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Research Article

Glycemic Control of Patients with Type 1 and Type 2 Diabetes Mellitus in Saudi Community

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Abstract

Background and Objective: The incidence of type 1 and type 2 diabetes mellitus is growing. Some national studies have measured glycemic control in people with diabetes. The objective of this study was to measure the glycemic control in people with type 1 and type 2 diabetes mellitus.

Methods: A cross section study of patients with type 1 and type 2 diabetes mellitus at the primary health care department and diabetic centre.

Main results: In total, 1612-patients were included in the study. There were 295 (18.3%) diagnosed with T1DM and 1317 (81.7%) with T2DM. There were 636 (39.5%) male and 976 (60.5%) were female with mean age 37.0 ± 7.9. Mean HbA1c was 8.1 ± 2.3, with significant differences in mean HbA1c between T1DM and T2DM patients. The correlation of, HbA1c with age and body mass index were ($r = 0.05$, $p = 0.04$) and ($r = -0.14$, $p < 0.0001$) respectively. HbA1c < 7.0 were achieved in 7.8% and 29.8 of T1DM and T2DM respectively, $p = 0.047$. There were significant differences in achieved HbA1c < 7.0 between genders for both T1DM and T2DM patients.

Conclusion: We found patients with type 1 and type 2 diabetes have poor glycemic control and that will increase their risk of diabetic complications.

Keywords: *Diabetes Mellitus; HbA1c; T1DM and T2DM*

Introduction

Diabetes mellitus is a major cause of excess mortality and morbidity. The prevalence and incidence of type 2 diabetes mellitus (T2DM) are increasing worldwide [1]. T2DM patients have a higher risk of developing microvascular and macrovascular disease than the general population. The occurrence of these complications depends largely on the degree of glycemic control as well as on the adequate control of cardiovascular risk factors [2-5]. Type 1 diabetes mellitus (T1DM) caused by destruction of the β-cells of the pancreas through a cellular-mediated autoimmune process [6]. Over the last three decades, the incidence of T1DM has been also on the rise worldwide [7-10]. At the same time, there is a trend towards diabetes being diagnosed at a younger age [11-14]. In Saudi Arabia, T1DM was prevalent in 0.2% of the Saudi males and 0.24% of the Saudi females [15]. Only 15% of patients with T1DM met the glycemic target, > 20% had very poor glycemic control (Hba1c > 8.8%) [16,17]. High prevalence of hyperglycemia (8.9 - 15%) was reported in different regions in Saudi Arabia [18]. The Diabetes Control and Complications Trial (DCCT) showed that good glycemic control has a significant effect on the development of nephropathy, retinopathy, and neuropathy of T1DM [19].

Gycosylated hemglobin (HbA1c) is used to evaluate the glycaemic control of diabetic patients [20,21]. HbA1c level < 7.0% as the primary glycaemic control target for diabetics is suggested by the American Diabetes Association (ADA) guidelines [6]. The percentage of patients who reach this objective seems to be notably lower (24%) in the case of less-controlled T2DM patients [22,23]. Increasing HbA1c levels were correlated with macrovascular and microvascular disease whereas decrease in HbA1c level decreases the prevalence of long term complications [24,25]. Therefore, we describe the glycemic control of population with T1DM and T2DM in our institution.

Methods

Older than 12 years old, had T1DM and T2DM were enrolled in the analysis. All patients were from the population of the Primary health and Diabetic Centres at King Fahad Armed Forces Hospital. A complete history and physical examination were taken, to have baseline laboratory assessments including HbA1c. HbA1c was expressed as percentage. High performance liquid chromatography was used. The HbA1c was divided into four groups; < 7.0, 7.0 - 7.9, 8.0 - 8.9 and ≥ 9.0.

Statistical Analysis

Univariate analysis of baseline and follow up demography and clinical laboratory endpoints were accomplished using unpaired t-test where appropriate. Chi square (X^2) test were used for categorical data comparison. Pearson correlation was used for correlation. All statistical analyses were performed using SPSS Version 22.0. All P values were based on two-sided tests. The difference between groups was considered significant when $P < 0.05$.

Results

In total, 1612-patients completed the study. There were 295 (18.3%) diagnosed with T1DM and 1317 (81.7%) with T2DM. There were 636 (39.5%) male and 976 (60.5%) were female with mean age 37.0 ± 7.9. Baseline characteristics are shown in table 1. Mean HbA1c was 8.1 ± 2.3 with significant differences in mean HbA1c between T1DM and T2DM patients. The correlation of HbA1c with age and body mass index were ($r = 0.05$, $p = 0.04$) and ($r = -0.14$, $p < 0.0001$) respectively.

Parameters		Total	T1DM	T2DM	P value
n (%)		1612	295 (18.3)	1317 (81.7)	
Age (years)		37.0 ± 7.9	25.9 ± 3.3	39.5 ± 6.3	< 0.0001
Gender	Male	636 (39.5)	96 (15.1)	540 (84.9)	0.007
	Female	976 (60.5)	199 (20.4)	777 (79.6)	
Body mass index (kg/m^2)		31.4 ± 6.0	31.4 ± 6.1	31.3 ± 6.0	0.9
HbA1c		8.1 ± 2.3	7.8 ± 2.3	8.2 ± 2.3	0.02

***Table 1**: Characteristics of patients with type 1 and type 2 diabetes mellitus stratified by age, gender, BMI and HbA1c. Data are means ± SD or number (%).*

HbA1c < 7.0 were achieved in 7.8% and 29.8 of T1DM and T2DM respectively, $p = 0.047$, figure 1. There were significant differences in achieved HbA1c < 7.0 between genders in both T1DM and T2DM patients. There were significant differences in the groups of HbA1c and the gender groups, figure 2.

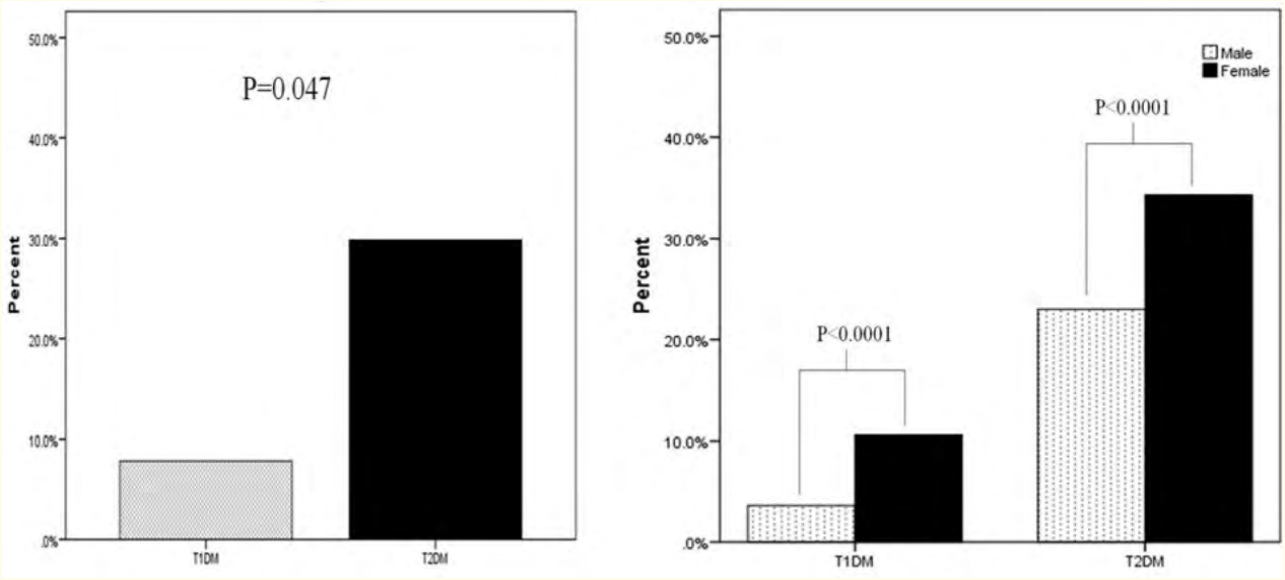

Figure 1: *Characteristics of patients with type 1 and type 2 diabetes mellitus stratified by HbA1c < 7.0 to gender.*

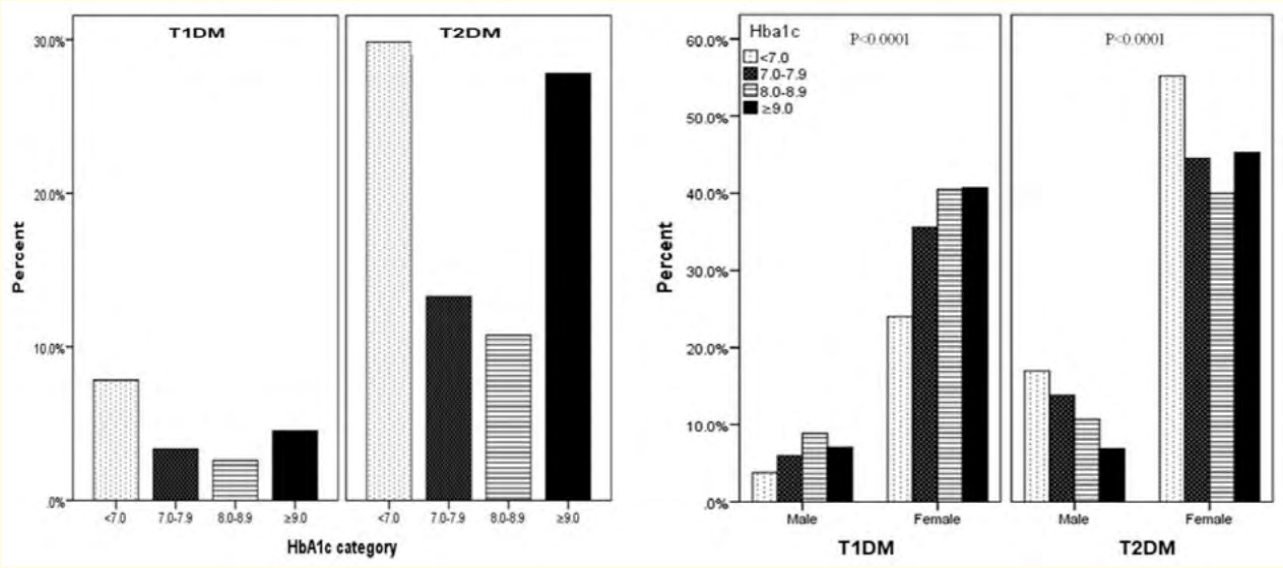

Figure 2: *Characteristics of patients with type 1 and type 2 diabetes mellitus stratified by HbA1c category to gender.*

Discussion

This study showed the glycemic control in patients with T1DM and T2DM. Generalization to all population could not be due to regionalized characteristics. In addition, it does not evaluate the healthcare services offered in our city. The size of our sample and the cross-section type of the study should be of consideration.

The American Diabetes Association treatment guidelines suggest an HbA1c level < 7.0% as the primary glycaemic control target for diabetics, and a decrease in HbA1c level reduces the prevalence of chronic complications due to the disease [6,22]. In comparison to conventional therapy, the reductions in HbA1c levels achieved in the intensive therapy arm of the DCCT were associated with decreased rates in incidence and progression of microvascular complications. Tight glycaemic control was beneficial in preventing or delaying microvascular complications [19].

In our study, there was nonsignificant an inverse relationship of good glycemic control with older age among patients with T2DM ($r = -0.025, p = 0.7$), in addition, the average HbAlc of 8.1% was similar to the intensive treatment cohort of the DCCT (8.2%), higher to that described in Belgium with values of 6.6%, a cross-sectional multi-centered study in Europe, Japan and lower than United states, with values of 8.6%, Denmark (mean HbA1c 9.1%) and a cross-sectional study with children and adolescents in France (mean HbA1c 9.0%) and a population based study in Scotland with value of 9.1% [26-30]. To compare our results with those described above conclude that our services are providing satisfactory glycemic control results.

In our study, 92.2% and 70.1% were not able to achieve the American Diabetes Association goal in T1DM and T2 DM respectively and only 11.2% and 56.8% of patients in T1DM and T2DM respectively had a HbA1c concentration less than 8% comparable to other studies [26]. That increases our population risks for complications of diabetes.

Several reasons may contribute to failure of not achieving the American Diabetes Association goal. In clinical practice compared to trial settings, barriers to tight glycaemic control exist. More intensive insulin regimen even in young people with type 1 diabetes was the major factor in producing good glycemic control in the DCCT [31].

Optimizing glycaemic control measures were recently introduced. These include an intensive education programme; Dose Adjustment for Normal Eating (DAFNE), DAFNE may produce short-term but not long-term improvements in HbA1c levels [32]. Along with considerable nurse educator resources, a highly motivated patient is needed. Many patients move away from the clinic area or do not comply with regimens long-term.

Poor glycemic control was shown in diabetic patients who frequently missed appointments than those who missed none. Patients had a difference that is clinically relevant when missing more than 30% of scheduled visits, a HbA1c value 0.7 point higher relative to those with perfect attendance, a. missing appointments could have a direct effect on clinical outcomes by reducing continuity of care, measuring clinical variables or adjust medications, delaying the appropriate timing of interventions and screenings, and lacking a trusting provider-patient relationship. Frequent aappointments cannot be offered as in clinical trials, due to resource limitations [33,34].

Many patients in the DCCT were treated with continuous subcutaneous insulin infusions (CSII), in contrast to no patients in our study. Achieving better glycaemic control was shown in some studies with the use of CSII over multiple daily injections in others not [35,36]. CSII is more expensive, requires an experienced diabetes team who can provide regular and frequent input into the ongoing care of the patient and a highly motivated patient without psychological problems. Studies with T1DM patients demonstrated that up to 62% of patients maintained a good glycemic control. Fluctuations of glycemia and, consequently, affect HbAlc could be attributed to different factors associated to general population can cause and upset the maintenance of good glycemic control [27-29]. The high prevalence of poor glycemic control shown in this study, reflects needs for more efforts for improvement.

The burden of T2DM is on the increase worldwide, affecting more than 8% of the global adult population [37]. The risk of diabetic complications in patients with T2DM is strongly associated with the level of glycemia. The risk of microvascular and perhaps macrovascular complications of diabetes could be reduced by achieving tighter glycemic control [38]. There was nonsignificant an inverse relationship of glycemic control with age among patients with T2DM ($r = -0.002$, $p = 0.9$). That it could be due to developmental effect where cohorts mature, and their glycemic control improves as they age and may also be related to rapid changes in lifestyles witnessed in Saudi over the past five decades. More than half (63.4%) of participants with T2DM had poor glycemic control which is similar to that reported in Saudi Arabia where half of the studied populations had poor glycemic control [39]. In USA, data from National Health and Nutrition Examination Surveys reported that 42% - 50% of people with diabetes met the HbA1c target of 7% [40,41]. In the United Kingdom, a series of retrospective analysis of data found that 76% - 79% of patients had HbA1c > 7.5% [42].

Conclusion

These data indicate that many patients with T1DM and T2DM have poor glycemic control where they will be at high risk of diabetic complications. A structured primary and secondary intervention programs will be required to effectively manage this disease. More national studies are needed to assess glycemic control among diabetic patients in Saudi Arabia.

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Conflict of Interest

The authors have no conflict of interest to disclose.

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