Original Article

Characteristics, glycemic control and outcomes of adults with type-2 diabetes mellitus attending specialized clinics in primary healthcare centers in Bahrain—A cross-sectional study

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Abstract

Introduction: Diabetes mellitus is a global health challenge that requires continuous and multidisciplinary management. Suboptimal diabetes management results in serious complications that impose a huge burden on patients and the healthcare system. This study aimed to assess the characteristics, glycemic control and outcomes of patients with type-2 diabetes attending primary healthcare centers in Bahrain according to the new American Diabetes Association (ADA) guidelines. **Materials and Methods:** A cross-sectional study was conducted among adult patients with type-2 diabetes mellitus attending diabetic clinics in Bahrain. A multi-stage sampling technique was adopted. The data collection tool consisted of three parts: baseline and sociodemographic data, the physical measures of the patients and the most recent laboratory results. An A1C of less than 7% was indicative of good glycemic control. **Results:** A total of 721 patients with type-2 diabetes mellitus were included with an average age of 58.4 years. Most patients were hypertensive ($n = 457$, 63.4%), and half of them were hyperlipidemic ($n = 373$, 51.7%). Around 57% ($n = 402$) of the patients adopted lifestyle modifications, 14.8% adopted diet control measures and around half performed weekly regular exercises. More than 92% of the cohort were on metformin, 52.0% ($n = 375$) were on Sulphonylurea medications and 41% ($n = 298$) were on insulin formulations. While only 40% of the patients had controlled diabetes ($n = 283$, 39.3%) and hypertension ($n = 298$, 41.3%), most patients achieved adequate cholesterol and low-density lipoprotein levels (83.2% and 76.6%, respectively). Non-Bahraini ($P \leq 0.001$), young ($P = 0.027$) and obese patients ($P = 0.003$) had lower glycemic control measures. Adequate cholesterol levels were seen more in patients with a controlled glycemic index ($P = 0.015$). **Conclusion:** Considering the new glycemic targets, glycemic and hypertension control was poor among diabetic patients, especially non-Bahraini, obese and young patients. Urgent interventions by policymakers, physicians and caregivers are needed to improve the outcomes of diabetes.

Keywords: Adult, Bahrain, diabetes mellitus, glycemic control, primary healthcare

Introduction

Diabetes Mellitus is one of the major global healthcare concerns that has been increasing rapidly in the last decades. Worldwide, more than half a billion adults suffer from diabetes.[1] In the Middle East and North Africa region including Gulf Cooperation Council (GCC) countries, there are more than 73 million adults with type-2 diabetes mellites.[2] It is predicted that type-2 diabetes

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will affect as high as a quarter of the GCC population by 2030. Bahrain is considered one of the countries with high diabetes prevalence in which around 15% of the adult population suffers from diabetes.[3]

The Global Burden of Disease Study in 2019 concluded that the global number of disability-adjusted life years (DALYs) attributed to type-2 diabetes was 66.3 million, with an age-standardized rate of 801.5 DALYs per 100,000 population. Due to the high burden, many organizations have undertaken actions to diagnose, manage the disease and delay the complications as well as prevention strategies.[4] This burden is further reflected in the healthcare systems. For instance, the overall medical costs attributed to diabetes accounted for 22% of the total healthcare expenditure and the direct health expenditure for a person with type-2 diabetes was 3.1 times higher than the average cost of a person without it in Bahrain.[5]

Thus, providing comprehensive care to people with diabetes is essential to reduce the impact and consequences of diabetes. This comprehensive medical assessment typically involves regular assessment of medical history, conducting a physical examination, and monitoring laboratory results like glycated hemoglobin (A1C), lipid profile, spot urinary albumin-to-creatinine ratio (ACR), estimated glomerular filtration rate and liver function test. It also includes measurement of body mass index (BMI), blood pressure and screening for complications.[6]

Adequate glycemic control is a cornerstone in diabetes management and is linked to a lower cardiovascular risk. Different tools are used to assess glycemic control levels. By far, A1C is the most common tool to determine glycemic control.[7] In general, A1C of more than 8 mmol/L is often indicative of poor glycemic control, while A1C of less than 7 mmol is often indicating good glycemic control.[8]

Diabetes often coexists with other cardiovascular diseases like hypertension and hyperlipidemia. Hypertension is the commonest comorbidity among patients with diabetes. It is seen in around 50–80% of patients with type-2 diabetes and is linked to poorer cardiovascular outcomes.[9] Concurrence of hypertension and hyperlipidemia in patients with diabetes augments the risks of macrovascular and microvascular complications.[10] Thus, optimal diabetes care extends beyond glycemic control to include blood pressure control, lipid control and weight control.

Aggressive risk factor modification has shown a large benefit in preventing and slowing the development of atherosclerotic cardiovascular disease in diabetes. According to multiple studies, decreasing the systolic blood pressure to <140 mmHg resulted in a significant reduction in cardiovascular events such as myocardial infarction, stroke and albuminuria. Hence, the latest updates of the standards of care in diabetes published by the American Diabetes Association (ADA) included new hypertension diagnosis cut-offs (systolic ≥130 mmHg or diastolic blood pressure ≥80 mmHg), new hypertension targets and new lipid management targets for high-risk patients.[11]

Despite all efforts and guidelines to control diabetes and the associated comorbidities, many studies revealed suboptimal control of diabetes and its related outcomes. For instance, a study conducted in the United States found that diabetes control in the period between 2007 and 2018 ranged between 57.4% and 50.5%. The study also showed that 55.7% of patients had achieved good lipid control (lipid control (non-high-density lipoprotein cholesterol level <130 mg/dL) and 70.4% achieved adequate blood pressure levels (<140/90 mm Hg).[12] The national audit in the United Kingdom revealed that around 60% of patients had A1C ≤7.5% and blood pressure ≤140/80 mmHg. Among all regions assessed in the audit, those who had A1C ≤7% constituted 57.4 to 44% of the sample.[13] A recent systematic review of 12 studies and 5765 participants revealed that 45.2% to 93% of patients had poorly controlled diabetes, i.e., A1C >7% or A1C ≥7%.[14] In addition, a study in Saudi Arabia revealed that only 24.1% of patients had good control of diabetes (A1C <7%).[15] In Qatar, a study showed that the patients with controlled diabetes constituted 36.3% only of all patients.[16] Moreover, around one-third (34.5%) only of Kuwaiti diabetic patients had adequate diabetes control.[17]

In Bahrain, a study conducted in a secondary care setting in Bahrain revealed that less than one-third of patients had an A1C level of less than 7% and less than two-thirds had controlled hypertension (<140/90 mmHg). Even poorer results were reported by some studies in other settings in Bahrain (A1C <7% in 20.4%–32% of the patients).[18]

This study aimed to assess the characteristics and outcomes of patients with type-2 diabetes attending primary healthcare centers in Bahrain. To the best of our knowledge, this is the first multi-centric study to investigate diabetes outcomes in Bahrain based on the new ADA guidelines. Understanding the characteristics and the outcome of patients with diabetes is vital to implement these guidelines and amending them locally and nationally based on the characteristics of our population.

Materials and Methods

Study setting and design

A cross-sectional study was conducted among adult patients with type-2 diabetes mellitus attending diabetic clinics in the primary healthcare centers in Bahrain. The primary healthcare system in Bahrain comprises five health regions and 28 primary care centers. One health center was selected from each region. Patients attending the diabetic clinics at the selected centers were invited to participate in the study. All diabetic clinics run by professional teams consisting of family physicians and diabetes specialist nurses. Ethical approval was obtained from the Ethics Committee of Primary Healthcare in Bahrain vide Letter No. 7 dated 28/3/2022 and informed written consent was taken from all participants in the study.

Sampling technique and size

The diabetic clinics are distributed among all health centers in five health regions in Bahrain. One health center was selected from each region, and a total of five health centers were included. The sample size has been determined to represent the diabetes prevalence and diabetic population in central diabetic clinic in Bahrain according to the following formula:

$$n = \frac{z^2 \times p \times (1 - p)}{e^2}$$

Where z = 1.96 is the standard normal value corresponding to 95% confidence interval, prevalence $P = 16.3\%$ is estimated by the prevalence of diabetes in Bahrain, and e is the margin of error and is usually assumed to be 0.05. Therefore, the calculated sample size was 210. To increase the power of the study and to compensate for the study design effect, a sample size of more than 600 was targeted.

$$n = \frac{1.96^2 \times 0.163 \times (1 - 0.163)}{0.05^2} = 210$$

To increase the power of the study and to compensate for the study design effect, a sample size of more than 600 was targeted.

Inclusion and exclusion criteria

Adult patients, aged 18 and above, who were diagnosed with type-2 diabetes mellitus and followed by diabetic clinics of primary care centers were eligible for selection. Pregnant patients, patients with cognitive impairment, inability to communicate verbally and terminally ill patients were excluded from the study.

Data collection instrument

A data collection tool was formulated. The tool consisted of three parts: the first part composed of sociodemographic data like age, sex, nationality, education, marital status, comorbidities, medications, duration of diabetes smoking, alcohol consumption, exercises, and diet patterns; the second part assessed the physical measures of the patients such as weight in kilograms (Kg), height in centimeters (cm), and blood pressure and the third part consisted of the most recent laboratory results including A1C, fasting plasma glucose and lipid profile.

Operational definitions

Diabetes mellitus was diagnosed according to the ADA diagnostic criteria. Duration of diabetes was calculated as the period, in years, between the diagnosis of diabetes and the data collection period. We assessed glycemic control according to A1C results. An A1C <7% was indicative of good control of diabetes, while A1C >8% indicated poor glycemic results. In addition, A1C readings between 7 and 8% were indicative of partially controlled diabetes.

A blood pressure of <130/80 mmHg was indicative of good blood pressure control. Blood pressure was measured by diabetes specialist nurses using validated machines.

We assessed neurological complications based on monofilament test and the presence of neuropathic symptoms, retinopathy according to retinal screening findings and nephropathy based on laboratory tests. Regular exercises were defined as the performance of weekly moderate-intensity exercises for 150 minutes or high-intensity exercises for 75 minutes. We asked patients four questions to assess their exercises as follows; do you exercise regularly? If yes, how often do you do exercises per week (daily to once weekly)? for how long do you exercise (in minutes) per week? and what type of exercises do you do, e.g., walking, running, swimming, football, bicycling and/or others? For dietary control, we asked the patients two questions; do you follow a healthy diet regimen? If yes, do you follow your healthy diet plan well? Diet control was defined as the adoption of a healthy diet regimen according to the patient. These two questions are used to assess general dietary practices by patients in the summary of diabetes self-care activity questionnaire.

Pilot study

A pilot study was carried out to identify possible challenges during the data collection process. A total of ten patients were included in the pilot study. Based on the responses received, the sequence of the question was modified.

Data analysis procedure

The data was analyzed using Statistical Package for Social Sciences software (V.25.0; IBM Corp, Armonk, New York, USA). Frequencies and percentages were computed for categorical variables while means and standard deviations were computed for continuous variables. Pie charts were used to present the results. T-test was used to determine statistical significance between two continuous variables while exacts Fisher and Chi-square tests were used for categorical variables. *P* value of <0.05 was considered statistically significant.

Results

A total of 721 patients were included in the analysis with an average age of 58.4 years. Almost three-quarters were Bahraini (n = 537, 74.5%), 51% were male and more than 80% of the studied cohort were married (n = 593, 82.2%). The average duration of diabetes in the studies group was 12.8 ± 7.9 years. Most patients were hypertensive (n = 457, 63.4%), and half of them were hyperlipidemic (n = 373, 51.7%). About 10% of the patients (n = 59, 8.2%) were smokers and 4% (n = 27) were alcohol-drinker. The baseline characteristics of the participants are shown in Table 1.

Characteristics of diabetes treatment

Around 57% (n = 402) of the patients adopted lifestyle modifications, 14.8% adopted diet control measures and around half performed weekly regular exercises. More than 95% of the cohort were on oral hypoglycemic agents (n = 691), more than 92% (n = 663) were on metformin and around half of them were on Sulphonylurea medications (n = 375, 52.0%). Additionally, insulin formulations were used in approximately 41% of the studied patients (298, 41.3%). Up to 85% of the patients were on statins (n = 614, 85.2%) Table 2.

Table 1: Baseline characteristics of the participants

Baseline characteristics	*n* (%)
Nationality	
Bahraini	537 (74.5)
Non-Bahraini	184 (25.5)
Sex	
Male	364 (50.5)
Female	357 (49.5)
Age in years, mean±SD	58.4±11.3
Education	
No primary education	72 (10.0)
Primary school	80 (11.1)
Intermediate school	94 (13.0)
Secondary school	281 (39.0)
University/College	194 (26.9)
Marital status	
Single	47 (6.5)
Married	593 (82.2)
Widowed	60 (8.3)
Divorced	21 (2.9)
Duration of diabetes in years, mean±SD	12.8±7.9
Comorbidities	
Hypertension	457 (63.4)
Hyperlipidemia	373 (51.7)
Thyroid disorders	88 (12.2)
Cardiac diseases	95 (13.2)
Cerebrovascular accidents	19 (2.6)
Chronic Kidney Disease	
Smoking	59 (8.2)
Alcohol	27 (3.7)
Diabetic microvascular complications	
Retinopathy	92 (12.8)
Nephropathy	84 (11.7)
Hypoglycemia	74 (11.3)
Neuropathy	14 (1.9)

Diabetes-related outcomes

Table 3 and Figure 1 show that 39.3% of the participants ($n = 283$) had controlled diabetes mellitus and 21.2% had partially controlled diabetes ($n = 153$). However, uncontrolled diabetes was noted in 285 participants (39.5%). Moreover, total cholesterol was less than 5 mmol/L in most patients ($n = 600$, 83.2%). Low-density lipoprotein was less than 2.6 mmol/L in approximately 77% ($n = 552$) of the patients and less than 1.8 mmol/L in 40.8% of them ($n = 294$) Figure 2. While more than two-thirds of the included patients ($n = 496$, 68.8%) had blood pressure levels of less than 140/90 mmHg, only 41.3% of them ($n = 298$) had a blood pressure level of less than 130/80 mmHg Figure 3.

Compared to Bahraini patients, most non-Bahraini patients had uncontrolled diabetes, ($P = <0.001$). Patients who had uncontrolled diabetes were younger than those with controlled diabetes ($P = 0.027$). In addition, Sulphonylurea ($P = 0.041$) and insulin prescription ($P < 0.001$) were higher among patients with uncontrolled diabetes. Patients with a controlled glycemic index had lower obesity rates than those with uncontrolled

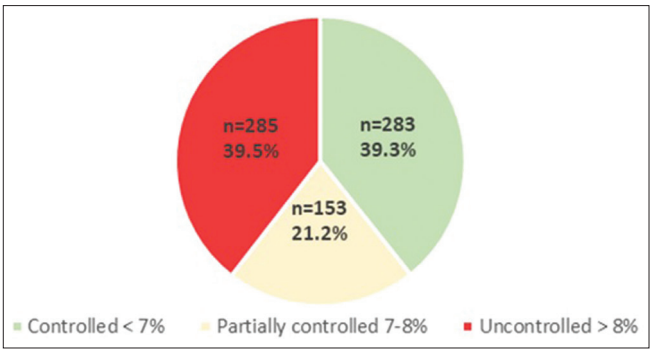

Figure 1: Glycemic control levels among the participants

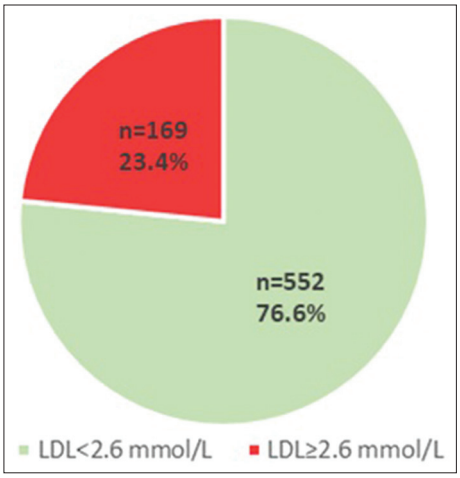

Figure 2: Low-density lipoprotein levels among the participants

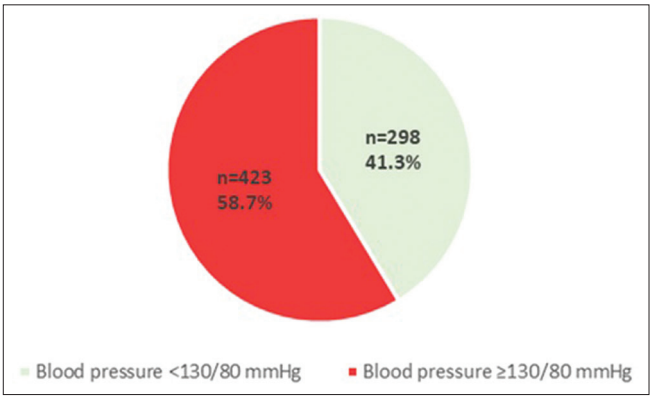

Figure 3: Blood pressure control levels among the participants

diabetes ($P = 0.003$). Adequate cholesterol levels were seen more in patients with a controlled glycemic index ($P = 0.015$). Table 4 presents the comparison between diabetes control and sociodemographic, comorbidities and other outcomes.

Discussion

The present study aimed to determine the glycemic control, characteristics and outcomes of adults with type-2 diabetes mellitus. The results showed suboptimal control of diabetes and hypertension among most patients. Dyslipidemia was controlled in most patients, however. Non-Bahraini and young patients

Table 2: Characteristics of diabetes treatment

Diabetes treatment	*n* (%)
Diet control	
Yes	107 (14.8)
No	614 (85.2)
Weekly exercise	
Yes	353 (49.1)
No	366 (50.9)
Oral agents	
Yes	691 (95.8)
No	30 (4.2)
Biguanide (Metformin)	
Yes	663 (92.0)
No	58 (8.0)
Sulphonylurea (Gliclazide/Glimepiride)	
Yes	375 (52.0)
No	346 (48.0)
Insulin (all types)	
Yes	298 (41.3)
No	423 (58.7)
Other injections	
Yes	11 (1.5)
No	710 (98.5)
Beta blockers	
Yes	143 (19.8)
No	578 (80.2)
Statins	
Yes	614 (85.2)
No	107 (14.8)

Table 3: Laboratory results and diabetes-related outcomes

Diabetes-related outcome	*n* (%)
Glycated hemoglobin (A1C)	
Controlled <7%	283 (39.3)
Partially controlled 7-8%	153 (21.2)
Uncontrolled >8%	285 (39.5)
Fasting plasma glucose (mmol/L), mean SD	8.1±3.3
Low-density lipoprotein <2.6 mmol/L	
Yes	552 (76.6)
No	169 (23.4)
Low-density lipoprotein <1.8 mmol/L	
Yes	294 (40.8)
No	427 (59.2)
Total cholesterol (mmol/L), mean±SD	4.2±4.4
Low-density lipoprotein in mmol/L, mean±SD	2.3±3.1
Total cholesterol <5 mmol/L	
Yes	600 (83.2)
No	121 (16.8)
Blood pressure <140/90 mmHg	
Yes	496 (68.8)
No	225 (31.2)
Blood pressure <130/80 mmHg	
Yes	298 (41.3)
No	423 (58.7)

had higher rates of uncontrolled diabetes. Moreover, patients with uncontrolled diabetes had higher obesity and uncontrolled cholesterol rates.

In line with the reported literature, our results showed high rates of hypertension and dyslipidemia common among diabetic patients. This finding can be explained by the fact that these diseases share a similar risk profile. The high coexistence of hypertension and hyperlipidemia in diabetic patients can partially explain the poor control of most patients as these diseases are predictors of poor glycemic control. The latter assumption is further supported by the lower rates of adequate cholesterol control among patients with uncontrolled diabetes in this study.

The overall glycemic control of diabetic patients in this study was low which could be attributed to low adherence to lifestyle measures like regular exercises and diet control regimens. In addition, it could be attributed to the influence of obesity on glycemic control. As seen in our study, several studies found that obesity negatively impacts the glycemic control of patients with diabetes.[19,20] The negative impact of obesity on diabetes control is explained by its influence on insulin resistance.

In general, our results revealed better glycemic control measures in comparison with the previous local and regional studies but substantially lower in comparison with the international figures. The variations in glycemic control rates can be attributed to different settings, different populations, different cut-offs for ideal glycemic control and sociocultural factors. However, it can be also the result of variations in practices, medical care and limited resources.[21]

In the last decade, the approach to treating patients with diabetes has changed dramatically. Several new oral hypoglycemic agents were approved to be used for diabetes control and showed significant benefits in reducing cardiovascular and renal complications. Nonetheless, Metformin remains a first-line therapy in several settings due to its safety, effectiveness and cost.[22] Insulin formulations and insulin secretagogues are less preferred nowadays due to the availability of novel medications like Glucagon-like peptide-1 agonists and Sodium-glucose co-transporters-2 inhibitors which carry lower risk of hypoglycemia and positive influence on A1C and cardiovascular risks. However, these new classes are not available in primary healthcare centers in Bahrain. Here, we found that most patients were on metformin. In most patients, insulin and Sulphonylurea are considered second- or third-line treatments and are used if patients fail to achieve adequate glycemic control despite being on metformin and other hypoglycemic agents.[23] This explains the higher frequency of Sulphonylurea and insulin among patients with uncontrolled diabetes.

In accordance with international data, only half of the population met the recommended threshold of exercise. It is well understood that many people have difficulties reaching the recommended physical activity targets to improve cardiovascular outcomes. Considering the rapid changes in lifestyle measures and the influence of these measures on glycemic control, this low reportable rate of physical activity is alarming.

Table 4: Comparison between diabetes outcomes and sociodemographic, comorbidities and other outcomes

Variable	Controlled *n*=283	Partially controlled *n*=153	Uncontrolled *n*=285	*P*
Nationality				
Bahraini	230 (42.8)	121 (22.5)	186 (34.6)	<0.001
Non-Bahraini	53 (28.8)	32 (17.4)	99 (53.8)	
Sex				
Male	139 (38.2)	71 (19.5)	154 (42.3)	0.263
Female	144 (40.3)	82 (23.0)	131 (36.7)	
Age in years, mean±SD	59.60+11.44	58.80+11.21	57.07+10.99	0.027
Education				
No primary education	27 (37.5)	12 (16.7)	33 (45.8)	0.730
Primary school	33 (41.3)	20 (25.0)	27 (33.8)	
Intermediate school	36 (38.3)	21 (22.3)	37 (39.4)	
Secondary school	104 (37.0)	65 (23.1)	112 (39.9)	
University/College	83 (42.8)	35 (18.0)	76 (39.2)	
Marital status				
Single	19 (40.4)	7 (14.9)	21 (44.7)	0.462
Married	235 (39.6)	125 (21.1)	233 (39.3)	
Widowed	22 (36.7)	18 (30.0)	20 (33.3)	
Divorced	7 (33.3)	3 (14.3)	11 (52.4)	
Duration of diabetes in years, mean±SD	12.01+8.43	12.69+7.90	13.56+7.23	0.074
Comorbidities				
Hypertension	180 (39.4)	95 (20.8)	182 (39.8)	0.931
Hyperlipidemia	143 (38.3)	81 (21.7)	149 (39.9)	0.866
Cardiac diseases	35 (36.8)	21 (22.1)	39 (41.1)	0.875
Cerebrovascular accidents	9 (47.4)	5 (26.3)	5 (26.3)	0.490
Smoking	24 (40.7)	14 (23.7)	21 (35.6)	0.788
Alcohol	259 (39.1)	139 (21.0)	264 (39.9)	0.092
Diabetic microvascular Complications				
Retinopathy	37 (40.2)	18 (19.6)	37 (40.2)	0.917
Nephropathy	37 (44.0)	11 (13.1)	36 (42.9)	0.151
Hypoglycemia	21 (28.4)	16 (21.6)	37 (0.5)	0.072
Neuropathy	2 (14.3)	4 (28.6)	8 (57.1)	0.153
Diet control	45 (42.1)	23 (21.5)	39 (36.4)	0.758
Weekly exercise	146 (41.4)	71 (20.1)	136 (38.5)	0.454
Biguanide (Metformin)	260 (39.2)	140 (21.1)	263 (39.7)	0.958
Sulphonylurea (Gliclazide/Glimepiride)	133 (35.5)	91 (24.3)	151 (40.3)	0.041
Insulin injections	60 (20.1)	59 (19.8)	179 (60.1)	<0.001
Obesity	112 (32.7)	78 (22.8)	152 (44.4)	0.003
Low-density lipoprotein <2.6 mmol/L	225 (40.8)	115 (20.8)	212 (38.4)	0.319
Low-density lipoprotein <1.8 mmol/L	125 (42.5)	63 (21.4)	106 (36.1)	0.238
Total cholesterol <5 mmol/L	245 (40.8)	132 (22.0)	223 (37.2)	0.015
Blood pressure <140/90 mmHg	197 (39.7)	111 (22.4)	188 (37.9)	0.340
Blood pressure <130/80 mmHg	119 (39.9)	61 (20.5)	118 (39.6)	0.907

Here we found that non-Bahraini had higher rates of uncontrolled diabetes. Consistent with our findings, several studies revealed high variability in diabetes care and management across different groups with patients with immigrants, patients with low socioeconomic status and expatriates being the most affected groups.[24,25] This finding might be attributed to genetic variations but should also raise concerns about inequalities in diabetes treatment and management.[26]

Although an A1C of <7% is recommended in most diabetic patients, a less stringent glycemic goal is reasonable in old people.[27] Surprisingly, our study found that patients with poor glycemic control were younger than those with good control. Some studies reported similar trends.[28] Possible reasons for inadequate glycemic control include that younger patients are less likely to adopt healthy lifestyle measures due to their social and occupational commitments and are less concerned about their health.[29]

In reference to the new targets for hypertension among patients with diabetes (BP < 130/80 mmHg), the results of the present study revealed most patients did not achieve the recommended blood pressure goals. This is far away from the international control targets for hypertension. However, when data were

analyzed according to old blood pressure targets, excellent overall hypertension control was noted among the patients. The dyslipidemia control is better compared to diabetes and hypertension control in our study and other regional data where the majority of patients in Kuwait were not meeting the low-density lipoprotein targets.

Compared to previous studies, the prevalence of retinopathy has been halved. This could be attributed to the implementation of screening programs that necessitate annual dilated exams for all diabetics across all health centers in Bahrain. Higher rates of diabetic neuropathy were reported in regional and international studies possibly due to different assessment tools; here we used monofilament solely to assess neuropathy while other studies used questionnaire-based assessment as well.[30,31]

Achieving adequate glycemic level requires a multidisciplinary approach in which addressing modifiable, and non-modifiable factors is needed. Diabetes necessitates lifelong medical treatment and lifestyle interventions. The growing rise of its prevalence creates a public health issue, with heavy burdens on patients, families and the healthcare system. This study provides essential information about the health status of type-2 diabetes patients and highlights the need to improve access to certified diabetes educators and dieticians as an opportunity to improve diabetes management within this community. More focus should be done on non-pharmacological approaches in primary health care for lifestyle modifications to control diabetes.

Our study has several strengths. It is the first multi-center study that assessed the characteristics of diabetic patients and their glycemic control in Bahrain. Several determinants of glycemic control were assessed. In addition, it is the first study to assess the control of hypertension and dyslipidemia according to the new ADA recommendations. A particular strength of this study was the inclusion of data from a high number of patients. However, our study has some limitations as well. The glycemic control was assessed according to A1C values only. New measures like continuous glucose monitoring are now available and provide more accurate information about glycemic control. Additionally, A1C targets were not individualized according to patients' characteristics and comorbidities; one target (<7%) was selected for all patients to indicate adequate control.

Conclusion

The overall control of diabetes and associated comorbidities like hypertension and dyslipidemia was suboptimal. Poor glycemic control was higher among non-Bahraini, obese and young patients. The effect of new targets in diabetes care resulted in a higher percentage of uncontrolled patients. Therefore, interventions to improve the outcomes of diabetes are urgently required by primary care physicians, nurses and healthcare policymakers.

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Conflicts of interest

There are no conflicts of interest.

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