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ORIGINAL ARTICLE

National and regional prevalence rates of diabetes in Saudi Arabia: analysis of national survey data

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Abstract

Background The prevalence of diabetes mellitus (DM) has grown globally including Saudi Arabia. However, there are no recent national and regional reports about DM in Saudi Arabia. Therefore, this study aimed to explore the national and regional prevalence rates of DM among the Saudi population.

Methods Data from an ongoing household health survey that was carried out by the General Authority for Statistics in 2017 was utilized in this study. The study sample was selected by including 24,012 households which was representative of the population and distributed according to the 13 administrative regions. A self-reported diagnosis of DM was collected by asking subjects if they have been diagnosed by a doctor.

Results The proportion of DM was 8.5% among the Saudi Arabia population (≥ 15 years) and was higher in male (10.3%) than female (9.9%). The prevalence of DM among the age group ≥ 60 years was the highest (49.2%), followed by the age group 45–64 years (38.9%) while the lowest prevalence was found among the younger group < 40 years (15.3%). There was a large difference between regions ranging from 7.3% in Najran to 11% in Makkah.

Conclusion This study showed the recent national and regional prevalence rates of DM among Saudi populations. The high prevalence of DM in Saudi Arabia requires an urgent public health call to improve early detection program and lifestyle interventions. This study urges to minimize the health and economic burden of DM by establishing and implementing a national diabetes prevention program.

Keywords Diabetes · Elevated blood glucose · Saudi Arabia · Prevalence · Epidemiology

Introduction

Diabetes mellitus (DM) is an ever-increasing worldwide health concern. Over the past decades, the prevalence of DM has significantly increased worldwide and currently reaching an epidemic proportion [1]. The most up-to-date stats according to the International Diabetes Federation (IDF) indicated that 9.1% among adults whose age ranges from 20 to 79 years, or 463 million people, have DM. Moreover, 374 million people live with impaired glucose tolerance and are especially at risk of DM later in their life. So far, about half (232 million people) of the adults with DM remain undiagnosed, many potentially developing complications while unknowing their problem [2, 3].

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Complications associated with the inadequate treatment of DM are very debilitating and life-threatening. Compared to people without DM, adults with DM are likely to develop macrovascular disorders (including coronary, cerebral, and peripheral vascular disorders), which are considered the major causes of death in people with DM and microvascular disorders (such as diabetic neuropathy, retinopathy, and nephropathy) [4]. DM therefore imposes a huge health and financial burden on people, healthcare systems, and countries. Global estimates indicated that 10% (USD 760 billion) of the total health expenditure in 2019 was spent on DM [2].

A number of reports have indicated that prevalence of DM is expected to be high in the Middle East region and North Africa, which probably attributed to the increased per capita income, economic progress, urbanization, and pronounced lifestyle changes that enabled physical inactivity and raised the rate of obesity [2, 5, 6]. Saudi Arabia is not so far from this global epidemic [7, 8]. Several surveys have documented that the prevalence of DM among Saudi population reached a disturbing proportion [9]. As reported by Saudi Arabia Ministry of Health, the prevalence of DM has considerably increased from 0.9 million people in 1992 to 2.5 million people in 2010, showing almost 3-fold increase in the prevalence rate in less than two decades [8, 10]. According to the World Health Organization (WHO) report, the Kingdom of Saudi Arabia is on the highest end of the spectrum regarding the prevalence of DM in the Middle East, recording 21.8% of all Saudi population in 2008 with DM [11]. A community-based epidemiological study reported that the prevalence of DM was 23.7% in people aged 30 to 70 years [3]. A cross-sectional study conducted in 2009 that collected data from a sample of 6024 Saudi subjects (age, 55.3 ± 13.2) indicated that the overall prevalence is 30% among Saudi population on DM and past medical history [12]. However, these studies have a number of limitations such as small and under-representative sample size, and lack of age-specific prevalence.

Despite international organizations such as IDF and WHO providing data about the prevalence rate of DM, by countries, these data may have some limitations in statistical precision because they are mostly calculated based on imputations [13]. Considering the growing-prevalence of DM over time, data from the above-mentioned studies may differ from the current rates of prevalence of DM. In addition, the samples recruited only from certain regions and may not give a true prevalence rate among Saudi Arabia.

A necessary first-step toward framing of etiological hypotheses, identifying the healthcare priorities, generating policy initiatives, and evaluating how effective are the healthcare services in mitigating the burden of DM is to establish national and regional registries. Therefore, to enhance our knowledge about the national prevalence of DM and compare it with other prevalence studies, this descriptive epidemiological study has been undertaken with the aim of estimating the national as well as the age-, gender-, and region-specific prevalence rates of DM among Saudi population.

Materials and methods

The design of this study was cross-sectional descriptive research. This study was part of a large Kingdom-wide screening using an ongoing household health survey that was carried out in 2017 by the General Authority for Statistics (GASTAT). The selected study sample was selected by including about 24,012 households that were recruited from 1334 enumeration areas as being representative of the survey community throughout the administrative regions in the Kingdom of Saudi Arabia [14]. Inclusion criteria included all individuals (Saudi and non-Saudi) residing in Saudi Arabia aged 15 years and older at the time of data collection as well as Saudi household members who were out of the country for education, trade, or tourism.

The method of selecting sample units from the statistical structures aimed at including the target population was carried out in two phases. The main sampling units were chosen in the first phase. These sample units were the enumerated regions that were part of the buildings and residential property enumeration and coding stage. From all administrative regions, 1334 enumeration areas were chosen by employing a proportional-size approach and weighting the overall Saudi Arabian sample of households. The following phase was to randomly collect the final sampling units from the statistical areas. By that time, the households in the enumeration areas (that were selected during the first phase) were selected by using the regular random sampling resulting in a total of 24,012 households throughout the Kingdom (Fig. 1). Each head of household or any adult member of the household, who is familiar with its affairs, was interviewed by a qualified field researcher from the GASTAT to record all data electronically on an iPad system.

After identifying the optimal size of the survey sample of homes in each administrative region, the primary sampling units were then drawn from the main sample population. The primary sample framework of the home surveys yielded a total of 1334 counting locations. The sampling process is illustrated in Fig. 1.

Data collection was carried out via trained research assistants. Those data collectors were selected based on educational level, field work experience, personal attitudes, successful completion of the training program, and age of above 20 years. Training program included practical and hands-on lectures on technical, administrative, and awareness materials that were utilized in data collection processes. This training program lasted for 1 week. Data collectors were also introduced to the objectives of the survey and detailed explanation

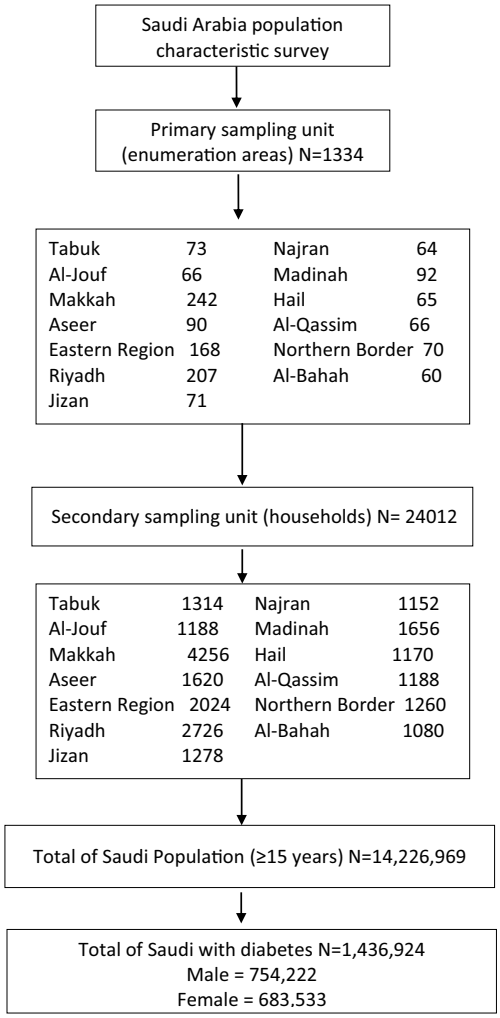

Fig. 1 The flowchart of the survey sample selection

of the questions and items in the questionnaire. Finally, data collectors were trained on how to deal with public and asking questions in record time to ensure efficiency of data collection.

In the current study, a self-reported diagnosis of diabetes was collected. The interviewed individuals were asked if any one of the household members have been diagnosed by a doctor and informed him/her that he/she has diabetes and were categorized as having DM in the study.

Statistical analysis

Data analyses were performed using statistical software Stata version 15.1 (Stata Corp, College Station, TX), and prevalence thematic mapping was generated via a web-based map customization tool (SimpleMaps.com, Pareto Software, LLC©, USA).

For the purpose of the current study, prevalence rates (%) of DM diagnosis (i.e., the basic descriptive epidemiology) were calculated for the entire sample. To generate insights into the age, gender, and geographic variability, the prevalence rates have also been calculated for the age-, gender-, and administrative region-stratified subsamples.

Results

The proportion of the population diagnosed with DM reached 8.5% among the population of Saudi Arabia 15 years and over, and the percentage rises between the male populations to reach (10.3%), while the female population was 9.9%. This percentage for the total Saudi population including all age groups was 10.1%. The prevalence among the age group (≥ 65 years) was the highest, recording 49.2%, followed by the age group 45–64 years that reached 38.9%, and the lowest prevalence was found among those who were younger than 40 years old as 15.3%.

Figure 2 illustrates the number of people aged 15 years and over, who are diagnosed with DM according to gender and age groups. The percentage of Saudis diagnosed with DM increases significantly with increasing age and that the rates of prevalence increase significantly at the age of 40 years and older compared to those who were under the age of 40 years; the prevalence of diagnosed DM in the Saudi population is the highest at the age of 65 years or more, where there is a large convergence in the ratio between males and females, as the ratio reached 48.9% for Saudi males while it reached 49.4% for Saudi females.

Figure 3 shows the national and prevalence rate of DM per 100,000 people among Saudi population. The highest prevalence of diagnosed DM was seen in the Makkah region (11%), followed by Hail with a rate of 10.8%, and the lowest percentage was recorded in the Najran region (7.3%).

Discussion

DM is one of the leading causes of death in Saudi Arabia [15]. This study suggests large differences in prevalence of DM based on age, gender, and Saudi regions. The highest prevalence rate of DM was in the older age category (i.e., > 65 years old), male gender, and in the Makkah region. The data present an increase of the prevalence of DM corresponding to aging for both genders.

These data suggest alarmingly high prevalence and change in the prevalence of DM has over the years. The rate of DM in Saudi Arabia was in the top 10 countries based on the International Diabetes Federation for people who aged between 20 and 79 years old [16]. There were dramatically increases in the prevalence of DM in Saudi Arabia, from 7% in 1989 to 32% in 2009 [17]. Based on the American Diabetes Association diagnostic criteria, a recent community-based

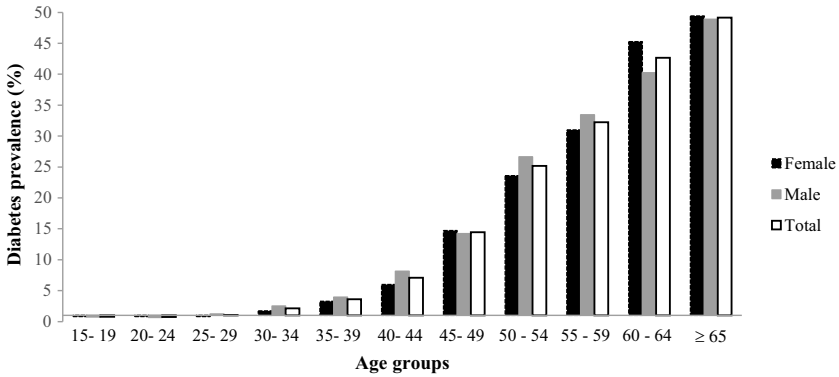

Fig. 2 Diabetes prevalence across gender and age groups

study showed 15.7% of Saudi population with DM which was in parallel with Turkish population and higher than Chinese population results [18]. The findings of this study suggest a lower prevalence compared to these results with large differences in prevalence between regions. However, these ranges were in parallel with the overall prevalence of DM in the USA [19]. Future studies may need to use high standard diagnostic criteria for DM to clarify the actual percentage of DM based on the types and risk factors in Saudi regions. This will help in identifying preventive strategies and treatment protocols for DM management centers around the Kingdom.

Risk factors for DM have been examined previously and include age, sex, and overweight or obesity. The prevalence of DM increased with age in the current study, and this was a common risk factor in Western countries such as the USA and China [20, 21]. In addition, previous evidence found similar results to our study regarding age (> 45 years) as a risk factor for DM in Saudi population [18, 22]. Aging has been linked with increased adiposity and lower muscle mass that might affect insulin sensitivity leading to DM [23, 24]. Males were found to have higher prevalence of DM when compared to males in the current study. These findings are consistent with previous evidence at a global level (9.0% in males, 7.9% in females) [25]. The difference in DM prevalence between men and women could be attributed to the predisposing risk factors in men such as being at risk for DM at a lower body mass index, and smoking [26]. Furthermore, previous research found similar trends for the higher prevalence of DM in men compared to women due to smoking, alcohol intake, and presence of other diseases such as hypertension and dyslipidemia [27, 28]. Overweight and obesity are the most common risk factors for DM globally and locally [17, 18, 22]. However, in

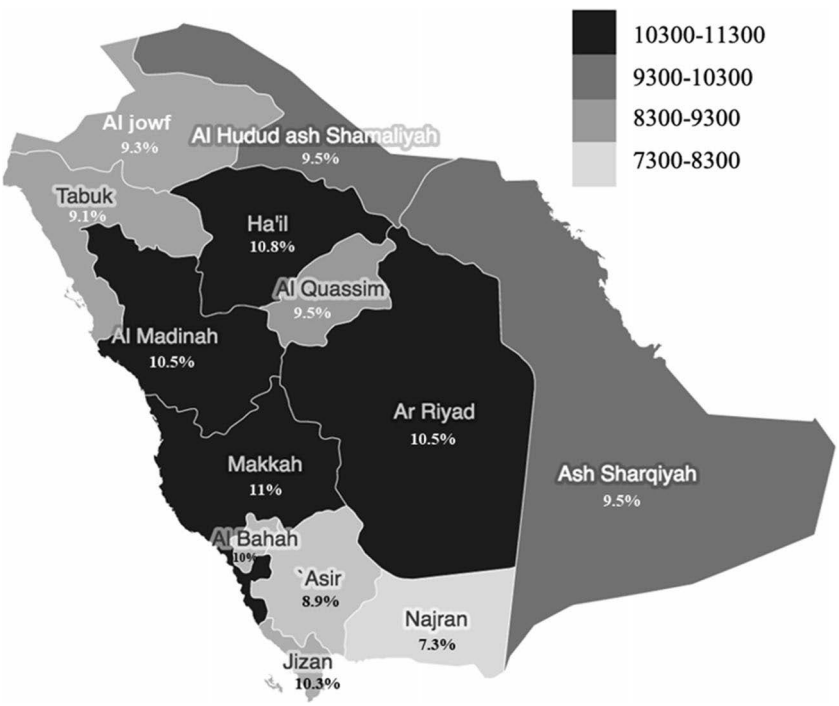

Fig. 3 The national and regional prevalence rates of diabetes per 100,000 people

the current study, overweight or obesity was not available. Future research should examine the associated risk factors with DM at a national level.

Lifestyle interventions have a significant impact on prevention of DM [29]. However, the data on Saudi lifestyle were not available. Our previous evidence has examined the prevalence of physical activity at a national level [30]. According to the findings of this study, the prevalence of satisfying physical activity recommendations (150 min/week) was 17.40% in Saudi population. This very low prevalence might be linked to the increased prevalence of DM. Although the Makkah region had the highest prevalence of practicing physical activity (23%) [30], it has the highest prevalence of DM (11%). These findings could be explained by the population living in this region. However, it is crucial to examine factors that affect DM distribution among regions in Saudi Arabia. Lifestyle modification has shown positive results on the prevention of DM or at least delay it. Physical activity and diet counseling are important interventional approaches for people who are at risk of DM. In addition, a cost-effective program such as lifestyle modification might help in establishing prevention programs for people living in the Kingdom of Saudi Arabia.

There are several limitations to this study that should be addressed in future research. The cross-sectional design of this study may lead to selection bias. There is a need to design multicenter longitudinal study from different regions and organizations. The diagnosis of DM was based on self-reported and highly standard diagnostic criteria using a gold standard–based screening study are imperative to be utilized in future studies. Another limitation is the lack of disease parameters such as duration and glucose level of glycemic control such as hemoglobin A1c. Future work should include such parameters for further understanding of the disease progression and impact in Saudi Arabia. Understanding other risk factors of DM will help in investigating the other associated risk factors with the DM diagnosis. This study did not distinguish type 1 and type of DM. Therefore, future research should examine the prevalence of each type at the national and regional level. Finally, we recommend including demographics such as education, ethnicity, occupation, marital status, and insurance coverage to help in optimizing the DM management for Saudi population.

Conclusion

This study showed the recent national and regional prevalence rates of DM among Saudi populations with large variations in prevalence by age, sex, and region. Future studies are needed to consider high-quality design and methods to help preventive strategies and DM management approaches in Saudi regions. Future studies are needed to investigate the effect of demographics including education, economy, ethnicity, and medical coverage on DM distribution based on different regions in the Kingdom of Saudi Arabia. In addition, there is a necessity to understand the prevalence of DM in corresponding with the risk factors related to DM such as obesity, smoking, and physical inactivity among Saudi population.

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Author contribution BA is involved in the study design. AA and BA helped with data analysis and interpretation. BA, AA, MMA RKA, and KK helped in writing and reviewing the final version of this manuscript.

Declarations

Conflict of interest KK has acted as a consultant and speaker or received grants for investigator-initiated studies for Astra Zeneca, Novartis, Novo Nordisk, Sanofi-Aventis, Lilly and Merck Sharp & Dohme, Boehringer Ingelheim, Bayer, Berlin-Chemie AG/Menarini Group, Janssen, and Napp.

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