01$) and DBP ($r = 0.49$) ($p<0.0001$).

Glycemic control, self care and knowledge. Patients were analyzed for glycemic control based on glycosylated hemoglobin (HbA1c) percentage into good and poor glycemic control categories. It was found that 46.7% of diabetics were poorly controlled with HbA1c of more than 7.5%. On regression analysis, poor glycemic control (raised HbA1c levels) was positively related with total cholesterol [$r = 0.24$] ($p<0.05$) and LDL-C ($r = 0.28$) ($p=0.02$) levels and negatively related with HDL-C ($r = 0.49$) ($p<0.0001$). Only 11.6% (n = 14) of diabetics were using glucometer for self-monitoring of blood glucose levels. Fifteen percent of diabetics were smokers. Approximately 62.5% (n = 75) of diabetic patients

could not interpret the value of fasting glucose. Fifty-four percent (n = 65) of the diabetic patients had never performed HbA1c estimations. Among the 45.9% (n = 55) of patients in whom it was performed 90% of patients were unaware how to interpret its value and could not answer what actually this value represents.

Hypertension. It was found that 48.3 % [n = 58] of subjects had hypertension. Approximately 41.7% (n = 50) had systolic and 28.3% (n = 34) had diastolic hypertension. Among these hypertensive subjects, 46.6% (n = 27) were unaware that they have hypertension and were not receiving any treatment for it. Prevalence of hypertension was also assessed in relation to the family history of DM. The prevalence of hypertension was higher in patients who had positive family history of DM but Chi square test revealed a non-significant difference (p=0.854). The prevalence of systolic and diastolic hypertension was 42.9% (n = 30) and 25.7% (n = 18) in males, while 40% (n = 20) and 32% (n = 16) in females. Although, prevalence of hypertension was higher in males as compared to females the difference was non-significant (p=0.676).

Diabetic dyslipidemia. We also analyzed the prevalence of dyslipidemia according to ATP III guidelines (**Table 4**).[4] The patients were categorized into optimal, borderline and high risk. It was found that 56.7%, 16.7%, 66.7% and 46.7% of our subjects had borderline to high-risk levels of serum total cholesterol, triglycerides, LDL and HDL.

Family history. Family history of DM was positive in 51.6% (n = 62) of patients. Diabetics with positive family history had higher prevalence of both systolic 34.5% (n = 20) and diastolic 24.1% (n = 14) hypertension as compared to those with negative family history, wherein it was 45.2% (n = 28) and 32.3% (n = 20). The difference was non-significant.

Diagnosis of diabetes mellitus. The patients were asked how their DM was diagnosed. In 25.8% (n = 31) of cases diabetes was diagnosed by fasting blood glucose levels. In 18.3% (n = 22) it was diagnosed by random blood glucose levels and in 35% (n = 42) by both fasting and random blood glucose levels. However, oral glucose tolerance test was used as a diagnostic test in 5.8% (n = 7) of cases. Approximately 15.1% (n = 18) of subjects could not recall the mode of diagnosis of their disease.

Discussion. This study was conducted to evaluate the knowledge and health status in a representative sample of Pakistani patients with type 2 DM. Most of the diabetics had poor glycemic control. There was a high prevalence of raised BMI and hypertension. Patients with positive family history of DM had higher prevalence of hypertension. Unawareness on self-care and illness was also high. The prevalence of dyslipidemia was also very high. A similar study was conducted to evaluate health status in patients with type 2 DM and reported that hypertension was undiagnosed or untreated in approximately 17% of diabetic patients, 58% had poor glycemic control, 45% had BMI >30 and 67% of patients were dyslipidemic. Most of the dyslipidemic hypertensives had uncontrolled hypertension. In addition, 22% of patients smoked cigarettes.[17] We have found that 25% of our patients were unaware of their hypertension and were not receiving any treatment for it, 46.7% had poor glycemic control (HbA1c >7.5%) and 23% had BMI >30. In the present study, 15% of the individuals were smokers. Smoking is associated with a decrease in body weight in patients without DM and an increase in insulin resistance and hemoglobin A1c (HbA1c) levels in patients with DM.[18] In a study on Indian type 2 diabetic patients, high prevalence of atherogenic dyslipidemia has been reported.[19] The prevalence of dyslipidemia is also very high in Kuwait and it is reported that diabetic patients with mixed hyperlipidemia benefit from tight glycemic control, appropriate advice on diet and exercise with regular reinforcement by continuing contact with professional dieticians and regular availability of drugs prescribed.[20] It has been suggested that inspite of ethnic and cultural differences diabetics have significantly higher prevalence of dyslipidemia.[21] The use of self-monitoring devices was very low in our patients (11.6%). In another survey, persons with diabetes were aware of their previous A1C testing but did not interpret the values accurately in relation to their own glycemic control. If clinicians expect patient knowledge and understanding of glycemic control measures to improve outcomes of care, patient education will need to emphasize the meaning of these values. Approximately 90% of our patients were unaware how to interpret HbA1c value.[22] In a large study, it was suggested that self-monitoring of blood glucose can have an important role in improving metabolic control if it is an integral part of a wider educational strategy devoted to the promotion of patient autonomy. A higher frequency of SMBG was associated with better metabolic control among subjects who were able to adjust insulin doses, whereas no relationship was found in all other patients, irrespective of the kind of treatment.[23] A study by Marchand et al[24] was designed to assess whether concept maps used with diabetic patients could describe their cognitive structure, before and after having followed an educational program. This study showed that concept maps can be a suitable technique to explore the type and organization of the patients' prior knowledge and to visualize what they have learned after an educational program. In the absence of additional risk factors such as diabetes and hypertension, there is a strong relationship between family history of diabetes with hyperinsulinemia and abdominal obesity in middle-aged Mexican individuals.[25] We found higher prevalence of hypertension in patients with positive family history of DM. We also found a significant relationship between

Appendix -1
Patient's clinical information

Name:

Age: Height:

Sex: Weight:

Body mass index: Occupation:

Address:

Family history: DM Hyperlipidemias Others

Type of diabetes:

Duration of diabetes:

How diabetes was diagnosed ? FBG RBG OGTT

Treatment for DM Diet / Oral hypoglycemics / Insulin

Type of insulin Dose

Type of oral hypoglycemic Dose

Self monitoring blood glucose (Glucometer) YES / NO

If yes then how frequent ?

- History of smoking YES / NO Duration No. of cigarettes per day
- What is normal Fasting Blood Glucose level?
- What is normal HbA1c level?
- Was your HbA1c ever measured?
- Do you have hypertension? YES / NO / Don't know

General Physical Examination
Physical appearance:
Pulse: Blood pressure: Temperature: Respiratory rate:

Investigations:
1. Fasting blood glucose (mmol/L):
2. HbA1c (%):
3. Serum total cholesterol (mmol/L):
4. Serum triglyceride (mmol/L):
5. Serum LDL (mmol/L):
6. Serum HDL (mmol/L):

DM - diabetes mellitus, FBG - fasting blood glucose, HbA1c - glycosylated hemoglobin, RBG - random blood glucose, OGTT - oral glucose tolerance test LDL - low-density lipoprotein, HDL - high-density lipoprotein

Table 1 - Adult treatment panel III classification of categories of risk based on lipoprotein levels in adults.

Risk categories	Total cholesterol		LDL		HDL		Triglyceride	
	mg/dl	mmol/l	mg/dl	mmol/l	mg/dl	mmol/l	mg/dl	mmol/l
High	≥240	≥6.2	≥130	≥3.4	≤35	≤0.9	≥400	≥4.5
Borderline	200-239	5.2-6.1	100-129	2.6-3.3	3.5-4.5	0.9-1.0	200-399	2.3-4.4
Optimal	<200	<5.2	<100	<2.6	>45	>1.0	<200	<2.3

For woman values of HDL cholesterol should be increased by 10 mg/dl,
LDL - low-density lipoprotein, HDL - high-density lipoprotein

Table 2 - Anthropometric parameters and lipid profile of diabetic patients. The data was expressed as median ± SD.

Anthropometric parameters	DM patients
Gender M/F	70/50
Age (years)	50.50 ± 10.72
SBP (mm Hg)	140.00 ± 14.16
DBP (mm Hg)	90.00 ± 9.18
BMI (kg/m^2)	25.75 ± 4.51
Plasma glucose F (mmol/l)	9.55 ± 3.07
HbA1c (%)	7.40 ± 1.52
Total cholesterol (mmol/l)	5.15 ± 1.02
LDL cholesterol (mmol/l)	3.21 ± 0.95
HDL cholesterol(mmol/l)	0.95 ± 0.25
Triglycerides (mmol/l)	1.60 ± 1.22

M - male, F - female, SBP - systolic blood pressure, DBP - diastolic blood pressure, BMI - body mass index, LDL - low-density lipoprotein, HDL - high-density lipoprotein, HbA1c - glycosylated hemoglobin

Table 3 - Percentage distribution of diabetes mellitus patients according to BMI into normal, overweight and obese categories according to World Health Organization criteria.

BMI	Males N=70		Females N=50		All diabetes N=120	
	n	(%)	n	(%)	n	(%)
<25	34	(48.6)	16	(32)	50	(41.6)
25-29.9	28	(40)	19	(38)	47	(39.2)
>30	8	(11.4)	15	(30)	23	(19.2)

$p<0.05$ as compared to males, BMI - body mass index

Table 4 - Percentage distribution of desirable, moderate risk and high risk levels in diabetes mellitus patients according to criteria by Adult Treatment Panel III.

Lipid types	Desirable		Moderate risk		High risk	
	n	(%)	n	(%)	n	(%)
Serum total cholesterol	52	(43.3)	48	(40)	20	(16.7)
Serum triglycerides	100	(83.3)	14	(11.7)	6	(5)
Serum LDL cholesterol	40	(33.3)	26	(21.7)	54	(45)
Serum HDL cholesterol	64	(53.3)	14	(11.7)	42	(35)

LDL - low-density lipoprotein, HDL - high-density lipoprotein

BMI and both SBP and DBP. Better knowledge on diabetes was not associated with better glycemic control as measured by the fasting blood glucose concentration. The reasons being wide difference in knowledge, the low rate of attendance at diabetes education sessions, and the very low awareness on chronic complications. To achieve the intended aim the diabetes education program needs to be improved.[26] Among primary care patients with type 2 diabetes, inadequate health literacy is independently associated with worse glycemic control and higher rates of retinopathy. Inadequate health literacy may contribute to the disproportionate burden of diabetes-related problems among disadvantaged populations. Efforts should focus on developing and evaluating interventions to improve diabetes outcomes among patients with inadequate health literacy.[27] Using ethnographic methods, it shows that the subjects' experiences of the disease and their health management decisions are closely linked to their cultural background and the environmental resources of the region. In developing countries the prevalence of using biomedicine and folk herbal remedies for treating diabetes, has been found quiet high. Approximately 24 local plants and plant products have been found to be used for lowering blood glucose levels.[28] Diabetes education programs, diabetes-related visits to dieticians and SMBG are associated with, and may be important sources of, improved diabetes knowledge in patients with type 2 diabetes.[29] Educating the diabetic patients is a challenge for all the health care workers worldwide. It becomes more difficult in developing countries where the level of education is low. There are no proper diabetes care centers and specialists. Above all, the poverty is also a big problem that limits the care of patients tremendously. People with diabetes should receive their treatment and care from a physician-coordinated team. Such teams include physicians, nurses, dieticians, and mental health professionals with expertise and a special interest in diabetes. The burden of diabetes is increasing very rapidly and demands for early intervention into the modifiable risk factors. Moreover, effective and continued efforts are needed for care of diabetic patients.

There is a high prevalence of poor glycemic control, atherogenic dyslipidemia and cardiovascular risk factors in Pakistani patients with DM. Most of Pakistani diabetics have poor knowledge of their disease and are unaware of its complications. Continuing patient and family education for care of diabetes and adherence to all aspects of self-care should be encouraged. Awareness programs shall be arranged on the importance of glycemic control, exercise and prevention of complications. Knowledge of diabetes and self-management skills should be assessed regularly.

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