Factors Affecting Glycemic Control among Patients with Type 2 Diabetes in Bahrain

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Background: In Bahrain, the prevalence of poor glycemic control among type 2 diabetes patients was found to be high. According to studies, a good glycemic control is defined by HbA1c<7. Good glycemic control is associated with a reduction in microvascular complications.

Objective: To evaluate the factors influencing glycemic control in Bahrain.

Design: A Cross-Sectional Study.

Setting: Endocrinology Clinic, King Hamad University Hospital, Bahrain.

Method: Data from 205 participants were reviewed. Participants were given a questionnaire to answer and their records were reviewed. SPSS was used for statistical data analysis. Patients who did not have HbA1c in their medical records were excluded from the analysis. A total of the 194 patients were included in the study.

Result: Fifty-six (28.9%) had good glycemic control. Factors that significantly affected the mean HbA1c were diet, medication adherence and receiving a combination of insulin and oral anti-diabetic medications.

Conclusion: Poor glycemic control was associated with diet, medication adherence and receiving a combination of insulin and oral anti-diabetic medications. These factors could be a target for future plans and actions, which would achieve a better glycemic control.

Diabetes Mellitus (DM) prevalence has been increasing worldwide. It currently poses a threat to human health. The International Diabetes Federation (IDF) estimated the global prevalence of diabetes to be 8.3%[1]. It also predicts that the number of people with diabetes will increase by 55% by 2035[1].

It was reported that 1 in 10 adults in the Middle East and North African region has diabetes[1]. In Bahrain, the prevalence of diabetes was estimated to be 15.6% in 2015[2]. Diabetes is also responsible for a large number of deaths. Statistics from MOH in Bahrain stated that 24% of total deaths from non-communicable diseases (NCD) were attributed to diabetes[3].

Diabetes mellitus is a major cause of morbidity and mortality. Diabetes-related complications are now posing a major burden for health care systems worldwide. The United Kingdom Prospective Diabetes Study (UKPDS) study concluded that a reduction of 37% for microvascular is achieved with every 1% reduction in the HbA1c level[4]. In that context, the American Diabetes Association (ADA) guidelines 2016 recommended an HbA1c below 7% for all non-pregnant adults[5]. Tighter glycemic control was suggested for individualized patients and less advocated for others[5].

Despite the great emphasis on tight glycemic control, a high number of patients remain poorly controlled. In Bahrain, it was found that only 14.8% of patients attending primary care (diabetic clinic) had good glycemic control. Similarly, 21.8% of patients in military hospitals had an HbA1c within normal range[6].

This high percentage of poorly controlled patients with diabetes in Bahrain is reflected upon the high prevalence of complications observed in the Kingdom. A study performed at the Bahrain Defence Force Hospital in 2012 concluded that 66% of patients with diabetes had complications, the most common of which was diabetic neuropathy accounting for 37%[7].

Several studies had focused on the increasing incidence and prevalence of type 2 diabetes in Bahrain as they are alarmingly high. The high percentage of patients with poor glycemic control had been previously established[6]. However, different factors might be affecting glycemic control in Bahrain.

Studies to identify factors associated with poor glycemic control were performed in many countries, but very little

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research is done in Bahrain on that topic, hence they are not yet well documented.

The aim of this study is to evaluate factors associated with poor glycemic control among patients with type 2 diabetes in Bahrain.

METHOD

Data were collected from patients' records from 10 April 2016 to 4 May 2016.

Two hundred five patients were included in the study. All patients were older than 23 years diagnosed with type 2 diabetes. The study excluded all pregnant women, patients with type 1 diabetes and patients with psychiatric conditions. Patients who did not have HbA1c in their medical records were also excluded from the analysis. A total of the 194 patients were included in the study.

Written informed consent was obtained from all patients. A questionnaire was prepared in Arabic and English and was then distributed to every eligible participant to complete based on their language preferences. Participants completed the survey with the help of researchers if needed. The questionnaire included data regarding lifestyle, medication adherence, diabetes duration and related complications.

Lifestyle and medication adherence were self-reported by patients. For exercise, ADA guidelines recommend "30 minutes of moderate-to-vigorous intensity aerobic exercise at least 5 days a week"[8]. Therefore, for the purpose of this study, exercise was divided according to ADA recommendations into 2 categories of exercise or no exercise.

However, BMI, HbA1c levels and medications were collected from the patient's records. Most patients included in the analysis had an HbA1c test done within the last three months. All patients who did not have HbA1c in their records were excluded from the study analysis.

Statistical analysis was performed using SPSS. Each variable was divided into two or three categories. Mean HbAIc was calculated for each variable. Independent-t-tests or one-way ANOVA were then used to compare the means and generate P-values. Statistical significance was taken at P-value of <0.05 and a confidence interval of 95%.

RESULT

A total of 205 patients participated in the study. However, 11 patients did not have HbA1c in their medical records and hence were excluded from the analysis. Table 1 shows a summary of the characteristics of the 194 patients included in the study.

One hundred ninety-four patients were included in the study (93 males and 101 females), aged between 25 and 97 with a mean age of 54.8 (S.D 11.7). Thirty-two (16.4%) patients had diabetes alone with no other comorbidity. Approximately half of the patients had diabetes for more than 10 years, 101 (52.1%). One hundred forty-seven (75.8%) were Bahrainis.

Table 1: Patients' Characteristics

Factor	N (%)
Gender	
Male	93 (47.9%)
Female	101 (52.1%)
Nationality	
Bahraini	147 (75.8%)
Non-Bahraini	47 (24.2%)
Glycemic Control	
Good	56 (28.9%)
Poor	138 (71.1%)
Age	
≤40	26 (13.4%)
40-65	136 (70.1%)
>65	32 (16.5%)
BMI	
Normal (18-25)	9 (6.2%)
Overweight (25-30)	38 (26.2%)
Obese (>30)	98 (67.6%)
Not recorded in the system	49 (25.3%)
Exercise	
Regular	28 (14.4%)
Irregular	166 (85.6%)
Diet	
Controlled	60 (30.9%)
Uncontrolled	134 (69.1%)
Smoking	
Yes	27 (13.9%)
No	167 (86.1%)
Diabetes Duration (years)	
≥5	59 (30.4%)
5-10	34 (17.5%)
>10	101 (52.1%)
Family History	
Yes	142 (73.2%)
No	52 (26.8%)
Diabetes Medication	
Hypoglycemic agents alone	71 (36.6%)
Insulin alone	36 (18.6%)
Combination of insulin and hypoglycemic agents	87 (44.8%)
Medication Adherence	
Yes	154 (79.4%)
No	40 (20.6%)
Education about Diabetes	
Yes	65 (33.5%)
No	129 (66.5%)
SMBG	
Yes	110 (56.7%)
No	84 (43.3%)
Complications	
Yes	83 (42.8%)
No	111 (57.2%)
Comorbidity	
Yes	162 (83.6%)
No	32 (16.4%)

Obesity, defined by BMI >30, was reported in 98 (67.6%) patients.

Table 2: Relationship between Studied Factors and Mean HbA1c

Characteristic	N (%)	Mean A1c (SD)	P-value
Gender			
Male	93 (47.9%)	8.53 (1.67)	0.052
Female	101 (52.1%)	8.04 (1.79)	
Race			
Bahraini	147 (75.6%)	8.37 (1.77)	0.179
Non-Bahraini	47 (24.2%)	7.98 (1.65)	
Age			
≤ 40	26 (13.4%)	8.13 (1.98)	
>40 and <65	136 (70.1%)	8.32 (1.74)	0.840
>65	32 (16.5%)	8.20 (1.59)	
BMI			
Normal (18-25)	9 (6.2%)	8.07 (2.01)	
Overweight (25-30)	38 (26.2%)	8.45 (1.74)	0.530
Obese (more than 30)	98 (67.6%)	8.10 (1.57)	
Not recorded in the system	49 (25.3%)		
Diabetes Duration (years)			
≤5 years	59 (30.4%)	7.85 (1.70)	
5-10 years	34 (17.5%)	8.44 (2.07)	0.076
>10 years	101 (52.1%)	8.47 (1.62)	
Exercise			
Regular	28 (14.4%)	7.92 (1.59)	0.240
Irregular	166 (85.6%)	8.34 (1.77)	
Diet			
Yes	60 (30.9%)	7.87 (1.65)	**0.030**
No	134 (69.1%)	8.46 (1.76)	
Smoking			
Yes	27 (13.9%)	8.92 (2.01)	0.077
No	167 (86.1%)	8.17 (1.68)	
Education about diabetes			
Yes	65 (33.5%)	8.17 (1.65)	0.532
No	129 (66.5%)	8.33 (1.80)	
SMBG			
Yes	110 (56.7%)	8.49 (1.72)	0.057
No	84 (43.3%)	8.01 (1.75)	
Diabetes Medications			
Hypoglycemic agents alone	71 (36.6%)	7.38 (1.30)	
Insulin alone	36 (18.6%)	8.60 (1.61)	**0.000**
Combination of insulin and hypoglycemic agents	87 (44.8%)	8.88 (1.83)	
Medication adherence			
Yes	154 (79.4%)	8.00 (1.56)	**0.000**
No	40 (20.6%)	9.34 (2.01)	
Complications			
Yes	83 (42.8%)	8.55 (1.80)	0.060
No	111 (57.2%)	8.07 (1.68)	
Comorbidity			
Yes	162 (83.6%)	8.24 (1.69)	0.511
No	32 (16.4%)	8.46 (1.99)	

Fifty-six (28.9%) patients had good glycemic control. The majority of patients were poorly controlled. Good and poor glycemic control was defined as an HbA1c below and above 7, respectively.

One hundred sixty-six (85.6%) patients did not engage in regular exercise, 134 (69.1%) reported not having a balanced diet and 27 (13.9%) were smokers.

One hundred fifty-four (79.4%) reported compliance with medications. Eighty-seven (44.8%) were on a combination of insulin and oral hypoglycemic agents. Thirty-six (18.6%) were on insulin alone and 71 (36.6%) were on monotherapy.

One hundred ten (56.7%) reported having one or more diabetes-related complications. Sixty-five (33.5%) reported being educated about diabetes. Self-monitoring of blood glucose (SMBG) at least once a day was reported among 110 (56.7%) patients.

Factors affecting the mean HbA1c were diet (P-value=0.03), medication adherence (P-value=0.00) and receiving a combination of insulin and oral anti-diabetic medications (P-value=0.00). Table 2 shows the relationship between all factors studied and their mean HbA1c.

DISCUSSION

Data showed that 71.1% of patients have poor glycemic control. This high percentage is also reported in other countries of the Middle East where 74.9% and 78.8% of patients had a poor glycemic control in Kingdom Saudi Arabia and Kuwait, respectively[6,9]. Similarly, in Malaysia, 77% of patients had a high HbA1C[10].

In the present study, glycemic control was shown to be significantly affected by the poor dietary practice among patients with type 2 diabetes. This could be explained by the high carbohydrate and fat content in traditional Arabic meals.

Relationship between diet and glycemic control was also reported in patients with diabetes in Jordan[11]. However, in other studies, this observation was not significant[10,12].

Medication types were also found to affect glycemic control. Mean HbA1c was found to be significantly higher in patients on insulin alone or a combination of medications compared to patients on monotherapy. This finding was also observed in many other countries globally including Malaysia and Jordan[9,10].

One possible explanation for this finding could be that people on multiple medications are usually the ones who have a longer diabetes duration and probable pancreatic cell dysfunction. Medication adherence could also account for this observation. It could be claimed that people on a combination of medications might have a poorer adherence and a higher tendency to forget than those on monotherapy, making them poorly controlled.

The current study finding supports previous studies revealing a strong association between adherence and glycemic control[10,12]. This correlation was proven by a study conducted in San Diego USA; the study concluded that "baseline endorsement of forgetting to take medication was associated with a 0.43% increase in 6-month HbA1c"[13].

The duration of DM was not found to be a significant factor in terms of glycemic control in this study. This lack of association

is not consistent with a number of studies[9,12,14]. These studies reported a positive relationship between having diabetes for a longer period of time and poor glycemic control.

In this study, no positive correlation between comorbidities and glycemic control was found. There is a similar pattern observed in previous studies[10,11].

A large number of patients was found to have no regular exercise in Saudi Arabia, which is very comparable to this study. This reflects the lack of exercise in the region in general. Although the exercise was not found to be associated with poor glycemic control in this study, lack of regular exercise was significant in Saudi Arabia[9].

This study had some limitations. One of the main limitations was that it is a single visit study. Following patients over a period of time would provide a better picture of the factors affecting glycemic control. Another limitation is the small sample of the study. This study was carried out in only one of the secondary care hospitals in the country which may not give an accurate representation of the whole population of Bahrain. Performing the study in the three main secondary care hospitals might yield different results.

CONCLUSION

Poor glycemic control was shown to be remarkably high in Bahrain. Factors that significantly affected the HbA1c were poor diet, taking a combination of medications and medication adherence. It is worth mentioning that these are all modifiable thus making them an important target for future improvements and plans.

It is therefore recommended that patients, dieticians and healthcare providers address these factors to achieve a better overall glycemic control in Bahrain.

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