

Prevalence and future prediction of type 2 diabetes mellitus in the Kingdom of Saudi Arabia: A systematic review of published studies

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Abstract

To highlight the prevalence and future projections of type 2 diabetes mellitus in the Kingdom of Saudi Arabia.

The systematic analytic study was conducted in the Department of Physiology, College of Medicine, King Saud University, Riyadh, Saudi Arabia, from Dec 2014 to April 2015. Systematic bibliographic search of scientific databases including ISI-web of science, PubMed and Google Scholar was conducted with key words of "diabetes mellitus" "prevalence", "incidence". Total 46 peer reviewed papers were selected and examined. All the experimental and epidemiologic studies reporting the prevalence of diabetes in Saudi Arabia were included. There was no restriction on publication prestige and language of the publication. Finally, we included 21 publications and remaining 25 papers were excluded. The future predicted prevalence of type 2 diabetes was calculated on the results of the published studies by regressing the 33 years (1982-2015) of prevalence rate of diabetes against the time period.

The prevalence of type 2 diabetes in Saudi Arabia is 32.8%. However, the predicted prevalence will be 35.37% in 2020; 40.37% in 2025 and 45.36% in the year 2030. The coefficient on time factor indicated that prevalence rate has increased during 1982-2015.

Saudi Arabia has a highest prevalence (32.8%) of type 2 diabetes mellitus. We forecast that the incidence of type 2 diabetes will increase from 32.8% in 2015 to 45.36% in 2030. Saudi Arabia should include diabetes preventive measures on a war footing basis in their national health policy to minimize the burden of the disease.

Keywords: Diabetes Mellitus, Prevalence, Future projection, Saudi Arabia.

Introduction

Diabetes mellitus is an emerging public health concern with growing prevalence and multiple debilitating complications. In spite of amazing improvement in medical

sciences, diabetes mellitus is still an incurable life-long disease and is speedily increasing in all age groups and both genders.¹ It effects many anatomical, physiological functions,² organs and body systems³ and is associated with wide ranging and devastating complications.⁴ The figures are rising in developing as well as developed countries and diabetes has involved both urban and rural zones of the globe. Its incidence is more commonly seen in the Arab world countries especially the GGC countries including the Kingdom of Saudi Arabia.

Saudi Arabia is the largest country of Arab world, with an approximate population of 30.77 million people.⁵ The overall picture of the health and disease in Saudi Arabia has changed tremendously during the last three decades. This period became economically prosperous for the country due to the socio-economic growth secondary to a rise in the production of natural resources especially oil and gas. During this period, there were major positive changes in the health care system, undergraduate and postgraduate education, safe drinking water and good sanitation. Although, the rapid growth in the socio-economic standard provoked great changes in living-standards and in the patterns of health and disease,⁶ it brought uninvited changes in the overall living standards and people largely migrated to urban areas. The traditional nutritional practices changed speedily and sedentary lifestyle infiltrated into the culture.^{7,8} Furthermore, people adopted a luxurious life style, physical inactivity, eating more and exercising less which resulted in metabolic problems, obesity and diabetes mellitus.^{7,8} This is the first study that has investigated the prevalence and future projection of diabetes mellitus in the Kingdom of Saudi Arabia. The aim of this study is to highlight the prevalence and future projections of type 2 diabetes mellitus in Kingdom of Saudi Arabia.

Research Methodology

The systematic analytic study was conducted in the Department of Physiology, College of Medicine, King Saud University, Riyadh, Saudi Arabia from Dec 2014 to April 2015.

Selection of studies: A systematic bibliographic search of scientific databases including ISI-web of science and PubMed was conducted by using key words of "diabetes

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mellitus" "hyperglycaemia", "prevalence", "incidence", "occurrence", "epidemiology" etc. Basic keywords were also entered in the Google Scholar search engine and after getting a related article, the title of that article was re-entered in the ISI-Web of Science and Pub-Med.

The article title and abstracts were thoroughly evaluated to consider the eligibility for inclusion. Studies in which diabetes mellitus, hyperglycaemia, prevalence, incidence, epidemiology were discussed were considered eligible for inclusion. No limitations on publication prestige, study design or language of publication were obligatory. However, we did not include secondary reports without the synthesis of novel data such as brief communications and non-observational correspondence. The inclusion criteria required that the study population must be of Saudi Arabia. All the studies were re-checked against pre-determined inclusion and exclusion criteria. We reviewed 46 papers, finally we included 21 studies and remaining 25 studies were excluded from the study. For the calculation of prevalence of type 2 diabetes in Saudi Arabia, we entered the prevalence of diabetes based on the results of the published studies. Predicted prevalence of type 2 diabetes mellitus was determined by regressing the 33 years (1982-2015) of prevalence rates of diabetes against the time period.⁹ In all cases, the coefficient on time was positive, indicating that prevalence rates increased during the period 1982-2015. We plotted a scatter chart and derived "Y" and "X" values based on the prevalence of diabetes. Y- indicated the prevalence in percentage, where X shows the year of prevalence. Future projection was calculated based on the equation

[Future Projection = (Y x value of year)-X].

Ethics statement: In this study we reviewed and analyzed the data base literature on the occurrence of type 2 diabetes mellitus; hence, we did not require the ethical approval.

Data analysis: The extracted data for prevalence of type 2 diabetes mellitus was entered into the computer, programme SPSS Version 20 was used for analysis and the prevalence rate was reported descriptively.

Results

Table shows the prevalence of type 2 diabetes mellitus in the Kingdom of Saudi Arabia. Saudi Arabia has 32.8% prevalence of type 2 diabetes mellitus. It was 2.5% in the year 1982, 4.3% in 1987, 6.0% in 1990, 10.3% in 1997, 8.3% in 2000, 23% in 2004, 31.3% in 2011 and 32.8% in the year 2015. However, the predicted prevalence of type 2 diabetes mellitus in the Kingdom of Saudi Arabia will be 35.378% in 2020, 40.37% in 2025 and 45.36% in the year 2030. The coefficient on time

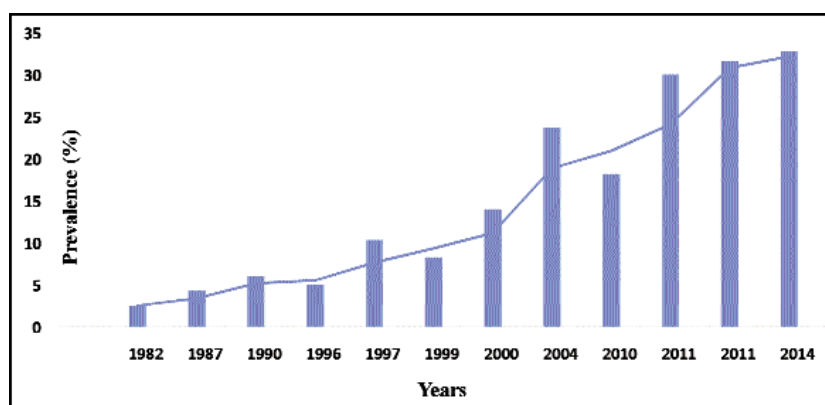


Figure: Prevalence of type 2 diabetes mellitus in the Kingdom of Saudi Arabia.

Table: Epidemiological studies in the Kingdom of Saudi Arabia [1982-2014].

Country	Author / year of publication	Urban / Rural	Sample size	Age range (Years)	Method	Prevalence
Saudi Arabia	Bacchus et al., 1982 ¹⁰	Rural	1385 M	24-65 years	GTT	2.5%
Saudi Arabia	Fatani et al., 1987 ¹¹	Rural	5222 M/F	>30 years	RBG/OGTT	4.3%
Saudi Arabia	Anukote 1990 ¹²	Urban	3158 M/F	18-65 years	Urine /FBG	6%
Saudi Arabia	El-Hazmi et al., 1996 ¹³	Urban / Rural	23493 M/F	2-70 years	OGTT	5%
Saudi Arabia	Al-Nuaim et al., 1997 ¹⁴	Urban / Rural	13177 M/F	15-60 years	RBG/ OGTT	10.3%
Saudi Arabia	Warsy et al., 1999 ¹⁵	Urban / Rural	14660 M/F	14-70 years	OGTT	8.3%
Saudi Arabia	Karim et al., 2000 ¹⁶	Urban / Rural	3747 M/F	>35 years	RBG/ OGTT	14%
Saudi Arabia	Al-Nozha et al., 2004 ¹⁷	Urban / Rural	16817 M/F	30-70 years	FBG	23.7%
Saudi Arabia	Al-Baghli et al., 2010 ¹⁸	Urban / Rural	197,681 M/F	>30 years	FBG	18.2%
Saudi Arabia	Alqurashi et al., 2011 ¹⁹	Urban / Rural	6024 M/F	55.3 years	Self reported	30%
Saudi Arabia	Al-Daghri et al., 2011 ⁸	Urban / Rural	9149 M/F	7-80 years	FBG	31.6%
Saudi Arabia	Al Rubeaan et al., 2014 ^{20,21}	Urban / Rural	53370 M/F	30-765 years	FBG	32.8%
Total Mean%						15.55%

DM=Diabetes Mellitus; U/R=Urban /Rural; M=Male; F=Females; FBG=Fasting blood sugar, OGTT=Oral Glucose Tolerance Test; Reference has been mentioned against each study.

factor was indicating that prevalence rates were increasing during the period 1982-2015. In Saudi Arabia the prevalence of diabetes increased in a step ladder pattern (Table, Figure).

Discussion

In the Arab world, Saudi Arabia is the Arab originated, third largest country constituting the bulk of the Arabian Peninsula. It has an estimated population of 30.77 million.⁵ A few studies have been conducted in Saudi Arabia to determine the prevalence of diabetes mellitus;¹⁰ Fatani et al., 1987;¹¹ Anokute 1990;¹² El-Hazmi et al., 1996;¹³ Al-Nuaim 1997;¹⁴ Warsy et al., 1999;¹⁵ Karim et al., 2000;¹⁶ Al-Nozha et al., 2004;¹⁷ Al-Baghli et al., 2010;¹⁸ Alqurashi et al 2011;¹⁹ Daghri et al., 2011;⁸ Rubaan et al., 2015^{20,21} (Table, Figure). In the present study, we reviewed the ISI web of science and PubMed based literature published between the period from 1982-2015 and found that the prevalence of diabetes mellitus has greatly increased in the Kingdom of Saudi Arabia [Table, Figure]. Presently, Saudi Arabia has prevalence of 32.8% of type 2 diabetes mellitus.

Bacchus et al., 1982¹⁰ conducted a study on the incidence of diabetes mellitus in 1385 males in the Al-Kharj region of Saudi Arabia by using WHO criteria for screening and interpretation of glucose tolerance tests. The age group of diabetic patients was 24-65 years and the overall prevalence was 2.8%. Bacchus et al.,¹⁰ study had some limitations including small sample size and representing male rural population only. Similarly, Fatani et al., 1987 reported the occurrence of diabetes mellitus from Saudi Arabia; the study also had similar limitations as Bacchus et al., including small sample size, representation of rural population, however, it showed the rising rate of diabetes and reported a prevalence of 4.3%. Anokute in 1990¹² conducted a study, but shared the same flaws comparatively small sample size, not representative of the whole population as well as both gender and based on the university students and staff from an urban population. This study also confirmed the rising pattern of diabetes prevalence as 6%. Later, El-Hazmi et al.,¹³ (1996) reported the incidence of diabetes mellitus from Saudi Arabia; they recruited an acceptable general population, representative of both gender as well as rural and urban population and they reported overall prevalence of type 2 diabetes 4.5% for females and 5.5% for males and combined prevalence was found to be at 5%. In a follow up report, that was published in the year 1999 by the same authors,¹⁵ the prevalence rate of diabetes among males was 9.7% and in females 7%, however, the mean prevalence was 8.3%.¹⁵ Ali Nuaim¹⁴ conducted a study and considered the age, gender, urban and rural zones and found that the frequency of diabetes among females was 14% and 9% and that among males was 12% and 7%, from urban and rural areas respectively.

In the new millennium, few large sample sized studies were

conducted and they considered all the established parameters such as reliable study protocol, age, gender, rural and urban population. Al Nozha et al (2004)¹⁷ found that the prevalence of diabetes was 23.7%. It confirmed the effect of urbanization with a higher rate in urban 25.5% versus the rural areas 19.5%. This study was based on the WHO diagnostic criteria and represents the general population. Al-Baghli et al., (2010) found the prevalence of diabetes to be at 18.2%. In their study, they recruited 197681 males and female subjects and their study methodology was based on Fasting Blood Glucose. Alqurashi et al.,¹⁹ conducted a study on 6024 subjects who had attended the primary care clinic and they determined the prevalence of diabetes mellitus among Saudi nationals. The authors reported that the overall incidence of diabetes mellitus was 30% with mean age of 55.3 years. Based on the gender, the prevalence of diabetes was 34.1% in males and 27.6% in females. The prevalence of diabetes mellitus was found to be increasing along with advancing age.

In the year 2011, Al Daghri et al., (2011)⁸ conducted a study in Saudi Arabia on 9149 Saudis, ages 7-80 years, 5357 males (58.6%) and 3792 females (41.4%). The diagnostic methodology was based on the WHO criteria. They reported that the age adjusted prevalence of DMT2 was 31.6% and it was meaningfully higher in males (34.7%) than in females (28.6%).

More recently, Rubaan et al., 2014^{20,21} conducted a national, household, population-based study of 53370 participants from 13 regions of the Kingdom of Saudi Arabia. Fasting blood sample was used to screen for diabetes mellitus. The prevalence of diabetes in the age groups 30-44 years was 14.7%, 45-64 years 37.5%, and ≥ 65 years was 44.7%. However, the overall mean of these three age groups was 32.8 %. Diabetes prevalence was significantly higher in urban areas when compared with rural areas. However, Type 1 diabetes prevalence was 0.8% contributing only to 6.6% of the total population of patients with diabetes. In the Kingdom of Saudi Arabia, the top 5 regions with the highest abnormal glucose metabolism prevalence were Makkah (43.4%), Aljouf (41.7%), Eastern region (37.16%), Madinah (35.4%), and Qassim (33.7%). Urbanization, age, and obesity were behind the wide variations in diabetes and IFG prevalence in all the regions.

Study limitations: The strengths of this study are: we searched the literature from very trustworthy sources including Institute of Scientific Information (ISI) Web of Science (Thomson Reuters), and PubMed. However, the limitations of the present study are: occasionally search tools may be unable to find a paper. We tried to search the similar type of studies such as randomized, cohort, community based, large

sample size studies which followed either ADA or WHO criteria, but we faced some methodological challenges; and in each study different methods were used to assess the glycaemic status. Due to the heterogeneity in the available literature, we were unable to select the uniform types of studies. Moreover, the literature is lacking therefore, we selected both randomized, cohort, and cross sectional, community and hospital based studies which followed either ADA or WHO criteria to confirm diabetes among the subjects.

Conclusion and Suggestions

The current prevalence of type 2 diabetes in the Kingdom of Saudi Arabia is 32.8%. The predicted prevalence will be 35.37% in 2020; 40.8% in 2025 and 45.8% in the year 2030. These figures show that diabetes mellitus is rapidly increasing in the Kingdom of Saudi Arabia. The projection of type 2 diabetes in the Saudi Arabia indicates that the situation may be more alarming than previously believed. The rising pattern of occurrence of type 2 diabetes mellitus develops a threatening and most challenging situation to the health care providers. It is suggested that, Saudi Arabia should include the diabetes preventive measures on a war footing basis in their national health policy to minimize the burden of the disease. Public education, regular physical exercise, nutritional knowledge of foods must be given to the community to control diabetes in the country. Diabetes and its complications should be frequently discussed in scientific, academic assemblies and both in electronic and print media to improve the public awareness to minimize the prevalence of the disease.

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