Original Article

DiabCare survey of diabetes management and complications in the Gulf countries

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ABSTRACT

Aim: To describe the status of diabetes control and complications, and the quality of diabetes management in Saudi Arabia, Kuwait, and the United Arab Emirates, and to obtain an insight into the relationship between these factors. **Methods:** Patients with diabetes for >12 months were enrolled from specialist clinics and general hospitals. All available data from the patients' medical files including patient demographics; glycemic, lipid, and blood pressure status; diabetes-related complications; and diabetes management were recorded in data collection forms and analyzed. **Results:** Overall, 1290 patients with diabetes were enrolled with a mean (±standard deviation) age of 49.4 ± 12.3 years and duration of diabetes of 8.7 ± 5.9 years. Glycemic control was poor: Mean glycated hemoglobin A_{1c} of 8.3 ± 2.0%, fasting and postprandial plasma glucose levels of 155.9 ± 57.1 mg/dL (8.7 ± 3.2 mmol/L), and 218.2 ± 87.4 mg/dL (12.1 ± 4.9 mmol/L), respectively. Diabetes-related complications such as neuropathy (34.9% of patients), background retinopathy (29.9%), and cataract (14.1%) were common. Cardiovascular complications were reported in <10% of patients, and microalbuminuria was detected in 34.4% of patients. Oral antidiabetic drug (OAD) monotherapy (43.3%) was the most common treatment, followed by insulin + OADs (39.3%) and insulin monotherapy (17.6%). **Conclusion:** The status of diabetes care was found to be suboptimal. Further improvements in diabetes management are necessary to prevent or delay the development of diabetes-related complications.

Key words: DiabCare survey, diabetes, diabetes complications, diabetes management, Gulf

Introduction

The number of people worldwide with diabetes is set to increase from 387 million in 2014 to 592 million by 2035.[1] The Middle-East and North-African region will bear a large part of the burden with an estimated rise from 37 million people with diabetes in 2014 to 67.9 million by 2035. As of 2014, Saudi Arabia, Kuwait, and the United Arab Emirates (UAE) had high diabetes prevalences of 24%, 23%, and 19%, respectively.[1]

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Factors such as aging populations, rapid urbanization, poor-quality nutrition, and reduced physical activity contribute to the surge in diabetes prevalence (particularly type 2 diabetes mellitus [T2DM]).[1] Inadequately controlled diabetes in the long-term is associated with a greater risk of developing complications such as cardiovascular disease (CVD), nephropathy, retinopathy, and neuropathy.[2]

Monitoring and improving the level of general diabetes care and the quality of life of patients in the Gulf countries is necessary to curb long-term health care and economic problems. Reliable baseline data are vital to any improvement program. The Gulf DiabCare Project was commenced in an effort to obtain comprehensive

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baseline data on the status and management of diabetes (type 1 diabetes mellitus [T1DM], T2DM, and gestational diabetes mellitus [GDM]) in Saudi Arabia, Kuwait, and the UAE. The Gulf DiabCare Project was designed on the lines of the European DiabCare[3-7] and Asian DiabCare Projects,[8-14] which provided valuable information on the status of diabetes management in those regions.

In light of the increasing prevalence of diabetes in the Arab Gulf, the Gulf DiabCare Project aimed to assess the status of diabetes control, management, and complications in diabetic patients, managed by endocrinologists, diabetologists, or doctors of internal medicine in Saudi Arabia, Kuwait, and the UAE, and to investigate the relationship between these factors. This survey was also conducted to explore the quality of diabetes management in these countries/further aimed to provide a mean of measuring the quality of diabetes management.

Methods

Design

The Gulf DiabCare survey was a joint collaboration between Novo Nordisk affiliates in Saudi Arabia, Kuwait, and the UAE and diabetologists in the same countries. The survey was designed to assess the status of diabetes control, management, and diabetes-related complications in the participating countries. The survey further aimed to provide insights into the relationship between these factors as well as a mean of measuring the quality of diabetes management.

Local steering groups consisting of the Novo Nordisk project coordinator and medical director of Novo Nordisk Gulf were constituted in each participating country to help identify diabetes-specialist clinics and general hospitals where patients with T1DM, T2DM, or GDM were treated by endocrinologists, diabetologists, or doctors of internal medicine.

Each center contributed all the selected data that they had available for the patients, as well as laboratory assessments (glycated hemoglobin A_{1c} [HbA_{1c}]) and clinical examinations, as recorded in the patients' files. All data were directly recorded on the data collection forms (DCFs) designed for this survey (see Supplementary Figure 1 for the sample DCF). No special tests were done for the purpose of this study.

Patients

Patients who had diabetes (T1DM, T2DM, or GDM) for >12 months were registered at the participating centers and were willing to participate in the survey were enrolled. There was no randomization scheme for this study. All patients who met the eligibility criteria and consented to participate in the study were to be recruited by the participating centers within 6 months from the start date of recruitment. A total of 17 participating diabetic-specialist clinics enrolled patients across the three countries from May 31, 2009, to January 18, 2010.

At the time of conducting this survey, approvals from the Ethical Review Board or the Ministry of Health were not mandatory for such surveys according to the local laws of the participating Gulf countries.

Assessments

The following data were collected: Demographics, type of diabetes, risk factors (smoking and alcohol consumption), clinical measurements (weight, height, waist circumference [WC], hip circumference, blood pressure [BP], HbA_{1c}, fasting plasma glucose [FPG], postprandial plasma glucose [PPG], fasting total cholesterol [TC], high-density lipoprotein [HDL] cholesterol, triglycerides [TG], serum creatinine, microalbumin, and proteinuria), eye and extremities examinations, other diabetes complications (cardiovascular and renal disorders), current diabetes management and other medications (including treatments for hypertension and hyperlipidemia), self-monitored blood glucose and urine (dipstick method), lifestyle management, and diabetes education received in the past year. The low-density lipoprotein (LDL) cholesterol value was estimated from the mean values of TC, HDL cholesterol, and TG using Friedewald's formula.[15]

The HbA_{1c} assessment was performed on the day of recruitment in each center using the Metrika-A1CNow® kit, and the result was immediately recorded on the DCF.

Statistical analysis

Based on the average percentage of the diabetic population aged between 18 and 79 years observed in the Asian DiabCare Project,[8] it was planned that 20 centers would each recruit 50 patients to obtain a sample size of 1000 patients.

All data were entered into a database (Microsoft® Access) by double data entry. Data from each center were pooled. Only descriptive statistical analyses were performed. The response rate to all the variables assessed was presented as a percentage. Subgroup analyses were performed to assess the relationships between the type of diabetes management, diabetes duration, diabetes complications, and glycemic and BP control. The results for the analyses were compared to the targets specified in the 2012 American Diabetes Association (ADA) and 2012 International Diabetes Federation (IDF) (for T2DM) guidelines.[16,17]

Data handling and statistical analyses were performed by Research2Trials®, Singapore using SPSS Inc. Released 2007. SPSS for Windows, Version 16.0. Chicago, SPSS Inc.

Results

Patient characteristics

A total of 1290 patients were enrolled, of which 90.0% had T2DM, 8.9% had T1DM, 0.9% had undetermined diabetes, and 0.3% had GDM [Table 1]. The majority of patients were male (69.8%). The mean (±standard deviation) age was 49.4 ± 12.3 years, duration of diabetes was 8.7 ± 5.9 years, and body mass index (BMI) was 31.0 ± 5.6 kg/m^2. A trend for central obesity was seen, with a mean WC of 101.7 ± 11.9 cm and a mean waist/hip ratio (WHR) of 1.0 ± 0.1 [Table 1].

Diabetes management

Overall, among patients with T1DM, T2DM, undetermined diabetes, or GDM, the majority were on oral antidiabetic drug (OAD) monotherapy (43.3%), followed by insulin + OADs (39.3%), and insulin monotherapy (17.6%) [Table 2]. Biguanides were the most commonly used OADs (77.1%).

Among patients who reported insulin use, insulin analogs were more commonly used (83.1%), followed by human insulin (18.5%) [Table 3]. The mean total daily dose and mean duration of insulin use were 58.8 ± 29.5 units/day (0.70 ± 0.35 units/kg/day) and 3.9 ± 4.7 years, respectively [Table 3]. Details of insulin treatment by type of diabetes (T1DM and T2DM) are presented in Table 4.

With regard to concomitant medication, 75.0% of patients were receiving antiplatelet therapy for the prevention or treatment of arterial thrombosis, while 3.4% of patients were receiving medication for obesity.

Glycemic control

The mean HbA_{1c} value was 8.3 ± 2.0%, with 24.0% and 13.3% of patients having an HbA_{1c} of <7.0% and <6.5%, respectively [Table 1]. The mean frequency of HbA_{1c} measurement was 3.2 ± 1.5 measurements/year. The mean PPG level was 218.2 ± 87.4 mg/dL (12.1 ± 4.9 mmol/L). The mean FPG level was 155.9 ± 57.1 mg/dL (8.7 ± 3.2 mmol/L), with 31.2% and 16.4% of patients having FPG ≤126.0 mg/dL (≤7.0 mmol/L), and <110.0 mg/dL (<6.1 mmol/L), respectively.

Lipids and blood pressure

The mean levels of TC, HDL cholesterol, and TGs were 186.1 ± 42.7 mg/dL, 43.0 ± 11.8 mg/dL, and 165.8 ± 91.8 mg/dL, respectively. LDL cholesterol value was estimated to be 109.94 mg/dL.

Table 1: Patient demographic characteristics and glycemic parameters

Parameter	*n*	RR (%)	Proportion (%)	Mean±SD	Range
Total number enrolled	1290	-	-	-	-
Age	1284	99.5	-	49.4±12.3	13-85
Gender	1229	95.3	-	-	-
Male	-	-	69.8	-	-
Female	-	-	30.2	-	-
BMI (kg/m^2)	1265	98.1	-	31.0±5.6	9.9-61.9
WC (cm)	833	64.6	-	101.7±11.9	57-140
HC (cm)	753	58.4	-	102.6±11.1	56-150
W/H ratio	753	58.4	-	1.0±0.1	0.8-1.3
Ethnicity	1251	97.0	-	-	-
Arabic	-	-	82.2	-	-
Indian	-	-	11.8	-	-
Caucasian	-	-	0.6	-	-
African	-	-	0.2	-	-
Others	-	-	5.4	-	-
Age at onset of diabetes (years)	1247	96.7	-	40.9±11.2	1-78
Duration of diabetes (years)	1253	97.1	-	8.7±5.9	1-41
Type of diabetes	1275	98.8	-	-	-
Type 1	-	-	8.9	-	-
Type 2	-	-	90.0	-	-
GDM	-	-	0.3	-	-
Others/uncertain	-	-	0.9	-	-
HbA_{1c}	1271	98.5	-	8.3±2.0	4.3-18.2
Number of HbA_{1c} tests per year	1134	87.9	-	3.2±1.5	0.0-12.0
Number of blood glucose tests per year	1138	88.2	-	8.6±7.0	0-99
Fasting plasma glucose (mg/dL (mmol/L))	1215	94.2	-	155.9±57.1 (8.7±3.2)	45-460
Postprandial plasma glucose (mg/dL (mmol/L))	1243	96.4	-	218.2±87.4 (12.1±4.9)	48-744

BMI: Body mass index, GDM: Gestational diabetes mellitus, HC: Hip circumference, *n*: Number of valid patient data used in the analysis, RR: Response rate, WC: Waist circumference, W/H: Waist/hip. -: Blank field, SD: Standard deviation

Table 2: Types of oral antidiabetic drug and combination therapy

Types of OAD therapy*			
Overall		**T2DM**	
Parameter	**Outcome**	**Parameter**	**Outcome**
n	1210	*n*	1095
RR (%)	93.8	RR (%)	95.5
No OAD, *n* (%)	198 (16.4)	No OAD, *n* (%)	93 (8.5)
Biguanides, *n* (%)	933 (77.1)	Biguanides, *n* (%)	914 (83.5)
Sulphonylureas, *n* (%)	648 (53.6)	Sulphonylureas, *n* (%)	642 (58.6)
Thiazolidinedione, *n* (%)	315 (26.0)	Meglitinides, *n* (%)	62 (5.7)
Meglitinides, *n* (%)	63 (5.2)	Glucosidase inhibitors, *n* (%)	54 (4.9)
Glucosidase inhibitors, *n* (%)	55 (4.5)	Thiazolidinedione, *n* (%)	307 (28.0)
Other OADs, *n* (%)	39 (3.2)	Other OADs, *n* (%)	38 (3.5)
Traditional/herbal medicine, *n* (%)	1 (0.1)	Traditional/herbal medicine, *n* (%)	1 (0.1)
Types of combination therapy†			
Overall (*n*=1275)		**T2DM (*n*=822)**	
Parameter	**Proportion (%)**	**Parameter**	**Proportion (%)**
1 class of OAD, no insulin	7.8	1 class of OAD, no insulin	7.6
2 classes of OAD, no insulin	22.8	2 classes of OAD, no insulin	22.4
3 classes of OAD, no insulin	11.9	3 classes of OAD, no insulin	11.8
>3 classes of OAD, no insulin	0.8	>3 classes of OAD, no insulin	0.8
1 class of OAD and insulin	16.9	1 class of OAD and insulin	15.9
2 classes of OAD and insulin	15.8	2 classes of OAD and insulin	15.5
3 classes of OAD and insulin	6.3	3 classes of OAD and insulin	6.2
>3 classes of OAD and insulin	0.3	>3 classes of OAD and insulin	0.3
Insulin alone	17.6	Insulin alone	8.4

*Patients may be treated with >1 type of OAD, †Traditional/herbal medication is not classified as a form of OAD therapy in the above table. *n*=number of valid patient data used in the analysis, *n* (%): Number of patients (percent patient), RR: Response rate, OAD: Oral antidiabetic drug, T2DM: Type 2 diabetes mellitus

Table 3: Overall insulin therapy

Parameter	*n*	RR	*n* (%)	Mean±SD	Range
Treated with insulin	1288	99.8		-	-
Yes	-	56.2	-	-	-
No	-	43.7	-	-	-
?	-	0.1	-	-	-
Insulin injections/day	711	55.1	-	2.0±0.9	-
Once	-	-	214 (30.1)	-	-
Twice	-	-	331 (46.6)	-	-
>Twice	-	-	166 (23.3)	-	-
Duration of treatment (years)	700	54.3	-	3.9±4.7	0.08–33.00
Insulin source*	682	52.9	-	-	-
Animal	-	-	4 (0.6)	-	-
Human	-	-	126 (18.5)	-	-
Analog	-	-	567 (83.1)	-	-
Insulin units/day	720	55.8	-	58.8±29.5	10.00–212.00
Insulin units/kg/day	715	55.4	-	0.70±0.35	0.12–2.81
Mode of administration	640	49.6	-	-	-
Syringes	-	-	124 (19.4)	-	-
Pump	-	-	1 (0.2)	-	-
Pen	-	-	515 (80.4)	-	-

*Some patients were treated with insulin from >1 source. *n* :Number of valid patient data used in the analysis, *n* (%): Number of patients (percent patient), RR: Response rate, ?: No available data, SD: Standard deviation

According to the ADA guideline on HDL-cholesterol,[16] 47.4% of males met the HDL-cholesterol target of >40.0 mg/dL, and 21.3% of females achieved the target of >50.0 mg/dL. When HDL-cholesterol levels were stratified according to the IDF (for T2DM) guidelines,[17] 53.3% of patients achieved the target level of >39.0 mg/dL.

The preferred treatment for hyperlipidemia was statins (77.8%). Overall (by treatment), 50.6% treated and 41.8% untreated males had HDL-cholesterol levels >40.0 mg/dL, while 20.4% treated and 23.9% untreated females had HDL-cholesterol levels >50.0 mg/dL. For patients with T2DM, 54.0% treated and 34.1% untreated patients had HDL-cholesterol levels >39.0 mg/dL.

Table 4: Insulin therapy by diabetes type

T1DM		T2DM	
Parameter	**Outcome**	**Parameter**	**Outcome**
Insulin injections/day			
n	113	*n*	578
RR (%)	100.0	RR (%)	50.4
Mean±SD	2.9±0.9	Mean±SD	1.8±0.8
Once, *n* (%)	2 (1.8)	Once, *n* (%)	209 (36.1)
Twice, *n* (%)	41 (36.3)	Twice, *n* (%)	279 (48.3)
>Twice, *n* (%)	70 (61.9)	>Twice, *n* (%)	90 (15.6)
Insulin units/day			
n	113	*n*	587
RR (%)	100.0	RR (%)	51.2
Mean±SD	66.3±25.2	Mean±SD	57.5±30.4
Range	13–160	Range	10–212
Insulin units/kg/day			
n	113	*n*	582
RR (%)	100.0	RR (%)	50.7
Mean±SD	1.0±0.4	Mean±SD	0.6±0.3
Range	0.25–2.81	Range	0.13–2.08
Duration of treatment (years)			
n	112	*n*	569
RR (%)	99.1	RR (%)	49.6
Mean±SD	8.5±7.3	Mean±SD	3.0±3.3
Range	0.08–33.00	Range	0.08–33.00
Mode of administration			
n	91	*n*	532
RR (%)	80.5	RR (%)	46.4
Syringes, *n* (%)	21 (23.1)	Syringes, *n* (%)	94 (17.7)
Pump, *n* (%)	1 (1.1)	Pump, *n* (%)	0 (0.0)
Pen, *n* (%)	69 (75.8)	Pen, *n* (%)	438 (82.3)
Insulin source*			
n	104	*n*	559
RR (%)	92.0	RR (%)	48.7
Animal, *n* (%)	0 (0.0)	Animal, *n* (%)	4 (0.7)
Human, *n* (%)	27 (26.0)	Human, *n* (%)	91 (16.3)
Analog, *n* (%)	89 (85.6)	Analog, *n* (%)	467 (83.5)

*Some patients were treated with insulin from >1 source. *n*: Number of valid patient data used in the analysis, *n* (%): Number of patients (percent patient), RR: Response rate, SD: Standard deviation, T1DM: Type 1 diabetes mellitus, T2DM: Type 2 diabetes mellitus

The mean systolic BP (SBP) and diastolic BP (DBP) were 130.3 ± 14.4 mmHg and 80.5 ± 8.6 mmHg, respectively. Using the ADA[16] and IDF recommendations[17] (for T2DM), 18.8% and 14.7% of patients, respectively, had BP controlled below 130/80 mmHg. About 60.0% of patients were treated for hypertension, and the common treatments were A2A/angiotensin II receptor blockers (48.2%), followed by calcium channel blockers (41.5%), diuretics (40.2%), and angiotensin-converting-enzyme inhibitors (38.8%).

Diabetes-related complications and renal function

An overview of diabetes-related complications is presented in Figure 1. The most commonly reported complication was diabetic neuropathy (34.9% of patients), followed by eye complications such as background retinopathy (29.9% of patients) and cataract (14.1%). Myocardial infarction/coronary artery bypass graft/angioplasty, stroke, and end-stage renal failure were each reported in <10% of patients.

Serum creatinine level >2 mg/dL was seen in 4.4% of patients. Proteinuria was <15 mg/dL in 55.2% of patients, between 15 mg/dL and 30 mg/dL in 14.8%, and ≥30 mg/dL in 30.0% of patients. Microalbuminuria was observed in 34.4% of patients, it was absent in 60.4% of the population, and about 5.3% of patients were unable to provide information on this parameter.

Lifestyle management and diabetes education

A total of 70.4% of patients seldom or never did any form of exercise, 58.2% seldom or did not follow a diet plan, 34.5% were smokers, and 4.4% reported alcohol consumption.

In the previous 12 months, 56.2% of patients received 1–3 days of diabetes education, 32.0% received ≥4 days of education, and 11.6% received no education at all. About 49.0% of patients with HbA_{1c} <6.5% had ≥4 days of education, 41.0% for those with HbA_{1c} ≥6.5–7.5%,and 23.9% for those with HbA_{1c} ≥7.5%.

Current diabetes management, duration of diabetes, and diabetes complications

Insulin use appeared to increase with duration of diabetes, with up to 75.7% of patients with duration of diabetes >10 years reporting the use of insulin + biguanides/sulfonylurea or insulin alone compared with up to 27.7% of patients with duration of diabetes of 1–5 years.

Over 41% of patients treated with insulin (either as monotherapy or combined with biguanides/sulfonylurea) reported some form of eye complications compared with up to 25.7% treated with biguanides or sulfonylurea alone. Similar trends were also observed for neuropathy (≥40% on insulin compared with up to 29% on biguanides or sulfonylurea alone), leg complications (>12.0% on insulin and <3.5% on biguanides or sulfonylurea alone), and cardiovascular complications (>10.0% on insulin and ≤4.0% on biguanides or sulfonylurea alone).

Among patients with HbA_{1c} >7.5%, 44.9% had eye complications, 13.1% had leg complications, and 46.0% had either neuropathy or cardiovascular complications, compared with 12.4%, 3.7%, and 22.4%, respectively, with HbA_{1c} <6.5%. Microalbuminuria was reported less frequently in patients who had a good control of SBP (26.8% vs. 48.2%) or DBP (29.1% vs. 46.3%). Over 60.0% of patients with good BP control tested negative for proteinuria (<15 mg/dL) in this survey compared with about 40.0% of those with poorer BP.

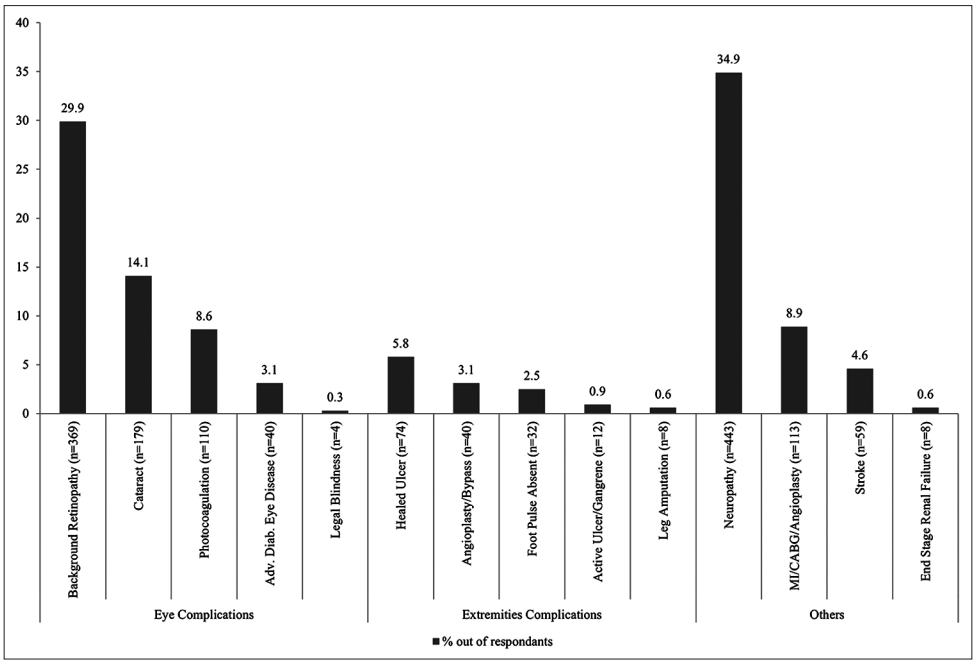

Figure 1: Overview of diabetes-related complications

Discussion

This survey provided a snapshot of the status of diabetes control and the related complications, and the quality of diabetes management in the Gulf countries of Saudi Arabia, Kuwait, and the UAE. The patients included show general trend of diabetic population in the Gulf States, and no specific selection criteria were followed. Baseline diabetes care was revealed to be suboptimal, with a lack of adequate management to prevent or delay the development of related complications. Ninety percent of patients had T2DM, which is in accordance with the global prevalence of this disease,[1] but slightly lower than that seen in the 2001–2011 Asian DiabCare Projects (90.6–98.0%).[11-14]

Poor glycemic control at baseline is a common finding in many observational studies.[18,19] Despite the availability of international and regional clinical practice guidelines for the treatment of diabetes, few patients in clinical practice actually meet these standards.[16,17,20,21] In the current survey, the mean HbA_{1c} level was 8.3%, FPG was 155.9 mg/dL (8.7 mmol/L), and PPG was 218.2 mg/dL (12.1 mmol/L). These levels were considerably higher than the glycemic targets advised by the ADA (HbA_{1c} <7.0%, FPG ≤126.0 mg/dL [≤7.0 mmol/L] and PPG <180.0 mg/dL [<10.0 mmol/L]) and IDF (HbA_{1c} <6.5%, FPG <110.0 mg/dL [<6.1 mmol/L] and PPG ≤145 mg/dL [≤8.0 mmol/L]).[16,17] The data suggest that many patients in the Gulf countries had relatively poor glycemic control. Furthermore, the current survey echoes the results from other studies from the region. The mean baseline HbA_{1c} level in a Gulf cohort of the large observational A_1chieve study was 9.4% (above the target of <7.0% recommended in clinical practice guidelines).[22] Another recent study conducted in T2DM patients in Saudi Arabia showed that only 22% of patients achieved a mean HbA_{1c} of <7.0%.[23] Despite the fact that the survey was conducted only in diabetes specialist centers, the results still showed poor glycemic control.

It is well-established that insulin therapy is ultimately essential to preserve declining glycemic control in T2DM.[24,25] Reluctance to initiate insulin therapy on the part of both physicians and patients is frequently seen in clinical practice.[25] In the current survey, the low proportion of patients receiving insulin even after 10 years of diabetes points to a lack of adequate disease management.

There is cause for concern regarding the high prevalence of diabetic complications that have been reported in the Gulf region.[26-28] The findings of the current survey also highlight this concern; diabetic neuropathy was the most commonly reported complication (34.9%), followed by background retinopathy (29.9%), cataract (14.1%), and cardiovascular complications (<10%). Impaired renal functioning was also present with microalbuminuria and proteinuria noted in ≥30% of patients. Increased urinary protein excretion is known to be a clinical manifestation of diabetic nephropathy.[29] The high proportion of patients with micro- and macro-vascular complications seen in the current survey could be due to multiple factors such as

a failure to intensify treatment strategies in time, lack of adequate follow-up, and patient nonadherence to treatment.

Improved glycemic control is of vital importance in reducing the incidence of micro- and macro-vascular complications in diabetes.[29,30] In the current survey, patients with HbA_{1c} levels >7.5% had markedly higher incidences of micro- and macro-vascular complications compared with patients having HbA_{1c} <6.5%.

The prevalence of microalbuminuria in the current survey indicated the importance of conducting regular screening tests.[31-33] Microalbuminuria is strongly associated with CVD risk factors, complications, and events and is also an early indicator of diabetes-related nephropathy and increased risk of proliferative retinopathy.[32,33] The high prevalence of micro- and macro-albuminuria noted in this survey emphasizes the need for increased awareness on this condition in the region. More patients with good BP control tested negative for proteinuria and microalbuminuria in this survey compared with those with poor BP. The goal of treatment should be to target all risk determinants simultaneously. Good long-term control of blood glucose, SBP, and DBP, together with regular exercise and smoking cessation coupled with the therapeutic achievement of blood glucose, BP, and lipid goals that are evidence-based are required to treat this condition, and to delay or prevent the occurrence of microalbuminuria in nonalbuminuric patients.[34,35]

Hypertension is a frequent comorbidity with diabetes, particularly T2DM.[36] In this survey, fewer than 20% of patients achieved the ADA and IDF-recommended SBP/DBP range of <130/80 mmHg.[16,17] Lipid levels appeared to be moderately controlled, with approximately 20-54% of patients achieving the ADA (>40.0 mg/dL for males and >50.0 mg/dL for females) and IDF (>39.0 mg/dL) recommended HDL-cholesterol levels. Approximately, 42–69% of patients achieved the ADA (<150 mg/dL) and IDF (<200 mg/dL) recommended TG levels.[16,17] About 75% of patients were receiving antiplatelet treatment, but it could not be ascertained whether this was for primary or secondary cardiovascular prophylaxis.

Previously conducted studies have revealed a lack of awareness of lifestyle risk factors for diabetes.[31,37] Obesity is considered a major risk factor for many chronic diseases and complications, including T2DM, CVD, hypertension, and stroke.[38,39] The prevalence of obesity is on the rise in the Gulf countries, due to an imbalance between energy intake and energy expenditure. In addition to this, there is a decrease in the mean age at diagnosis of diabetes and an increased prevalence of lifestyle-related disorders in younger age groups.[38,40] In the current survey also risk factors such as nonadherence to a diet plan and lack of exercise were commonly reported. The average BMI reported was 31 ± 5.6 kg/m^2, and most of the patients were overweight with a trend of central obesity; however, only 3.4% patients were receiving medications for obesity. The WHR of 1.0 seen in these patients was higher than the cut-off values observed in other studies in this region (around 0.8).[41,42] Numerous studies have also demonstrated that diet and lifestyle modifications along with anti-obesity medications are an important component of diabetes management.[38,43] The results of this survey also highlight that suitable medical and lifestyle interventions for obesity are vitally required in this region.

Increased diabetes awareness and education can play a key role in improving patient adherence to therapy. The current survey showed that increased diabetes education appeared to be linked to improved HbA_{1c} levels, with more patients who had received ≥4 days of education attaining HbA_{1c} <6.5%.

This survey was based on retrospective data collection. As this was an observational study, there was no randomization scheme, and hence the study results could be subject to selection bias during recruitment. Furthermore, although information on patients' TC, TG, and HDL cholesterol levels was collected, the values for LDL cholesterol were not collected during the survey. The mean LDL cholesterol level was subsequently estimated using Friedewald's formula.[15] Another limitation is that the survey reflects only the status of diabetes care in 17 specialist centers in the Gulf region. Although as per the protocol it was planned to include analysis from both specialist clinics and general hospitals, investigators who participated in the study were from 17 diabetes specialist clinics, and general hospitals were not included in the survey. Whether the level of care provided in general hospitals is adequate can only be ascertained if a similar study is also conducted among them. Further studies among the patient population from general hospitals are required to investigate if there is any difference in patient management compared to specialist centers. Results from large observational studies such as A_1chieve in the Gulf region have also revealed poor glycemic control at baseline among the participating patients, suggesting that the inadequate level of care is widespread.[22] The current findings regarding the level of diabetes care in the Gulf countries show that much can still be done to improve disease management as suboptimal control of HbA_{1c}, lipids, and BP was widespread. Although the frequency of severe debilitating complications is currently low among these diabetic patients, the prevalence of neuropathy and background retinopathy points to

initial damage to the nerves and blood vessels. In addition, cataract, which can result in blindness, is relatively prevalent (14.1%) in this population and can be prevented with good glycemic control. The results of this survey echoed those of the European[5-7] and Asian DiabCare[8-14] projects wherein the improvement in glycemic control was identified as the major factor to prevent chronic diabetic complications. Such surveys can help determine the general baseline status of patients and can provide valuable insights on gaps existing between clinical recommendations and actual practice. The findings emphasized the need for regular and effective diabetes education, frequent assessments, and better glycemic control, together with prompt management of associated complications in the Gulf region.

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Conflicts of Interest

Sherif Mehanna is employed by Novo Nordisk Pharma Gulf.

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