Khlid Al et al., Prim Health Care 2017, 7:2
DOI: 10.4172/2167-1079.1000270

Primary Health Care: Open Access

Research Article OMICS International

# Risk Factors Associated with Diabetes Mellitus in a Saudi Community: A Cross-Sectional Study

**Khlid Al A[1], Abbas Al M[2*] and Nisha S**

[1]Department of Respiratory therapy, Inaya Medical College, Riyadh, Saudi Arabia
[2]Department of Nursing, Inaya Medical College, Riyadh, Saudi Arabia.

## Abstract

**Background:** According to World Health Organization (WHO) statistics almost seven million of the Saudi population are diabetic and three million are pre-diabetic. The risk of developing diabetes increases with some risk factors including family history, age, obesity and lack of physical activity. It is highly significant to allocate resources to quantify the prevalence of diabetes through preforming an assessment of the blood glucose level of the target population. Therefore, we designed this study to determine the association between certain demographic and clinical variables and random blood sugar among Saudi population.

**Methods:** Cross-sectional design using survey was used to recruit subjects from business location in the capital city of Riyadh. A total of 144 subjects were recruited using Simple random sampling technique. Information gathered included age, gender, family history, history of gestational diabetes, hypertension, level of physical activity, body mass index (BMI) and results of random blood sugar (RBS).

**Results:** The study provided information about the association between certain demographic and clinical variables and Random Blood Sugar among Saudi population. The age and physical activity were significantly associated with high blood sugar level. Also, females who were diagnosed with Gestational Diabetes Mellitus (GDM) demonstrated a high score of RBS and therefore are at high risk for type 2 Diabetes Mellitus (DM).

**Conclusion:** In conclusion, this study revealed that there is a significant association between certain demographic and clinical variables and Random Blood Sugar among Saudi population. A prevention program at the level of the community should be initiated targeting those risk factor groups to prevent diabetes mellitus. Also, further studies to modify the risk factors are highly recommended to control and reduce the DM prevalence in Saudi Arabian population.

**Keywords:** Diabetes mellitus; Gestational diabetes; Risk factors; Prevalence Saudi Arabia

## Introduction

Diabetes mellitus is one of the largest global health emergencies of the 21st century and a major public health problem in Saudi Arabia in parallel with the worldwide diabetes pandemic. The adoption of a modern lifestyle is a predisposing factor to this emerging pandemic. The indigenous Saudi population seems to have a special genetic predisposition to develop type 2 DM, which is further amplified by a rise in obesity rates, and the presence of other variables of the insulin resistance syndrome. [1].

As per the statistics of World Health Organization (WHO) Saudi Arabia ranks seventh in the world for the diabetes rates. Approximately seven million of the population in Saudi Arabia is diabetic and around 3 million are pre-diabetic. Indeed, diabetes has approximately shown a ten-fold increase among Saudi population in the past three eras. [2]. DM is irreversible once established. Diabetes develops slowly but progresses from pre-diabetes to diabetes without proper treatment. [3]. As time progresses more and more people live with diabetes, which leads to serious life-changing complications. In addition to the 415 million adults who are estimated to currently have diabetes, there are 318 million adults with impaired glucose tolerance, which puts them at high risk of developing the disease in the future. It has been estimated that two out of five adults with diabetes are undiagnosed in the Middle East [4]. The risk of developing type 2 diabetes increases with family history, age, obesity and lack of physical activity. Besides members of certain racial/ethnic groups, women with prior GDM and individuals with impaired glucose tolerance (IGT) or impaired fasting glucose (IFG) are prone to develop diabetes as well.

Diabetes mellitus is known to affect quite a few body systems and thereby affect the individual's health in different ways such as having coronary artery disease (CAD), renal failure, diabetic retinopathy, etc. Therefore, many countries attempted to study the consequences of diabetes on the population. However, it is interesting to note that the prevalence of DM is extremely variable among different populations though it increases with aging. The urban areas of Saudi Arabia have high prevalence of DM, owing to changes in the lifestyles of people particularly over the past few decades. [5]. A study conducted in rural areas of Saudi Arabia showed that there was an escalation of prevalence with age and higher-income groups with an overall prevalence in women as twice as that for men. The blood glucose was significantly affected by the factors such as age, income and BMI [6]. An investigation on the prevalence and associated factors for glucose intolerance among Saudi populations in urban and rural communities revealed that the measurement of mean random plasma glucose (RPG) from the urban population was considerably higher than that of the rural population. The world's highest age adjusted prevalence of DM was found in the urban population of Saudi Arabia [7].

In nutshell, the modernization and resultant shift in lifestyle to more sedentary activity with higher-fat diets and obesity are the causes of the increased prevalence of diabetes mellitus in the Saudi community. Rational planning and allocation of resources would be effective with the quantification of prevalence of DM among the Saudi population

***Corresponding author:** Dr. Abbas Al M ,Department of Nursing, Inaya Medical College, Riyadh, Saudi Arabia.Tel:0555877487; E-mail: aalmutair@inaya.edu.sa

**Received** May 13, 2017; **Accepted** June 22, 2017; **Published** June 29, 2017

**Citation:** Khlid Al A, Abbas Al M, Nisha S (2017) Risk Factors Associated with Diabetes Mellitus in a Saudi Community: A Cross-Sectional Study. Prim Health Care 7: 270. doi: 10.4172/2167-1079.1000270

[8]. Type 2 DM is diagnosed by analyzing an elevated blood glucose concentration. Therefore, it is essential to perform an assessment with blood glucose determination in the target population in order to determine the prevalence of type 2 DM. Considering this, the main objective of our study was to determine the prevalence of type 2 DM in a representative sample among the visitors of a business location in Riyadh. Furthermore, we also intended to identify the risk factors associated with the development of diabetes mellitus.

## Materials and Methods

Subjects were recruited from the visitors of a business location in Riyadh. A total of 144 subjects were selected using simple random sampling technique. Information gathered include demographic factors such as age, gender, family history, history of gestational diabetes, hypertension, level of physical activity, Body Mass Index (BMI) and results of Random Blood Sugar (Tables 1 and 2). The exclusion criteria included subjects with other chronic diseases such as hypertension, renal and liver diseases and infectious diseases. Visitors with chronic and infectious diseases were directed to visit a medical center to do further medical investigations. Incompletely filled questionnaires also were removed resulting in a total sample size to n=144.

SPSS software, version 23 (SPSS Inc., Chicago, Illinois, USA) was used for data entry and analysis. The data were presented as scores using a predefined scoring system for each variable. The main outcome was resting blood sugar level, which was calculated on a continuous scale. The Pearson correlation test was used to infer any significant correlation between demographic, clinical variables and main outcome. On the other hand, for analysis of the association between the studied variables and the outcome, generalized linear model (GLM) was used. All analyses were carried out at a significance level of 0.05.

## Results

Two variables, specifically age of the participants and physical activity, were significantly associated with the outcome (P=0.027, P=0.03, respectively) (Table 3). Significant associations in the analysis were used in a generalized linear model to determine the independent factors associated with high RBS levels. The final model showed that being 50 years or older and with no physical activity will increase the risk of having a higher score of RBS, hence will be at high risk of type 2 diabetes. On the other hand, after adjusting for gender, female who were diagnosed with gestational diabetes increase the risk of higher score of RBS and therefore a higher risk of type 2 DM.

After Combining the variable scores for each participant, a linear regression model was used to interpret any association between the total score and final resting blood sugar level (Table 4). Our model revealed a significant association between the total score and RBS (P=0.007). Moreover, using this model, we can conclude that that for each added one unit score unit and increase of 8.437 in resting blood sugar level was recorded (P=0.007). Therefore, increase in the total score of the submitted survey is associated with a higher risk of type 2 DM (Figures 1-3).

## Discussion

This cross-sectional survey provides information about the association between certain demographic and clinical variables and Random Blood Sugar among Saudi population. In the results, age of the participants and physical activity were significantly associated with the Random Blood Sugar level RBS (p=0.027, p=0.03, respectively). This confirms a study conducted in rural Saudi Arabia to assess the prevalence of diabetes mellitus. It is also in congruent with a study examining the longitudinal relation among physical activity, BMI and development of type 2 DM in a high risk population [9].

In fact, there were several studies which showed that a physically active lifestyle results in lower incidence of diabetes mellitus. A study conducted among 5990 male alumni of University of Pennsylvania revealed that the leisure time physical activity such as walking, stair climbing, sports etc. are inversely related to the development of type 2 DM. It is not only effective in preventing the type 2 DM but also provides a pronounced protective effect among persons who are at high risk for

| Parameter Estimates | | | | | | | |
|---|---|---|---|---|---|---|---|
| Parameter | B | Std. Error | 95% Wald Confidence Interval | | Hypothesis Test | | |
| | | | Lower | Upper | Wald Chi-Square | df | Sig |
| (Intercept) | 243.682 | 115.8177 | 16.683 | 470.680 | 4.427 | 1 | 0.035 |
| [Age=0] | 0.705 | 106.6664 | -208.358 | 209.767 | 0.000 | 1 | 0.995 |
| [Age=1] | 26.750 | 114.7790 | -198.213 | 251.713 | 0.054 | 1 | 0.816 |
| [Age=2] | 265.773 | 119.8827 | 30.807 | 500.739 | 4.915 | 1 | 0.027 |
| [Age=3] | 0[a] | | | | | | |
| [Physically Active=0] | -158.682 | 53.6132 | -263.762 | -53.602 | 8.760 | 1 | 0.003 |
| [Physically Active=1] | 0[a] | | | | | | |
| (Scale) | 10539.366[b] | 3042.4530 | 5985.408 | 18558.173 | | | |
| Dependent Variable: RBS<br>Model: (Intercept), Age, Physically Active | | | | | | | |
| a. Set to zero because this parameter is redundant | | | | | | | |
| b. Maximum likelihood estimate | | | | | | | |

**Table 1:** Model 1.

| Coefficients[a] | | | | | | |
|---|---|---|---|---|---|---|
| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
| | | B | Std. Error | Beta | | |
| 1 | (Constant) | 75.311 | 17.742 | | 4.245 | 0.000 |
| | T_score | 8.437 | 3.070 | 0.230 | 2.749 | 0.007 |
| a. Dependent Variable: RBS | | | | | | |

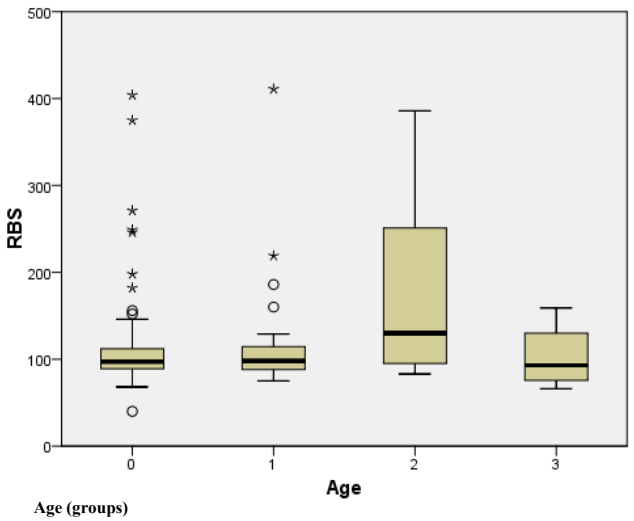
**Table 2:** Model 2.

| Variable | Score | Frequency (%) |
|---|---|---|
| **Age (groups)** | Less than 40 years | 95 (65.5) |
| | 40-49 years | 27 (18.6) |
| | 50-59 years | 18 (12.4) |
| | 60 years older | 4 (2.8) |
| | | |
| **Gender** | Male | 31 (21.4) |
| | Female | 113 (77.9) |
| | | |
| **Gestational Diabetes** | Yes | 20 (13.8) |
| | No | 11 (7.6) |
| | | |
| **Family History** | Yes | 52 (35.9) |
| | No | 92 (62.1) |
| | | |
| **Hypertension Diagnosis** | Yes | 117 (80.7) |
| | No | 19 (13.1) |
| | | |
| **Physically Active** | Yes | 67 (46.2) |
| | No | 70 (48.3) |
| | | |
| **BMI** | BMI less than 18.50 | 10 (6.9) |
| | BMI 18.50-24.99 | 33 (22.8) |
| | BMI 25:00-29.99 | 57 (39.3) |
| | BMI 30 or more | 43 (29.7) |

**Table 3:** Sociodemographic data.

| | |
|---|---|
| **Mean** | 121.56 |
| **Std. Deviation** | 67.42 |

**Table 4:** RBS descriptive statistics.




**Age (groups)**

| | |
|---|---|
| 0 | Less than 40 years |
| 1 | 40-49 years |
| 2 | 50-59 years |
| 3 | 60 years older |

**Figure 1:** From the histogram above, we can observe that the data is skewed to the left. As the RBS scores are not normally distributed as shown, we can explain this by the fact of our small sample size.

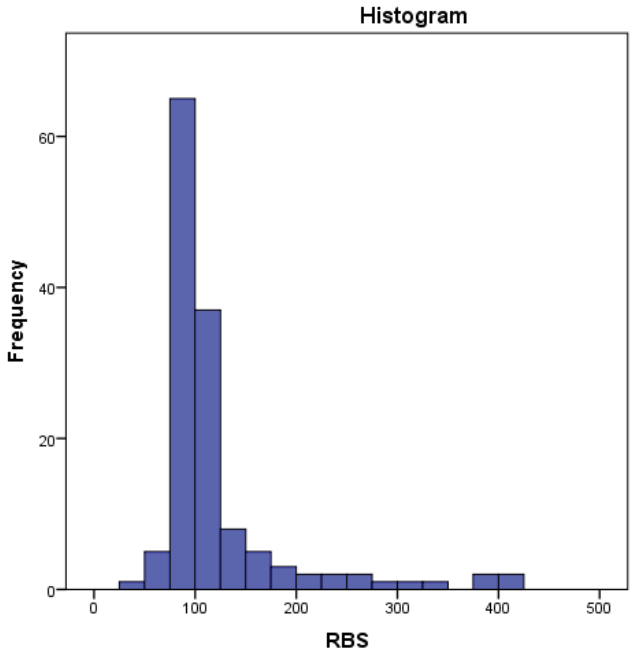
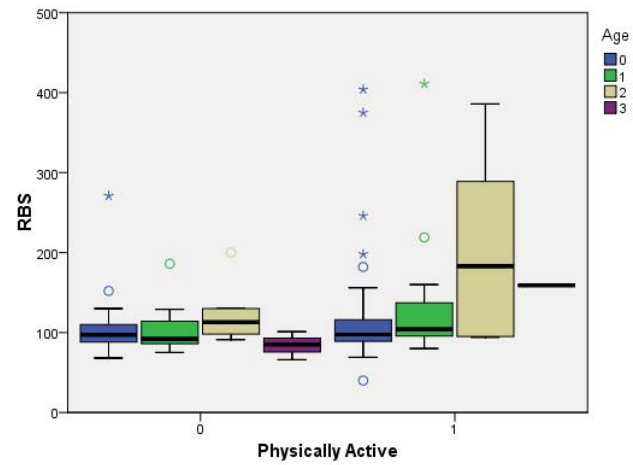



**Figure 2:** A boxplot representing the age and physically active variables in relation with RBS scores. It can be clearly noticed that older participants with no physical activity are at higher risk of increase in their RBS score, hence higher risk of type 2 DM (RBS 0-500 mg/dL).




**Physically Active**

| | |
|---|---|
| 1 | Yes |
| 2 | No |

**Figure 3:** A line graph representing the increase in mean RBS score as the total score of the survey participants' increase. A steep increase is noticed beyond the total score of 8, which is explained by our previous regression analysis. As most probably, participants who recorded more than 8 in their total scores are from older age groups.

the disease [10]. A prospective cohort study including 5 years follow-up among US male physicians yielded similar results. Apparently, even after adjusting for BMI, the development of type 2 DM was reduced by exercise. It also identified the increased physical activity as a primary prevention strategy for type 2 DM [11]. Comparable findings were observed between regular vigorous exercise and incidence of type 2

DM in a prospective cohort study including 87253 US women aged between 34-59 years, even after doing multivariate adjustments for age, BMI, etc., the reduced risk for type 2 DM found with exercise was not altered [12]. A review of literature about physical inactivity among the population of Saudi Arabia exposed a high prevalence (43.3%-99.5%) of physical inactivity among Saudi children and adults. Additionally, the Saudi population is at high risk for coronary heart disease due to physical inactivity owing to major life style changes in recent years [13].

The results of the present study are very much consistent with the abovementioned prospective studies. However, diabetes was diagnosed by measuring Random Blood Glucose level in the present study, whereas subjective reporting was used in some of the previous studies. Precisely, the incidence of diabetes increases with decreased physical activity in higher age group.

1-3% of all pregnant women develop Gestational Diabetes Mellitus (GDM). Pregnancy induced insulin resistance coupled with decreased production of insulin are considered as the primary causes of GDM. A systematic review on patients with type 2 DM with a history of GDM, reported that once diagnosed with GDM, the progression to type 2 DM was at more similar rates, there was a marked rise of cumulative incidence in the first 5 years and followed by a slow rise after 10 years [14]. The prevalence of postpartum diabetes is found in women with the diagnosis of GDM at less than 24 weeks of gestation [15]. Even non obese glucose tolerant women with a history of GDM were showing a metabolic profile of type 2 DM [16].

The results of the current study are in congruent with the above findings. The females who were diagnosed with GDM, demonstrated a high score of RBS and therefore are at high risk for type 2 DM

A cross-sectional study conducted among adults in Bangladesh revealed that older age, higher socioeconomic status, hypertension and obesity are significantly correlated to the development of type 2 DM [17]. Likewise, a cross-sectional epidemiological study conducted in Greece showed that the prevalence of type 2 DM increased significantly with older age ($p<0.001$) [18]. Similarly, the prevalence of diabetes in the adult population of US between 40-74 years of age is increasing [19]. A household survey conducted in Saudi Arabia showed a significant increase in the prevalence of type 1 DM, type 2 DM and Impaired Glucose Tolerance in the age group >30 years and a slight decrease in the incidence of type 1 DM among those over the age of 60 years .It also shed light to the fact that Saudi Arabia is one among the countries that have a high prevalence for DM and a moderate risk for Impaired Glucose Tolerance [20].

The prevalence of diabetes mellitus was found to increase with age in the Al Kharj area of Saudi Arabia as 23% of the diabetic patients belonged to the age group more than 65 years whereas, only 0.3% remained in the age group below 24 years. [21].

## Conclusion

The findings of the present study also showed that being 50 years or older with less physical activity will increase the risk of having high score of RBS, hence will be at high risk for type 2 DM.

In summary, the current study reemphasize the need for devising a nationwide awareness program about a lifestyle modification including increased physical activity (30-45 min/day), weight reduction, improved eating habits as well as early detection of diabetes. Being health care providers in Saudi Arabia, we have the responsibility for an immediate action to save the country from this alarming condition before it exceeds the capacity of adjustment. A large prospective study is recommended to assess the effectiveness of a lifestyle modification program on the reduction of prevalence of type 2 DM among Saudi population.

## References

1. Elhadd TA, Al-Amoudi AA, Alzahrani AS (2007) Epidemiology, clinical and complications profile of diabetes in Saudi Arabia: A review. Ann Saudi Med 27: 241-250.
2. Abdulaziz Al, Dawish M, Alwin Robert A, Braham R, Abdallah Al Hayek A, et al. (2016) Diabetes mellitus in Saudi Arabia: a review of the recent literature. Curr Diabetes Rev 12: 359-368.
3. Guariguata L, Nolan T, Beagley J (2014) International Diabetes Federation. IDF Diabetes Atlas.
4. Lindström J, Peltonen M, Eriksson JG, Ilanne-Parikka P, Aunola S, et al. (2013) Improved lifestyle and decreased diabetes risk over 13 years: long-term follow-up of the randomised Finnish Diabetes Prevention Study (DPS). Diabetologia 56: 284-293.
5. Al-Nozha MM, Al-Maatouq MA, Al-Mazrou YY, Al-Harthi SS (2004) Diabetes mellitus in Saudi Arabia. Saudi Med J 25: 1603-1610.
6. Fatani HH, Mira SA, El-Zubier AG (1987) Prevalence of diabetes mellitus in rural Saudi Arabia. Diabetes Care 10: 180-183.
7. Al Nuaim AR (1997) Prevalence of glucose intolerance in urban and rural communities in Saudi Arabia. Diabet Med 14: 595-602.
8. Alqurashi K, Aljabri K, Bokhari S (2011) Prevalence of diabetes mellitus in a Saudi community. Ann Saudi Med 31: 19-23.
9. Kriska AM, Saremi A, Hanson RL, Bennett PH, Kobes S, et al. (2003) Physical activity, obesity and the incidence of type 2 diabetes in a high-risk population. Am J Epidemiol 158: 669-675.
10. Helmrich SP, Ragland DR, Leung RW, Paffenbarger Jr RS (1991) Physical activity and reduced occurrence of non-insulin-dependent diabetes mellitus. N Engl J Med 325: 147-152.
11. Manson JE, Nathan DM, Krolewski AS, Stampfer MJ, Willett WC, et al. (1992) A prospective study of exercise and incidence of diabetes among US male physicians. JAMA 268: 63-67.
12. Manson JE, Stampfer MJ, Colditz GA, Willett WC, Rosner B, et al. (1991) Physical activity and incidence of non-insulin-dependent diabetes mellitus in women. The Lancet 338: 774-778.
13. Al-Hazzaa H (2004) Prevalence of physical inactivity in Saudi Arabia: A brief review. East Mediterr Health J 10: 663-670.
14. Kim C, Newton KM, Knopp RH (2002) Gestational diabetes and the incidence of type 2 diabetes. Diabetes Care 25: 1862-1868.
15. Kjos SL, Buchanan TA, Greenspoon JS, Montoro M, Bernstein GS, et al. (1990) Gestational diabetes mellitus: The prevalence of glucose intolerance and diabetes mellitus in the first two months post-partum. Am J Obstet Gynecol 163: 93-98.
16. Damm P (1998) Gestational diabetes mellitus and subsequent development of overt diabetes mellitus. Dan Med Bull 45: 495-509.
17. Chowdhury MAB, Uddin MJ, Khan HM, Haque MR (2015) Type 2 diabetes and its correlates among adults in Bangladesh: A population based study. BMC public health 15: 1070.
18. Tentolouris N, Andrianakos A, Karanikolas G, Karamitsos D, Trontzas P, et al. (2012) Type 2 diabetes mellitus is associated with obesity, smoking and low socioeconomic status in large and representative samples of rural, urban and suburban adult Greek populations. Hormones (Athens) 11: 458-467.
19. Harris MI, Flegal KM, Cowie CC, Eberhardt MS, Goldstein DE, et al. (1998) Prevalence of diabetes, impaired fasting glucose and impaired glucose tolerance in US adults: The Third National Health and Nutrition Examination Survey, 1988-1994. Diabetes care 21: 518-524.
20. Bacchus RA, Bell JL, Madkour M, Kilshaw B (1982) The prevalence of diabetes mellitus in male Saudi Arabs. Diabetologia 23: 330-332.
21. El-Hazmi M, Warsy A, Al-Swailem A, Al-Swailem A, Sulaimani R, et al. (1996) Diabetes mellitus and impaired glucose tolerance in Saudi Arabia. Ann Saudi Med 16: 381-385.

This article was originally published in a special issue, **Universal Health Coverage** handled by Editor(s). Saurabh RamBihariLal Shrivastava, Department of Community Medicine, Shri Sathya Sai Medical College & Research Institute, India