INTRODUCTION

Diabetes mellitus is a worldwide chronic condition and a health burden.[1,2] The prevalence of diabetes mellitus in Saudi Arabia has been previously estimated around 23.7% in adult population, which ranks it as one of the countries in the region with the highest prevalence of this condition.[3,4] The management of diabetes mellitus can be challenging and requires a multidisciplinary team approach.[5,6] This involves glycemic control, as well as management of co-existing risk factors, such as hypertension and dyslipidemia in order to reduce complications.[7,8] A diabetic annual review can be done to assess the control of diabetes and complications. The review would include the measurement of glycated hemoglobin (HbA1c), albumin creatinine ratio (ACR), fasting lipids (including low-density lipoprotein [LDL]), blood pressure (BP), and retinal screening, and a podiatrist assessment.[1] HbA1c reflects glycemic control over several months and is an indicator of the complications of diabetes.[1] Good glycemic control is known to delay the onset of diabetic microvascular complications.[9] Persistent

Objective: To assess the level of control and prevalence of type 2 diabetes in King Abdulaziz Housing City (Iskan) population of Saudi Arabia. Materials and Methods: Retrospective cross-sectional study conducted in a primary-care setting. All Type 2 diabetics referred to our diabetes center between January 2011 and January 2015 were identified, and their computerized records reviewed. Glycated hemoglobin levels (HbA1c), low-density lipoprotein (LDL), blood pressure (BP), and the albumin-creatinine ratio (ACR) were noted and the patients categorized accordingly. Demographic data (age and gender) were also documented. Inactive patients (not seen for more than 2 years) were excluded. Results: The overall prevalence of type 2 diabetes for all age groups in ISKAN population was 3.25%. About 56% of the diabetics were female and 70% were aged between 18 and 59 years. The rate of uncontrolled diabetes was 59.3%. Males were more likely to have uncontrolled diabetes (odds ratio: 1.44, CI: 1.17–1.76, P = 0.0004). Forty percent of the diabetics had an LDL above target (≥2.6 mmol/l) while 25.9% had uncontrolled hypertension (BP ≥ 140/90). Of those who had an ACR test done within the last year (59.3%), the rate of micro- and macro-albuminuria was 8.8% and 2.5%, respectively. Conclusions: The overall prevalence of type 2 diabetes in our community seems lower than the previously reported national figures. An alarming number of diabetics in our population have an uncontrolled disease. More stringent diabetes annual review and recall program is needed to control diabetes and reduce complications.

Key words: Diabetes, glycemic control, prevalence, Saudi Arabia
albuminuria is a marker for predicting nephropathy in type II diabetics, and the measurement of ACR is one tool for assessment. Diabetic patients are at increased risk of cardiovascular disease (CVD), and diabetes is an independent risk factor. Therefore, monitoring and management of LDL, as well as BP, is recommended as this reduces CVD risk and renal injury. Annual dilated, and comprehensive eye examination is recommended to look for retinopathy, a frequent cause of new cases of blindness in adults. Moreover, an annual check by a podiatrist is essential as it involves assessment for neuropathy and ulcerations, which contribute to more than 80% of amputations in diabetics.

King Abdul‑Aziz Housing City (ISKAN) is one of the National Guard housing compounds located in the Saudi Capital, Riyadh. Its population is about 53,160 of eligible residents who are mainly officers or soldiers and their dependents. The housing area is served by 11 primary care (satellite) clinics as well as a diabetes center, which accepts referrals for newly diagnosed and uncontrolled type 2 diabetics. The aim of our study was to assess the level of control of type 2 diabetics using measurable parameters (HbA1C, LDL, BP, and ACR) as well as to describe their demographics, and estimate the prevalence of type 2 diabetes in the above population.

MATERIALS AND METHODS

All type 2 diabetics referred from primary care clinics within ISKAN to the diabetes center since its opening in 2011 were identified through the logbook of the diabetes center and their computerized records were reviewed. HbA1c levels, LDL, BP, and ACR were noted and patients were categorized accordingly. Three HbA1c groups were compared (HbA1c equal or below 7 mmol/l, HbA1c between 7 and 8, and HbA1c of 8 mmol/l and above) as well as two BP groups (BP below 140/90 and BP equal or above 140/90). Levels of LDL above or below 2.6 mmol/l and the presence of micro- or macro-albuminuria were also documented. The American Diabetes Association (ADA) and Eighth Joint National Committee (JNC-8) guidelines were used to set the above targets. Micro-albuminuria was defined as an ACR between 2.5 and 29 mg/mmol for males, and 3.5–29 mg/mmol for females while macroalbuminuria was defined as an ACR above 30 mg/mmol (300 mg/l). Demographic data were noted and the prevalence rate of type 2 diabetes in the ISKAN population was estimated by dividing the total number of type 2 diabetics over the Iskan population. Inactive patients (i.e., not seen for more than 2-years) were excluded from assessment but were included in calculating the prevalence.

RESULTS

Type-two diabetics referred and seen at our diabetes center between January 2011 and January 2015 were 1733. Of this number, 1632 (94.2%) were active patients and were included in our study. The overall prevalence of type 2 diabetes in the ISKAN population was 3.25% (1733 cases: 53,160 population). Of our studied diabetics, 55.5% were females and 70% were aged between 18 and 59 years. The rate of uncontrolled diabetes (HbA1c ≥ 8 mmol/l) among the type 2 diabetics was 59.3%. Males were more likely to have uncontrolled diabetes (odds ratio: 1.44, CI: 1.18–1.76, P = 0.0004). However, age, LDL, and BP did not have a statistically significant association with uncontrolled diabetes. Forty percent of diabetics had an LDL above target (≥2.6 mmol/l) while 25.9% had uncontrolled hypertension (BP ≥ 140/90). In the 12 months preceding our study, (January 2014–January 2015) 59.3% of diabetics had an ACR test done. Of this number, 8.8% had micro-albuminuria and 2.5% macro-albuminuria.

| Table 1: Demographics of active diabetics in an ISKAN population (n=1632) |
|---------------------------------------------|
| Demographics | Percentage |
| Age (Years) | |
| 18‑59 | 70 |
| ≥60 | 30 |
| Gender | |
| Male | 44.5 |
| Female | 55.5 |
| Nationality | |
| Saudi | 100 |
| NonSaudi | - |

| Table 2: Relationship between HbA1c and examined parameters (n=1632) |
|---------------------------------------------|
| HbA1c <8 | HbA1c ≥8 | OR | 95% CI | P |
| Gender | |
| Male | 256 | 474 | 1.44 | 1.18-1.76 | 0.0004 |
| Female | 395 | 507 | |
| Age (Years) | |
| 18‑59 | 449 | 690 | 1.17 | 0.94-1.44 | 0.17 |
| ≥60 | 213 | 280 | |
| LDL | |
| <2.6 | 408 | 569 | 0.88 | 0.71-1.07 | 0.22 |
| ≥2.6 | 253 | 402 | |
| BP | |
| <140/90 | 497 | 714 | 0.92 | 0.73-1.15 | 0.49 |
| ≥140/90 | 164 | 257 | |

OR: Odds ratio; CI: Confidence interval; LDL: Low-density lipoprotein; BP: Blood pressure; HbA1c: Glycated hemoglobin
However, such glycemic control may also be acceptable for certain groups such as the elderly with short life expectancy, frail diabetics with multiple co-morbidities and those with a history of severe hypoglycemia. An HbA1c above eight is generally accepted as being uncontrolled diabetes and is associated with a higher rate of diabetic complications. Raised LDL is a major factor in the pathogenesis of atherosclerosis and CVD. The ADA recommends keeping the LDL of diabetics below 2.6 mmol/l if there is no known history of CVD and below 1.8 mmol/l if CVD is present. The guidelines for managing hypertension in diabetics have evolved with higher targets now being accepted. An HbA1c level of 8 mmol/l or above was not done for many. We investigated whether our diabetics had an ACR test within the last 12 months (prior to the conduct of our study) and examined whether albuminuria, a sign of early kidney disease, was present. We found that about 40% of our diabetics had dyslipidemia with an LDL level of 2.6 mmol/l or above, an added cardiovascular risk factor for our diabetics. This in turn, can delay appropriate management, and control of diabetes.

In our studied population, two important factors affected the patients’ compliance: Access to satellite clinics and patient beliefs and educational level. Residents of the housing complex can register their extended families (parents), who live outside the housing complex and sometimes outside Riyadh City. The visits of this group of patients to the clinics are infrequent, leading to a sporadic monitoring of their condition and an improper adjustment of their medications. Moreover, the majority of residents at the ISKAN housing complex come from a moderate educational background, have rigid cultural beliefs and misconceptions about illness and a fear of escalation of treatment (especially initiation of insulin). This in turn, can delay appropriate management, and control of diabetes.

We found that about 40% of our diabetics had dyslipidemia with an LDL level of 2.6 mmol/l or above, an added cardiovascular risk factor for our diabetics. This could have been due to insufficient titration of statin therapy, as well as noncompliance and an intermittent use of statins. Other national institutes have reported a hyper-cholesterolemia rate of 29% among their diabetics, though an LDL test was not done for many. About three quarters (74.1%) of our diabetics had BP within the recommended target (<140/90). Although the result is promising, it perhaps reflects the application of the newer guidelines in our study and the fact that some diabetics did not have co-existing hypertension.

In our study, an HbA1c level of 8 mmol/l or above was used to define uncontrolled diabetes. A higher target but perhaps a more realistic one in identifying uncontrolled diabetics requiring immediate action. Despite our higher threshold, the rate of uncontrolled diabetes in our population was 59.3% while only 18.5% had “good control of diabetes” (HbA1c ≤7). A study by Zhaolan et al., found that 63% of their studied population had poorly controlled diabetes (A1c >7.5%) while only 12.1% met an optimum HbA1c target (<6.5%). Another study by Al‑Rowais, in Riyadh, found that the rate of “unacceptable HbA1c” for diabetics attending a university hospital was about 60% (HbA1c >7), while 36% had an HbA1c above 8. The rate of uncontrolled diabetics (HbA1c >7) in a Jordanian study by Khattab et al., was about 65%. Several factors including patient’s compliance and understanding of the disease, literacy in treatment strategy by physicians contribute to the lack of control.

DISCUSSION

The huge burden of diabetes is putting a strain on health systems worldwide. Uncontrolled diabetics are at a much higher risk of complications such as retinopathy, nephropathy, neuropathy, and CVD. Various treatment targets have been set to help guide the physician in managing his diabetic patients and monitoring their diabetes control. Ideally, control of diabetes involves managing an HbA1c level under or close to 7 mmol/l. An HbA1c above eight is generally accepted as being uncontrolled diabetes and is associated with a higher rate of diabetic complications. Raised LDL is a major factor in the pathogenesis of atherosclerosis and CVD. The ADA recommends keeping the LDL of diabetics below 2.6 mmol/l if there is no known history of CVD and below 1.8 mmol/l if CVD is present. The guidelines for managing hypertension in diabetics have evolved with higher targets now being accepted. A BP of <140/90 is recommended by the JNC8 for diabetics. Lower BP targets (<130/80) are desired for diabetics with nephropathy and if tolerated, by younger diabetics.

In our study, an HbA1c level of 8 mmol/l or above was used to define uncontrolled diabetes. A higher target but perhaps a more realistic one in identifying uncontrolled diabetics requiring immediate action. Despite our higher threshold, the rate of uncontrolled diabetes in our population was 59.3% while only 18.5% had “good control of diabetes” (HbA1c ≤7). A study by Zhaolan et al., found that 63% of their studied population had poorly controlled diabetes (A1c >7.5%) while only 12.1% met an optimum HbA1c target (<6.5%). Another study by Al‑Rowais, in Riyadh, found that the rate of “unacceptable HbA1c” for diabetics attending a university hospital was about 60% (HbA1c >7), while 36% had an HbA1c above 8. The rate of uncontrolled diabetics (HbA1c >7) in a Jordanian study by Khattab et al., was about 65%. Several factors including patient’s compliance and understanding of the disease, literacy and treatment strategy by physicians contribute to the lack of control.
inconvenient while others do not appreciate the reason for doing it. Apart from this, doctors do not always remember to ask for the urine test since the request is made on a separate request form.

Type 2 diabetes was more prevalent in 18–59 age group at a rate of 70%, which compares well with other national studies. For example, Al-Rowais who looked at 1520 diabetics, found that 59.2% were under the age of 60.[31] In Al-Nozha et al. survey of 4004 diabetics, 75.9% of them were aged between 30 and 59 years.[3]

Our study reports the overall prevalence of 1733 type 2 diabetics, which corresponds to a rate of 3.25% in the “ISKAN” population with a catchment area of 53,160 eligible residents. In Saudi Arabia, although the previously reported prevalence of diabetes mellitus was ~20–30%,[26,28] differences in methodology account for variation in results. For example, the reported rate of 23.7% in Al-Nozha’s study, a survey of an age specific group (30–70 years), was of subjects from households in primary care catchment areas, utilizing fasting blood glucose as per the 1997 ADA guidelines.[3] Several studies have used that figure in their reports.[26–28] In our study, we calculated the overall prevalence of “type 2 diabetes” for “all age groups” in a local community. ADA 2010 guidelines were applied in our study period, utilizing HbA1c to diagnose diabetes. The estimated figures from the World Health Organization (WHO) on diabetics in Saudi Arabia in 2000 was about 890,000 cases with a projection to over 2,500,000 in 2030.[29] Bearing in mind that the Saudi Arabia’s population was about 22 million in 2000, and rose to almost 31 million in 2014,[14] the calculated overall prevalence in Saudi Arabia would have been ~4% in 2000, and about 8% in 2014 – using the 2030 estimate. In a study done by Wild et al.,[3] that looked at the global prevalence of diabetes “for all age groups”, the prevalence was found to be 2.8% in the year 2000 with a projection of 4.4% in 2030.[19]

Interventions that target follow-up arrangements have been known to improve diabetic outcomes.[3] A register-recall system to follow-up uncontrolled diabetics can, therefore, be valuable. Such a system could be an important tool for providing structured care for diabetics and in identifying and recalling patients who do not meet the recommended targets.[19] Primary prevention programs that target prediabetics (promoting healthy diet, exercise, and weight reduction) and patient education programs are also an integral part of reducing the prevalence rate of diabetes.

Limitations

In our study, we reported diabetics referred to our local diabetes center from primary care clinics. Despite efforts to promote diabetic referrals, a number of diabetics who should have been referred, were not referred to our clinic. This may have resulted in an under-estimation of our reported prevalence. With the relatively large population size at ISKAN (53,160), we estimate that our result might be skewed by 1–2% and the actual overall prevalence in our ISKAN community lies between (3.25% and 5.25%). Moreover, our reported rate reflects the overall prevalence of diabetes in a specific community “ISKAN” with its own characteristics (mainly soldiers with multiple younger siblings). Therefore, applying that rate on a national level may be biased.

CONCLUSIONS

Although the prevalence of type 2 diabetes seems lower than the previously reported national figures – due to methodological differences, the number of people with uncontrolled diabetes in our population is alarming. Recalling uncontrolled diabetics and a more stringent annual review program are needed to control diabetes and reduce long-term complications. Patient education programs are also essential to improve compliance and clarify misconceptions.

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Conflicts of interest

There are no conflicts of interest.

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