# Prevalence, risk factors and clinical aspects of Diabetes Mellitus among Saudis in the Western Region. Saudi Arabia: A community based study

**Fathi M. El-Gamal** (1)
**Hadeel Elshahti** (2)
**Malath Bukhari** (2)
**Mohammed Aljohani** (2)
**Naif Alsifri** (2)
**Waad Ahmed** *(2)*
**Rawan Gaber** (2)
**Suzan Abulaban** (2)
**Abdulathim AlHarbi** (2)
**Sarah Shuailah** (2)
**Ali Alshikhi** (2)

(1) Chairman of the Family Medicine Department. IbnSina National College. Jeddah. KSA
(2) Medicine program. Ibn Sina National College. Jeddah. KSA

**Corresponding author:**
Prof. F. M. El-Gamal. Department of Family Medicine.
Ibn Sina National College. Al Mahjer Street. Jeddah.
Kingdom of Saudi Arabia.
Tel: 6356555-6355882 / Fax: 6375344 – P.O. Box 31906 Jeddah 21418
**Email:** drfathimhelgamal1996@hotmail.com

Received: October 2020; Accepted November 2020; Published: December 1, 2020.
Citation: . Fathi M. El-Gamal et al. Prevalence. risk factors. and clinical aspects of Diabetes Mellitus among Saudis in the Western Region. Saudi Arabia: A community based study World Family Medicine. 2020; 18(12): 179-186
DOI: 10.5742/MEWFM.2020.93925

## Abstract

Background: The prevalence of diabetes mellitus (DM). in Saudi Arabia. is growing at a fast rate. About 25% of the 30 – 70 years old subjects suffer from DM; this figure is further predicted to double by the year 2030.

Aim of this study: To investigate the occurrence of DM among different age groups. and explore the determinants. risk factors and clinical aspects of DM among Saudis in Jeddah city.

Method: A cross-sectional study. which included 1.106 subjects. randomly. visiting the walk area in North of Jeddah. or one Mall in East of Jeddah city. during the study period. An interview questionnaire was used to collect data on socio-demographic and clinical characteristics of the participants. Anthropometric measurements as well as blood pressure and capillary Random Blood Glucose (RBG) test. were assessed on each subject. Chi square test and Multinomial Logistic Regression were used to analyze the data. Odds Ratio (OR). and 95% confidence interval (95% CI) were employed. The level of significance was 0.05.

Results: DM was prevalent among 35% of Saudi subjects. aged 60 years or older. DM was discovered accidently in 46.1% of the diabetic subjects. Hyperglycemia was found in 11.8% of subjects with no doctor having diagnosed DM. Subjects who were 40 years or more. were 7 times more at risk to develop DM (OR: 6.98; 95% CI: 4.18. 11.66). those who lived in separate houses. were 2 times more likely to develop DM (OR: 2.207; 95% CI: 1.195. 4.082). and subjects who have family history of DM. were 2.4 times more likely to develop DM (OR: 2.430; 95% CI: 1.447. 4.082). Subjects who have DM. were 2.4 times more likely to develop vision problems (OR: 2.430; 95% CI: 1.447. 4.082). were 3 times more at risk to suffer from hypertension (OR: 3.085; 95% CI: 1.524. 6.243). and 10 times more at risk to develop foot ulcer (OR: 10.080; 95% CI: 1.490. 68.206). These complications were significantly associated with increased duration of DM.

Conclusion: DM is a major health problem among Saudis in Jeddah city. Our results demonstrate the need for major intervention to reduce this burden and to engage other sectors of the government and the community in these efforts.

Key words: DM. Saudi Arabia. complications. Risk factors.

## Introduction

Diabetes mellitus (DM) is a noninfectious chronic disease caused by the inability of the pancreas to effectively produce enough insulin or when the body in unable to properly use the insulin produced by it [1-2]. Globally. an estimated 463 million adults are living with diabetes. according to the 2019 data from the International Diabetes Federation [3]. Diabetes prevalence is increasing rapidly; previous 2017 estimates put the number at 425 million people living with diabetes [4]. The number is projected to almost double by 2030 [3]. The increase in incidence in developing countries follows the trend of urbanization and lifestyle changes. including increasingly sedentary lifestyles. less physically demanding work and the global nutrition transition. marked by increased intake of foods that are high energy-dense but nutrient-poor (often high in sugar and saturated fats) [5. 6]. Due to its chronic nature. the severity of the complications and the control methodologies required. diabetes is an expensive disease. affecting both the sufferer as well as his/her family and the health authorities as well [7-9]. The Kingdom of Saudi Arabia began to notice an insidious increase in the prevalence and incidence of DM soon after the rapid industrialization which resulted in a remarkable rise in the standard of living and adopting a more 'Westernized' lifestyle. The unhealthy dietary patterns and drop in the level of physical activity across the country saw the alarming rise in the level of diabetes to over 25% of the adult population. The rate is anticipated to more than double by 2030 [10. 11-13]. According to the World Health Organization (WHO). Saudi Arabia ranks second in the prevalence of diabetes in the Middle East region and seventh in the world [14]. More disturbing perhaps. is the rising tendency for diabetes in the recent years with a nearly ten-fold increase over the past thirty years in Saudi Arabia [15]. Moreover. studies conducted since the late 1980s have revealed a growing trend among adult Saudis. in which one of five adults had DM [16-22]. The aim of this study was to investigate the occurrence of DM among different age groups. and explore the determinants. risk factors and clinical aspects of DM among Saudis in Jeddah city.

## Subjects and Methods

This was a cross-sectional study. using the non-probability convenient sampling technique. where subjects. randomly. visiting the walk area in North of Jeddah city or one Mall in the East of Jeddah city. during the study period. were enrolled in the present study. The targeted participants were Saudis. aged 7 through to 85 years old. The total number was 1.106 subjects. This number was greater than the minimal required sample size for such a study. which was calculated to be 1.091 (based on effect size of 0.1. $\alpha = 0.05$. power = 80%. df = 3) [23].

Data were collected on each subject. after we obtained written consent to participate in the study. Each subject was asked the interview questionnaire which provided information on personal and socio-demographic characteristics. as well as clinical aspects. Anthropometric measurements. mainly weight and height of the subject. were measured using standard techniques and equipment. The body mass index (BMI) was calculated for each subject (the body mass in kg. divided by the square of the height in meters. with the value universally being given in units of kg/m2) [24]. Blood pressure measurement was conducted on the right arm. using mercury sphygmomanometer in sitting position. after 5 minutes rest. and mean of two measurements were recorded. Both systolic and diastolic blood pressures were measured. For each person a random capillary blood sample was taken for blood sugar measurement (mg/dL). It was done without regards to time since the last meal for the entire sample. Glucose level below 140 mg/dL (7.8mmol/L) was considered normal. whereas higher glucose level indicates hyperglycemia.

Statistical analysis: The SPSS software (version 23. PC/ IBM). was employed and Chi square test and Multinomial Logistic regression were used to analyze the data. Odds Ratio (OR). and 95% confidence interval (95% CI) were employed. The level of significance was 0.05

## Results

Table 1 shows the distribution of studied subjects according to presence of DM and sociodemographic variables. The present study comprised 1.106 subjects. where the majority were in the age range 21 to 60 years old (82%). Doctor diagnosed diabetes mellitus (DM). was encountered among 9.5% of the studied subjects with highest prevalence among age group 40 to less than 60 years old . and those 60 years old and over (20.6% and 35.3% respectively). On the other hand. prevalence of DM was lowest among those aged less than 21 years old (0.9%) and those aged 21 to less than 40 years old (4.1%). These differences were statistically significant. where $p < 0.000$. No significant difference was found between diabetic and non-diabetic subjects regarding educational and occupational levels ($p > 0.05$). Compared to subjects with no DM. diabetic subjects were more encountered among those who had extended families ($p < 0.03$). and among those who lived in separate houses ($p < 0.006$).

Table 2 displays distribution of studied subjects according to presence or absence of DM and clinical aspects. Greater proportions of subjects with DM had grade 1. 2 and 3 obesity (21%. 13.2% and 8.6% respectively). compared to subjects without DM (19.4%. 6.5%.and 4.7% respectively). These differences were statistically significant where $p < 0.016$. A greater proportion of subjects with DM had elevated systolic blood pressure or stage 1 hypertension (36.4%. and 25.7% respectively). compared to subjects without DM (26% and 11.6% respectively). These differences were statistically significant where $p < 0.000$. A greater proportion of subjects with DM had family history of DM (59.8%) compared to those without DM (42/7%). This difference was statistically significant where $p < 0.001$. Random blood sugar level was significantly higher among subjects with DM. compared with those without DM (64.7% and 11.8% respectively) where $p < 0.000$. About 9.0% of the subjects without DM were pre-diabetics. while 3.0% were diabetics and they did not know.

Table 3 shows duration of having DM and mode of control of diabetes among patients with DM. In a great proportion of the subjects. DM was discovered accidently (46%). particularly among those who had the disease for a duration longer than 10 years. The majority of the patients with DM received oral hypoglycemic drugs to control their DM (68%). Insulin was used by 17.6% of the patients; while following healthy diet was only adopted by 17.6% of the patients. No significant difference was found between those who had DM for a short. or long duration ($p > 0.05$).

Table 4 displays prevalence of complications among subjects with DM. Neuropathy is the most prevalent complication among subjects with DM. followed by retinopathy and nephropathy (33.3%. 21.6%. and 16.7% respectively). Although. these complications were more prevalent among those who had the disease for 10 years or more. these differences were not statistically significant ($p > 0.05$).

Table 5 displays the treatment history of the patients with DM. and duration of having DM. History of treatment for hypertension was the most common (23.5%). followed by treatment for vision problems and atherosclerosis (15.7% and 8.8% respectively). History for treatment of these diseases were significantly higher among those who had the disease for more than 10 years compared to those who had it for a shorter periods ($p <0.05$). History of treatment for angina and foot ulcer was only encountered among subjects who had DM for long duration ($p <0.05$).

Table 6 shows the relationships between DM and some demographic and clinical aspects. Subjects aged 40 years or older are 7 times more likely to develop DM (OR: 6.98; 95%CI: 4.18. 11.66. $p < 0.000$) compared to those under the age of 40 years. Subjects who live in separate houses. are 2 times more likely to develop DM (OR: 2.207; 95%CI: 1.195. 4.082. $p < 0.011$) compared to those who live in shared houses. Subjects who have family history of DM. are 2.4 times more likely to develop DM (OR: 2.430; 95%CI: 1.447. 4.082. $p < 0.001$) compared to those who have not. Subjects who have DM. are 2.4 times more likely to develop vision problems (OR: 2.430; 95%CI: 1.447. 4.082. $p < 0.001$) compared to those who have not. Subjects who have DM. are 3 times more likely to suffer from hypertension (OR: 3.085; 95%CI: 1.524. 6.243. $p < 0.002$) compared to those who have not. Subjects who have DM. are 10 times more likely to develop foot ulcer (OR: 10.080; 95% CI: 1.490. 68.206. $p < 0.018$) compared to those who have not.

## Discussion

According to the World Health Organization (WHO). Saudi Arabia ranks second in the prevalence of diabetes in the Middle East region and seventh in the world [14]. In the present study we aimed at exploring the burden of DM among Saudis from Jeddah city. and investigated the hyperglycemic state among subjects who were not diagnosed as diabetic before and investigate the risk factors associated with DM. A previous study in Saudi Arabia reported that the prevalence of diabetes had risen to 34.1% in males and 27.6% in females. It was reported that the mean age for diabetes onset in males and females was 57.5 and 53.4 years. respectively [20]. Another study reported that the overall prevalence of DM in Saudi Arabia. and especially in the central region (Riyadh). was 23.7% (age group 30-70 years). while another 14.1% had impaired fasting glucose [21]. A more recent study in Saudi Arabia reported that more than 50% of the population. 30 years or older. were either diabetic (25.4%) or pre-diabetic (25.5%) [22]. In Jeddah city we found. also. that occurrence of DM was 0.7% among subjects younger than 21 years old. 4.1% among those aged 21 to 40 years old. and then the figure increased markedly to 20.6% among those aged 40 years to 60 years. with the highest burden among those aged over 60 years old (35.3%). The median age of onset was 38 years old. Evidence-based interventions are available to prevent or delay the onset of diabetes in people with pre-diabetes [25. 26]. and to reduce rates of complications among those with type 2 diabetes [27]. As with many diseases. screening and early detection of diabetes and prediabetes is the first step to initiating prevention and treatment interventions. and has received considerable interest [28].

The present study revealed that. in the subjects with no doctor diagnosed DM (age range: 7 – 85 years old). 12 % had abnormally high Random Blood glucose level (the occurrence of pre-diabetes was 8.9%. and of diabetes was 3.0%). This finding is similar to a previous study [29].

In the present study we found a significant relation between age and occurrence of DM. where subjects older than 40 years old were 7 times at risk of developing DM compared to the younger ones (95% CI 4.180-11.657; $p <0.000$). We found also that subjects who lived in separate houses were 2.2 times more likely to develop DM compared with those who lived in shared houses (95% CI 1.195-4.075;$p <0.01$). However. other socio-demographic characteristics were not significantly associated with DM such as education. occupation. marital status. and family characteristics. These findings are consistent with findings from a previous study [29].

Several large prospective studies have raised the possibility that cigarette smoking increases the risk of type 2 diabetes [30]. In a meta-analysis of 25 prospective cohort studies. current smokers had an increased risk of developing type 2 diabetes compared with non-smokers [31]. In the present study we found that subjects with DM were significantly more encountered among the ex-smokers compared to the non-smokers ($p < 0.046$). Risk factors for type 2 diabetes are well established and include underlying genetic susceptibility. Because family history reflects genetic susceptibility in addition to other factors. it may be a useful public health tool for disease prevention [32]. The present study showed that subjects with family history of DM. were 2.4 times more at risk to develop DM compared to those without family history (95% CI: 1.447-4.082; $p< 0.001$). Overall. a family history approach appears

**Table 1. Distribution of studied subjects according to presence of DM and sociodemographic variables**

| Variables | | Diabetes Mellitus | | | | | | Chi square | p-Value |
|---|---|---|---|---|---|---|---|---|---|
| | | No | | Yes | | Total | | | |
| | | # | % | # | % | # | % | | |
| Age in years | < 21 | 151 | 14..8% | 1 | 0.9% | 152 | 13.5% | 118.32 | 0.000 |
| | 21 - | 592 | 58.1% | 25 | 32.4% | 617 | 54.8% | | |
| | 40 - | 243 | 23.8% | 63 | 58.9% | 306 | 27.2% | | |
| | 60+ | 33 | 3.2% | 18 | 16.8% | 51 | 27.2% | | |
| Level of education | Illiterate | 32 | 3.1% | 4 | 3.7% | 36 | 3.2% | 9.647 | 0.086 |
| | Read and write | 42 | 4.1% | 11 | 10.3% | 53 | 4.7% | | |
| | Essential | 78 | 7.7% | 10 | 9.3% | 88 | 7.8% | | |
| | Average | 376 | 36.9% | 32 | 29.9% | 408 | 36.2% | | |
| | University | 448 | 44.0% | 46 | 43.0% | 494 | 43.9% | | |
| | Higher | 43 | 4.2% | 4 | 3.7% | 47 | 4.2% | | |
| Level of occupation | High clerical | 157 | 15.4% | 23 | 21.5% | 180 | 16.0% | 3.876 | 0.423 |
| | Average clerical | 242 | 23.7% | 23 | 21.5% | 265 | 23.5% | | |
| | Skilled | 189 | 18.5% | 19 | 17.8% | 208 | 18.5% | | |
| | Manual | 91 | 8.9% | 12 | 11.2% | 103 | 9.1% | | |
| | Unemployed | 340 | 33.4% | 30 | 28.0% | 370 | 32.9% | | |
| Type of family | nucleus | 847 | 83.1% | 80 | 74.8% | 927 | 82.3% | 4.645 | 0.031 |
| | extended | 172 | 16.9% | 27 | 25.2% | 199 | 17.7% | | |
| Nature of house | rented | 514 | 50.4% | 54 | 50.5% | 568 | 50.4% | .000 | 0.996 |
| | owned | 505 | 49.6% | 53 | 49.5% | 558 | 49.6% | | |
| Type of house | Separate | 719 | 70.6% | 89 | 83.2% | 808 | 71.8% | 7.608 | 0.006 |
| | Shared | 300 | 29.4% | 18 | 16.8% | 318 | 28.2% | | |
| | Smoker | 408 | 92.3% | 34 | 7.7% | 442 | 100% | 6.177 | 0.046 |
| | Ex-smoker | 73 | 83.9% | 14 | 16.1% | 87 | 100% | | |
| | Non-smoker | 508 | 91.1% | 59 | 9.9% | 597% | 100% | | |

to be a promising new screening tool to fight the growing epidemic of diabetes. As part of the metabolic syndrome. hypertension and diabetes are closely associated with obesity and frequently occur together in an individual [33]. Despite this close relationship between hypertension and type 2 diabetes. little information exists on the relationship of BP levels with the subsequent development of type 2 diabetes. Finding an independent association between BP or BP progression and new-onset diabetes may be important. as it could imply close surveillance of blood glucose levels in individuals with increasing BP levels. Few studies analyzed the precise relationship between BP and incidence of type 2 diabetes. Gress et al [34] found that individuals with hypertension had a relative risk of 2.34 (95% confidence interval 2.16–2.73) of developing type 2 diabetes compared with individuals without hypertension. In the present study. we found that subjects with hypertension were 3.085 times more likely to have DM (95% CI:1.524-6.243; p< 0.002) compared to those with normal blood pressure.

Results from metabolic and epidemiologic studies provide strong evidence that obesity is causally related to type 2 diabetes. Many studies have reported associations between body mass index (BMI) and type 2 diabetes in men and women [35]. The present study confirmed. also. the relationship between obesity and DM. where subjects with gross obesity were 3.3 times more likely to suffer from DM compared to subjects with normal BMI (95% CI 1.337-7.991; p < 0.009). Type 2 DM is one of the most common metabolic disorders majorly affecting the adult population. It accounts for 90–95% of all diabetes cases [36-38]. Long-term elevations in blood glucose levels contribute to many complications in various organs. including the kidneys. skin. nerves. heart. and blood vessels [39]. This rise in blood glucose. particularly after diagnosis. is mainly due to a lack of compliance with the management plan that involves lifestyle modification and pharmaceutical interventions [40]. In the present study we found that only 35.2% of the subjects have RBS less than 140mg/dl. while 63% had increased RBS (25.7% had RBS 140 – 199 mg/dL. and 39% had RBS ≥ 200 mg/dL). One of the main impairments occurring from hyperglycemia is damage to the vasculature. It occurs either at small (microvascular complications) or large blood vessels (macro-vascular complications). Diabetic retinopathy is the most common microvascular complication. followed by diabetic nephropathy and neuropathy. All macro-vascular complications arise from

**Table 2. Distribution of studied subjects according to presence of DM and clinical aspects**

| Variables | | Diabetes Mellitus | | | | | | Chi square | p-Value |
|---|---|---|---|---|---|---|---|---|---|
| | | No | | Yes | | Total | | | |
| | | # | % | # | % | # | % | | |
| Grades of obesity | Body weight deficient | 30 | 3.0% | 2 | 1.9% | 32 | 2.9% | 14.017 | 0.016 |
| | Normal | 239 | 23.7% | 14 | 13.3% | 253 | 22.7% | | |
| | Overweight | 432 | 42.8% | 44 | 41.9% | 476 | 42.7% | | |
| | Obesity grade 1 | 196 | 19.4% | 22 | 21.0% | 218 | 19.6% | | |
| | Obesity grade 2 | 66 | 6.5% | 14 | 13.3% | 80 | 7.2% | | |
| | Obesity grade 3 | 47 | 4.7% | 9 | 8.6% | 56 | 5.0% | | |
| Grades of systolic hypertension | Normal | 602 | 59.1% | 37 | 34.6% | 639 | 56.8% | 28.275 | 0.000 |
| | Pre-Hypertensive | 265 | 26.0% | 39 | 36.4% | 304 | 27.0% | | |
| | Hypertension stage 1 | 118 | 11.6% | 27 | 25.2% | 145 | 12.9% | | |
| | Hypertension stage 2 | 23 | 2.3% | 3 | 2.8% | 26 | 2.3% | | |
| | Hypertensive crisis | 10 | 1.0% | 1 | 0.9% | 11 | 1.0% | | |
| Grades of diastolic hypertension | Normal | 385 | 37.8% | 28 | 26.2% | 413 | 36.7% | 7.221 | 0.125 |
| | Pre-Hypertensive | 394 | 38.7% | 46 | 43.0% | 440 | 39.1% | | |
| | Hypertension stage 1 | 193 | 19.0% | 28 | 26.2% | 221 | 19.6% | | |
| | Hypertension stage 2 | 41 | 4.0% | 5 | 4.7% | 46 | 4.1% | | |
| | Hypertensive crisis | 5 | 0.5% | 0 | 0.0% | 5 | 0.4% | | |
| Family history of DM | Yes | 435 | 42.7% | 64 | 59.8% | 499 | 44.3% | 11.507 | 0.001 |
| | No | 584 | 57.3% | 43 | 40.2% | 627 | 55.7% | | |
| Family history of hypertension | Yes | 398 | 39.1% | 51 | 47.7% | 449 | 39.9% | 2.991 | 0.084 |
| | No | 621 | 60.9% | 56 | 52.3% | 677 | 60.1% | | |
| Family history of heart disease | Yes | 161 | 15.8% | 20 | 18.7% | 181 | 16.1% | .600 | 0.438 |
| | No | 858 | 84.2% | 87 | 81.3% | 945 | 83.9% | | |
| Family history of obesity | Yes | 154 | 15.1% | 14 | 13.1% | 168 | 14.9% | .314 | 0.575 |
| | No | 865 | 84.9% | 93 | 86.9% | 958 | 85.1% | | |
| Random blood glucose levels | < 139 mg/dL | 870 | 88.1% | 37 | 35.2% | 907 | 83.1% | 247.203 | 0.000 |
| | 140 < 200 mg/dL | 87 | 8.9% | 27 | 25.7% | 114 | 10.4% | | |
| | ≥ 200 mg/dL | 30 | 3.0% | 41 | 39.0% | 71 | 6.5% | | |

the development of atherosclerosis. which gradually causes the narrowing of arterial walls [41. 42]. The present study revealed that patients with DM were 10 times more likely to suffer from foot ulcer (p<0.001). 3 times at risk to suffer from hypertension (p<0.0.002). and 2.4 times at risk to suffer from vision problems compared to subjects with no doctor diagnosed DM. This is consistent with findings of a previous study [43].

## Conclusion

The prevalence of DM among the Saudis in Jeddah City is high. Although DM is a common chronic health problem. yet a great proportion of the subjects with DM were discovered accidently. and the majority are not properly controlled. Appropriate actions should be taken to build up medical therapy and lifestyle management to overcome amendable risk factors for complications in order to reduce morbidity and mortality. Considering that the elderly. the obese. those with high blood pressure and those with positive family history of DM are at the highest risk of having prediabetes and DM. systematic healthcare interventions targeting these groups are recommended to reduce the burden of the disease. Additional studies employing social and behavioral paradigms are needed so that interventions with direct effects on relevant social and behavioral issues can be designed and implemented before the diabetes problem further increases in its scope and severity.

### Limitation

Though the study showed important findings of burden of DM. its risk factor. and management practice among Saudis. in Jeddah city. it has its own limitations. Firstly. the cross-sectional study design could not reveal the condition of the actual population. Secondly. the study participants were subjects visiting general places. and self-selection bias could not be ruled out and over-consideration of the actual prevalence of the DM. Therefore. it may be somewhat improper to generalize the findings of this study to the entire population of Jeddah city. Another limitation is the use of RBS testing to assess the hyperglycemia. because the participants were seen on one occasion only in the community. and other tests like fasting blood sugar test and post prandial glucose test were not feasible.

### Acknowledgment

The authors would like to thank all the data collectors. and participants. We also like to thank all who were involved in facilitating the research activities.

**Table 3. Distribution of subjects with DM according to duration of having the disease and method of control of DM**

| Variables | | Duration of Diabetes Mellitus | | | | | | Chi square | p-Value |
|---|---|---|---|---|---|---|---|---|---|
| | | < 10 years | | ≥ 10 years | | Total | | | |
| | | # | % | # | % | # | % | | |
| Diagnosis of DM | Due to symptoms | 38 | 63.3% | 15 | 35.7% | 53 | 52.0% | 9.637 | 0.022 |
| | accidently | 21 | 35.0% | 26 | 61.9% | 47 | 46.1% | | |
| Control of DM by diet | yes | 16 | 26.7% | 12 | 28.6% | 28 | 27.5% | .045 | 0.832 |
| | no | 44 | 73.3% | 30 | 71.4% | 74 | 72.5% | | |
| Control of DM by insulin | yes | 10 | 16.7% | 8 | 19.0% | 18 | 17.6% | .096 | 0.756 |
| | no | 50 | 83.3% | 34 | 81.0% | 84 | 82.4% | | |
| Control of DM by oral hypoglycemic agent | yes | 39 | 65.0% | 31 | 73.8% | 70 | 68.6% | 1.394 | 0.498 |
| | no | 21 | 35.0% | 11 | 26.2% | 32 | 31.4% | | |

**Table 4. Distribution of subjects with DM according to duration of having the disease and suffering from complications of DM**

| Complications of DM | | Duration of Diabetes Mellitus | | | | | | Chi square | p-Value |
|---|---|---|---|---|---|---|---|---|---|
| | | < 10 years | | ≥ 10 years | | Total | | | |
| | | # | % | # | % | # | % | | |
| Neuropathy | yes | 19 | 31.7% | 15 | 35.7% | 34 | 33.3% | .182 | 0.670 |
| | no | 41 | 68.3% | 27 | 64.3% | 68 | 66.7% | | |
| Nephropathy | yes | 9 | 15.0% | 8 | 19.0% | 17 | 16.7% | .960 | 0.619 |
| | no | 50 | 83.3% | 34 | 81.0% | 84 | 82.4% | | |
| Retinopathy | yes | 12 | 20.0% | 10 | 23.8% | 22 | 21.6% | .881 | 0.644 |
| | no | 47 | 78.3% | 32 | 76.2% | 79 | 77.5% | | |
| Vascular disease | yes | 4 | 6.7% | 0 | 0.0% | 4 | 3.9% | 2.914 | 0.088 |
| | no | 56 | 93.3% | 42 | 100.0% | 98 | 96.1% | | |

**Table 5. Distribution of subjects with DM according to duration of having the disease and treatment for diseases**

| Variable | Categories | B | Sig | Exp (B) | 95% CI for Exp (B) | |
|---|---|---|---|---|---|---|
| | | | | | Lower bound | Upper Bound |
| Intercept | | -4.474 | .000 | | | |
| Age groups | ≥ 40 years | 1.943 | .000 | 6.981 | 4.180 | 11.657 |
| Smoking | Smoker | -.047 | .852 | .954 | .580 | 1.568 |
| | Ex-smoker | .506 | .170 | 1.658 | .806 | 3.412 |
| Obesity | Body deficient | 1.055 | .196 | 2.872 | .580 | 14.215 |
| | Normal | 1.184 | .009 | 3.269 | 1.337 | 7.991 |
| | Grade I | .631 | .112 | 1.880 | .864 | 4.092 |
| | Grade II | .534 | .212 | 1.706 | .738 | 3.945 |
| | Grade III | -.102 | .827 | .903 | .361 | 2.259 |
| Family history | Heart disease | -.211 | .537 | .810 | .415 | 1.582 |
| Family history | Obesity | -.446 | .230 | .640 | .309 | 1.325 |
| Treatment for | Vision | .888 | .001 | 2.430 | 1.447 | 4.082 |
| Treatment for | Renal disease | -.153 | .577 | .858 | .502 | 1.469 |
| Treatment for | Neuritis | -.211 | .537 | .810 | .415 | 1.582 |
| Treatment for | Hypertension | 1.126 | .002 | 3.085 | 1.524 | 6.243 |
| Treatment for | Atherosclerosis | .273 | .504 | 1.314 | .589 | 2.933 |
| Treatment for | Angina | -1.150 | .173 | .317 | .061 | 1.655 |
| Treatment for | Foot ulcer | 2.311 | .018 | 10.080 | 1.490 | 68.206 |

**Table 6: Multinomial Logistic Regression for Having DM with some clinical variables**

| Variable | Categories | B | Sig | Exp (B) | 95% CI for Exp (B) | |
|---|---|---|---|---|---|---|
| | | | | | Lower bound | Upper Bound |
| Intercept | | -4.474 | .000 | | | |
| Age groups | ≥ 40 years | 1.943 | .000 | 6.981 | 4.180 | 11.657 |
| Smoking | Smoker | -.047 | .852 | .954 | .580 | 1.568 |
| | Ex-smoker | .506 | .170 | 1.658 | .806 | 3.412 |
| Obesity | Body deficient | 1.055 | .196 | 2.872 | .580 | 14.215 |
| | Normal | 1.184 | .009 | 3.269 | 1.337 | 7.991 |
| | Grade I | .631 | .112 | 1.880 | .864 | 4.092 |
| | Grade II | .534 | .212 | 1.706 | .738 | 3.945 |
| | Grade III | -.102 | .827 | .903 | .361 | 2.259 |
| Family history | Heart disease | -.211 | .537 | .810 | .415 | 1.582 |
| Family history | Obesity | -.446 | .230 | .640 | .309 | 1.325 |
| Treatment for | Vision | .888 | .001 | 2.430 | 1.447 | 4.082 |
| Treatment for | Renal disease | -.153 | .577 | .858 | .502 | 1.469 |
| Treatment for | Neuritis | -.211 | .537 | .810 | .415 | 1.582 |
| Treatment for | Hypertension | 1.126 | .002 | 3.085 | 1.524 | 6.243 |
| Treatment for | Atherosclerosis | .273 | .504 | 1.314 | .589 | 2.933 |
| Treatment for | Angina | -1.150 | .173 | .317 | .061 | 1.655 |
| Treatment for | Foot ulcer | 2.311 | .018 | 10.080 | 1.490 | 68.206 |

## References


[1] American Diabetes Association. Diagnosis and classification of diabetes mellitus. Diabetes Care. 2013; 36 Suppl 1: S67-74.

[2] American Diabetes Association. Diagnosis and classification of diabetes mellitus. Diabetes Care. 2014; 37 Suppl 1: S81-90.

[3] International Diabetes Federation. IDF Diabetes Atlas. 9th edn. Brussels. Belgium: 2019.

[4] International Diabetes Federation. IDF Diabetes Atlas. 8th edn. Brussels. Belgium: 2019.

[5] World Health Organization. Global Report on Diabetes. Geneva. 2016.

[6] Wild S. Roglic G. Green A. Sicree R. King H (2004). "Global prevalence of diabetes: Estimates for the year 2000 and projections for 2030". Diabetes Care 2004; 27 (5): 1047–53.

[7] Cornelis MC. Zaitlen N. Hu FB. Kraft P. Price AL. Genetic and environmental components of family history in type 2 diabetes. Hum Genet. 2015; 134: 259-67.

[8] Hu H. Sawhney M. Shi L. et al. A Systematic Review of the Direct Economic Burden of Type 2 Diabetes in China. Diabetes Ther. 2015; 6: 7-16.

[9] Li J. Gong YP. Li CL. Lu YH. Liu Y. Shao YH. Genetic basis of type 2 diabetes - recommendations based on meta-analysis. Eur Rev Med Pharmacol Sci. 2015; 19: 138-48.

[10] Babiker AM. Al Jurayyan NA. Al Jurayyan RN. Al Gadi I. Drop SL. The clinical pattern of diabetes insipidus in a large university hospital in the Middle East. J Trop Pediatr. 2015; 61: 100-5.

[11] Al-Herbish AS. El-Mouzan MI. Al-Salloum AA. Al-Qurachi MM. Al-Omar AA. Prevalence of type 1 diabetes mellitus in Saudi Arabian children and adolescents. Saudi Med J. 2008; 29: 1285-8.

[12] Aljohani NJ. Metabolic syndrome: Risk factors among adults in Kingdom of Saudi Arabia. J Family Community Med. 2014; 21: 170-5.

[13] Al-Rubeaan K. Abu El-Asrar AM. Youssef AM. et al. Diabetic retinopathy and its risk factors in a society with a type 2 diabetes epidemic: a Saudi National Diabetes Registry-based study. Acta Ophthalmol. 2015; 93: e140-7.

[14] World Health Organization. Chapter 1- Chronic diseases: causes and health impacts. Preventing Chronic Diseases: A Vital Investment. Geneva: World Health Organization; 2005. p. 34-58.

[15] Alzaid A. Diabetes: a tale of two cultures. Br J Diabetes Vasc Dis 2012; 12: 57.

[16] Al-Daghri NM. Al-Attas OS. Alokail MS. et al. Diabetes mellitus type 2 and other chronic non-communicable diseases in the central region. Saudi Arabia [Riyadh cohort 2]: a decade of an epidemic. BMC Med. 2011; 9: 76.

[17] Fatani HH. Mira SA. el-Zubier AG. Prevalence of diabetes mellitus in rural Saudi Arabia. Diabetes Care. 1987; 10: 180-3.

[18] Gillies CL. Abrams KR. Lambert PC. Cooper NJ. Sutton AJ. Hsu RT. et al. Pharmacological and lifestyle interventions to prevent or delay type 2 diabetes in people with impaired glucose tolerance: systematic review and meta-analysis. BMJ. 2007; 334: 299.

[19] Wilson A. Gyi AA. The status and perspective of diabetes health education in China: inspiration from Australia. Int J Nurs Pract. 2010; 16: 92-8.

[20] Alqurashi KA. Aljabri KS. Bokhari SA. Prevalence of diabetes mellitus in a Saudi community. Ann Saudi Med. 2011; 31: 19-23.

[21] Al-Nozha MM. Al-Maatouq MA. Al-Mazrou YY. et al. Diabetes mellitus in Saudi Arabia. Saudi Med J. 2004; 25: 1603-10.

[22] Al-Rubeaan K. Al-Manaa HA. Khoja TA. et al. Epidemiology of abnormal glucose metabolism in a country facing its epidemic: SAUDI-DM study. J Diabetes. 2014 Sep 30. doi: 10.1111/1753- 0407.12224.
[23] Faul F. Erdfelder E. Lang A-G. Buchner A. G*Power 3: A flexible statistical power analysis program for the social. behavioral. and biomedical sciences. Behavior Research Methods 2007; 39. 175-191.
[24] Cotes JE. Chinn DJ. Miller MR. Lung Function. 6th ed. Chester. United Kingdom:
Wiley-Blackwell 2006. ISBN13: 0632064939.
[25] Mozaffarian D. Marfisi R. Levantesi G. et al. Incidence of new-onset diabetes and impaired fasting glucose in patients with recent myocardial infarction and the effect of clinical and lifestyle risk factors. Lancet 2012; 370:667.
[26] Collins GS. Mallett S. Omar O. Yu LM. Developing risk prediction models for type 2 diabetes: a systematic review of methodology and reporting. BMC Med 2011; 9:103.
[27] Andersson DK. Lundblad E. Svärdsudd K. A model for early diagnosis of type 2 diabetes mellitus in primary health care. Diabet Med 2013; 10:167.
[28] Li Y. Xu W. Liao Z. Yao B. Chen X. Huang Z. et al. Induction of Long-term Glycemic Control in Newly Diagnosed Type 2 Diabetic Patients Is Associated With Improvement of β-Cell Function. Diabetes Care 2014; 27:2597.
[29] Ryan DH. Espeland MA. Foster GD. Haffner SM. Hubbard VS. Johnson KC; et al. Look AHEAD Research Group. Look AHEAD (Action for Health in Diabetes): design and methods for a clinical trial of weight loss for the prevention of cardiovascular disease in type 2 diabetes. Control Clin Trials. 2003 Oct;24(5):610-28. doi: 10.1016/s0197-2456(03)00064-3. PMID: 14500058.
[30] Knowler WC. Fowler SE. Hamman RF. Christophi CA. Hoffman HJ. Brenneman AT; et al. 10-year follow-up of diabetes incidence and weight loss in the diabetes prevention program outcomes study. Lancet. 2009;374:1677–1686.
[31] American Diabetes Association. Standards of medical care in diabetes-2014. Diabetes Care. 2013; 37 (1) : S14–S80.
[32] Eborall HC. Griffin SJ. Prevost AT. Kinmonth AL. French DP. Sutton S. Psychological impact of screening for type 2 diabetes: controlled trial and comparative study embedded in the ADDITION (Cambridge) randomized controlled trial. BMJ. 2007;335:486. doi: 10.1136/bmj.39303.723449.55.
[33] Tuomilehto J. Tuomilehto-Wolf E. Zimmet P. Alberti KG. Knowler WC. Primary prevention in diabetes mellitus. In: Alberti KG. Zimmet P. DeFronzo RA. Keen H (eds) International textbook of diabetes mellitus. 2nd edn. Wiley. Chichester. 1997 .
[34] Ivy JL. Zderic TW. Fogt DL. Prevention and treatment of non-insulin-dependent diabetes mellitus. Exerc Sport Sci Rev. 1999; 27 :1–3533
[35] Bray GA. Culbert IW. Champagne CM. Crow MD. Dawson L. Eberhardt B; et al. Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. N Engl J Med 2002; 346:393-403. DOI: 10.1056/NEJMoa012512N Engl J.
[36] American Diabetes Association. Classification and diagnosis of diabetes: standards of medical care in diabetes-2018. Diabetes Care. 2018; 41(Supplement 1): S13–S27. doi:10.2337/dc18-S002
[37] World Health Organization. Global report on diabetes: executive summary. World Health Organization. 2016. Available from: https://apps.who.int/iris/handle/10665/204874.
[38] International Diabetes Federation. IDF Diabetes Atlas. 8thed. Brussels. Belgium: International Diabetes Federation; 2017. Available from: http://www. idf.org/diabetesatlas.
[39] Zheng Y. Ley SH. Hu FB. Global aetiology and epidemiology of type 2 diabetes mellitus and its complications. Nat Rev Endocrinol. 2018;14(2):88–98. doi:10.1038/nrendo.2017.151
[40] Goyal A. Gupta Y. Singla R. Kalra S. Tandon N. American diabetes association disclosures: standards of medical care in diabetes-2020. Diabetes Care. 2020;3(supplement1):S1–S212. [Google Scholar]
[41] Ozougwu JC. Obimba KC. Belonwu CD. et al. The pathogenesis and pathophysiology of type 1 and type 2 diabetes mellitus. J Physiol Pathophysiol. 2013;4(4):46–57. doi:10.5897/JPAP2013.0001
[42] Chawla A. Chawla R. Jaggi S. Microvascular and macrovascular complications in diabetes mellitus: distinct or continuum? Indian J Endocrinol Metab. 2016;20(4):546. doi:10.4103/2230-8210.183480
[43] Zenebe Negash1 and Malede Yismaw1. Management Practice and Contributing Risk Factors for Chronic Complications Among Type 2 Diabetes Mellitus Adult Patients in Follow-Up at a Tertiary Care Teaching Hospital. Diabetes Metab Syndr Obes. 2020; 13: 3969–3976. doi: 10.2147/DMSO.S275677