

Type 2 diabetes mellitus risk assessment among Alrass city employees, Qassim, Saudi Arabia

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ABSTRACT

Background: Diabetes mellitus (DM) is a serious chronic disease that can affect all parts of human body and associated with short-term and long-term complications such as retinopathy, nephropathy, and neuropathy. Age, obesity, family history, and hypertension are considered to be the most common risk factors for the incidence of DM. This study aimed to assess the risk of type 2 diabetes among governmental employee in Alrass city in Qassim, Saudi Arabia. **Material and Methods:** A cross-sectional survey was done using health professional-administrated questionnaire. Two groups of data collectors were formed and trained to fill out the questionnaire, each group was consist of 1 family medicine doctor and 4 nurses. Data were entered and analyzed using SPSS v. 26. **Results:** A total of 527 subjects participated in our study with a response rate of 100%. Of them, more than half (55%) were females. Approximately all of our participants were Saudi 92% regarding age, more than three quarters (79.5%) were aged less than 45 years, 15.6% were ranged from 45 to 50 years, and 4.9% were from 55 to 64 years. We reported no significant correlation between gender and nationality regarding the risk of DM. **Conclusion:** Saudi females who aged less than 45 years and obese participants had a risk for developing DM.

Keywords: Body mass index, diabetes mellitus, risk factors, Saudi Arabia

Introduction

Diabetes mellitus (DM) is a major public health problem and associated with multiple risk factors such as unhealthy diet, obesity, physical inactivity, cardiovascular diseases, and family history. Most of these risk factors are modifiable and could be prevented by intervention programs.^[1] As per the World Health Organization (WHO), in 2014, the global prevalence of diabetes was 8.4% and total number of people with diabetes was 422 millions. More specifically, Eastern Mediterranean Region has the highest prevalence of DM, 13.7%, compared to other regions of the world. Saudi Arabia, on of the Eastern Mediterranean

Region countries, has been ranked as the second highest in the prevalence of DM in this region.^[2]

The chronic hyperglycemia of diabetes is linking to long-term damage, dysfunction, and failure of different organs, like eyes, kidneys, nerves, heart, and blood vessels.^[3] DM are divided into 2 forms, the first caused by no insulin secretion, as a result of β -cells damage of the pancreas (type 1 DM), and the other that are a result of insulin resistance that occurs at the level of skeletal muscles, liver, and adipose tissue, with different degrees of β -cells damage (type 2 DM [T2DM]).^[4] The commonness of type 2 diabetes is increasing internationally and speaks to an overwhelming weight on public health and socioeconomic development of all countries. Type 2 diabetes is a multifactorial disease and because of a blend of environmental and hereditary hazard factors (numerous environmental hazard factors add to the pathogenesis of type 2 diabetes, including lifestyles such as sedentary behavior, diet, smoking, and liquor utilization,

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inner environmental factors such as incendiary variables, adipocytokines, and hepatocyte factors, outside environmental factors such as environmental endocrine disruptors).^[5]

As per national health information survey, in 2013, the total prevalence of diabetes and prediabetes among adults aged more than 18 years has been estimated to be 13.4% and 16%, respectively, and nearly half of people with diabetes are undiagnosed. Furthermore, the survey has shown that around 60% either obese or overweight and physically inactive and only 7% consume daily adequate amount, ≥ 5 servings, of vegetables and fruits.^[6]

A study done in Saudi Arabia estimated the current direct cost of diabetes is 4.5 billion dollars and the future cost will rise to 7.2 billion dollars when undiagnosed and prediabetic patients convert to diabetic status.^[7] In fact, the economic weight of diabetes is anticipated to be higher as a result of the roundabout cost of diabetes like lost efficiency because of comorbidity or early mortality and social cost are not evaluated.^[8]

Prediabetes patients and people at high risk for T2DM are recommended to have lifestyle intervention program to delay or prevent the onset of T2DM. The effectiveness of the intervention program has been proven in several studies. It can decrease the incidence of type 2 diabetes by 58% and 43% for 3 years and 20 years of follow-up. The main objectives of lifestyle intervention program are increasing physical activity, reducing abnormal body weight and promoting healthy diet.^[9]

This study aimed to assess the risk of type 2 diabetes among governmental employee in Alrass city in Saudi Arabia.

Material and Methods

Study setting: This study has been conducted in governmental institutions in Arrass city, Kingdom of Saudi Arabia in which systematic random sampling technique has been used to select the institutions, whereas convenience sampling method has been used to select the participants within these institutions. The study was approved from Regional and National Research Ethics Committee, KSA, [H-04-Q-001] ON 27/3/217.

Study tool: The instruments of the study were weight and height scale, waist tap measure, and validated scored questionnaire. The inclusion criteria are nonpreviously diagnosed as a diabetic patient, more than 20 years of age, and all employees who are available during conducting the study. Therefore, those who are on leave during sample collection or unwillingness to participate in the study were excluded from the study.

Study design: The study design of the current research was a cross-sectional survey using health professional-administrated questionnaire. This validated questionnaire was developed by International Diabetes Federation and known as The Finnish Diabetes Risk Score “FINDRISC”. It consists of multiple

questions about personal and social data, anthropometric measurement, lifestyle, family history of DM, and past history of hyperglycemia, hypertension, or polycystic ovarian syndrome “PCOS”. The questionnaire was in English language and back translated to Arabic by 2 expert Arabic native speakers.

The total number of governmental employee is estimated to be about 15,000. As per national health survey in 2013, the total prevalence of DM was 13.4%.^[6] Considering confidence interval (99.9%), margin of error 5, and design effect 1. Using openepi epidemiologic calculator, the estimated sample size was 487 and adjusted to 527.

Data collection

Two groups of data collectors were formed and trained to fill out the questionnaire, each group consist of one family medicine doctor and 4 nurses. Data have been entered and analyzed using SPSS v. 27. Data coding and entry were carried out by a trained person. The variables numbering follows the questions numbers on the questionnaire. Another person has been assigned to check the entered data for completeness and accuracy.

Data Analysis

All variables are described using frequencies and percentages as they are categorized. Proportions were compared using Chi-square test and P value $< .05$ was considered for statistical significance.

Results

A total of 527 subjects participated in our study with a response rate of 100%. Of them, more than half (55%) were females. Approximately all of our participants were Saudi 92% regarding age, more than three quarters (79.5%) were less than 45 years, 15.6% were ranged from 45 to 50 years, and 4.9% were from 55 to 64 years. Also, only 34.5% had normal weight (body mass index [BMI] < 25), while 39.1% and 26.4% were overweight (BMI 25-30) and (BMI > 30) obese. Forty point two percent had normal waist circumference, while 59.8% had waist circumference more than normal where, 32.4% were 94-102 cm M, 80-88 cm F, and 27.3 were > 102 cm M, 88 cm F. Furthermore, more than half (54.6%) were physically inactive and about three quarters of them (76.5%) did not consume the daily requirement of vegetables and fruits. From all participants, only 5.3% and 8.5% had diagnosed with hypertension and hyperglycemia. In regards to the family history of DM, more than half (56%) of participants had first-degree relatives with DM and 23.3% had second-degree relatives with DM. 21.4% of all female were suspected to have a poly cystic ovarian syndrome (PCOS). Finally, more than one-third (36.3%) had moderate, high, or very high risk to develop T2DM within 10 years [Table 1].

Gender as a risk factor for diabetes mellitus

The statistical analysis showed that regarding the gender as a risk factor for DM, 16% of male participants had a high and very

Table 1: Descriptive statistics of demographic characteristics of participants

	Description (n=527)
Gender	
Male	237 (45)
Female	290 (55)
Nationality	
Saudi	485 (92)
Non-Saudi	42 (8)
Age	
<45 years	419 (79.5)
45-54 years	82 (15.6)
55-64 years	26 (4.9)
BMI	
<25 kg/m ²	182 (34.5)
25-30 kg/m ²	206 (39.1)
>30 kg/m ²	139 (26.4)
Waist	
<94 cm M, 80 cm F	212 (40.2)
94-102 cm M, 80-88 cm F	171 (32.4)
>102 cm M, 88 cm F	144 (27.3)
Physical Activity	
Yes	239 (45.4)
No	288 (54.6)
Vegetables & Fruits daily consumption	
Yes	124 (23.5)
No	403 (76.5)
Hypertension	
No	499 (94.7)
Yes	28 (5.3)
Hyperglycemia	
No	482 (91.5)
Yes	45 (8.5)
The family history of diabetes	
No	109 (20.7)
Yes, second degree	123 (23.3)
Yes, first degree	295 (56)
Polycystic Ovarian Syndrome	
No	228 (78.6)
Yes	62 (21.4)
Risk Level of DM	
Very low	139 (26.4)
Low	197 (37.4)
Moderate	112 (21.3)
High	75 (14.2)
Very High	4 (0.8)
Risk Level of DM	
High + V. high	79 (15)
V. low + Low + moderate	448 (85)

high risk for developing DM, while it was 14.1% among female participants while most of the participants had low and moderate risk; 84% among males and 85.5% among females. There was no significant correlation between gender and the risk of DM.

Nationality as a risk factor for diabetes mellitus

Table 3 showed that regarding the nationality as a risk factor for DM, 15.3% of Saudi participants had a high and very high

risk for developing DM, while it was 11.9% among non-Saudi participants while most of the participants had low and moderate risk; 84.7% among Saudi and 88.1% among females. No significant correlation between nationality and the risk of DM has been reported [Table 2].

Discussion

It has been found that Saudi females who are aged less than 45 years, over-weight, with normal waist, did not perform physical activity, did not consume fruits and vegetables daily, had not diagnosed with hypertension and hyperglycemia, first-degree relatives, and had not PCOS were risk factors associated with T2DM in adult Saudi patients.

Regarding the nonmodifiable risk factors of DM including age, gender, and genetics, our findings that diabetic patients were more likely to be less than 45 years old, this results mismatched with a similar study conducted by Murad *et al.*,^[10] in Jeddah which reported that the prevalence of diabetes was higher among participants who are aged more than 40 years and also disagreed with previous studies,^[11-13] it was reported that the prevalence of diabetes was higher in patients aged 45–64 years, while regarding genetics, in our study, the first-degree relatives family history of diabetes are risk factors for developing DM similar to those reported earlier in the literature.^[10-13] Regarding gender, compatible with our finding, the authors^[11-13] reported that diabetes was predominant in women. However, our results are contrary to those of other authors who also reported diabetes to be more frequent in men.^[10,14-17] It is plausible that the variation in the incidence of diabetes between men and women are because nondiabetic men are generally more insulin-resistant than women.^[18]

It has been showed that overweight and obese patients whose BMI was more than 25 kg/m² associated with diabetes, which might be because obesity enhances insulin resistance. Similar to our findings, previous studies,^[10,19,20] including two studies conducted on Saudi patients,^[10,20] also showed a direct relationship between BMI and diabetes. The elevated prevalence of DM in the Saudi population has been linked to obesity, which is a consequence of major sociocultural and lifestyle changes. The promotion of fast foods, changes in the traditional Saudi diet, both in quantity and quality, and physical inactivity are as a result of urbanization.^[21] Hence, similar to other authors,^[22] it is proposed that weight reduction and weight gain prevention as measures to control the rising prevalence of DM. This is important because adult-onset diabetes, in addition to being linked to high BMI in men, is also associated with the duration of weight gain.

Unexpectedly, our results showed that approximately all of participants did not suffer from hypertension, contrary Murad *et al.*^[10] estimated an increased prevalence of hypertension in diabetic persons is similar to those reported in other studies.^[21,23,24] It has been shown that although both diabetes and hypertension occur independently, they are known to exacerbate each other.^[24]

Table 2: Comparison of the risk level of DM regarding gender

	Gender		P*
	Male	Female	
Risk Level of DM			
Very low	56 (23.6)	83 (28.6)	0.196
Low	92 (38.8)	105 (36.2)	0.538
Moderate	51 (21.5)	61 (21)	0.892
High	37 (15.6)	38 (13.1)	0.412
Very High	1 (0.4)	3 (1)	0.631
Risk Level of DM			
High + Very high	38 (16)	41 (14.1)	0.544
Low + moderate	199 (84)	249 (85.9)	

*Chi-square test

Table 3: Comparison of the risk level of DM regarding nationality

	Nationality		P*
	Saudi	Non-Saudi	
Risk Level of DM			
Very low	131 (27)	8 (19)	0.261
Low	178 (36.7)	19 (45.2)	0.273
Moderate	102 (21)	10 (23.8)	0.673
High	71 (14.6)	4 (9.5)	0.363
Very High	3 (0.6)	1 (2.4)	0.283
Risk Level of DM			
High + Very high	74 (15.3)	5 (11.9)	0.559
Low + moderate	411 (84.7)	37 (88.1)	

*Chi-square test

Regarding fruits and vegetable intake in diabetic patients, the 2005 dietary guidelines for Americans recommended consuming 2 cups of fruit and 2.5 cups of vegetables per day for a reference 2,000-calorie intake, with higher or lower amounts depending on the calorie level.^[25] Furthermore, they supposed selecting from all five vegetable subgroups (dark green, legumes, orange, starchy vegetables, and other vegetables) many times a week. However, the 2005 dietary guidelines, the 2010 guidelines did not recommend precise amounts of vegetables and fruits that should be consumed; instead, they state that Americans should “increase fruit and vegetable intake,” specifically by allowing half of one’s plate to consist of vegetables and fruits. The 2010 guidelines^[25] are limited and inconsistent but suggest an inverse relationship between total fruit and vegetable consumption and the occurrence of type 2 diabetes. Three of the five studies involved in that systematic review were the same as those included in the current systematic review. Therefore, it appears that, although the findings are essentially the same, the stated conclusions are slightly different and nuanced. Findings from the current systematic review and meta-analysis do not support a strong association between intake of fruit, vegetables, or combined fruit and vegetables and reduced type 2 diabetes risk. This finding is consistent with that of a previous systematic review on the topic^[26] and the evidence from systematic reviews conducted by the United States department of

agriculture (USDA) and the U.S. Department of Health and Human Services.^[25] However, the present study observed that more than three-quarters of participants reported that daily consumption of fruits and vegetables are not risked factors for DM.

Conclusion

It has been concluded that Saudi females who are aged less than 45 years, over-weight, with normal waist, did not perform physical activity, did not consume fruits and vegetables daily, had not diagnosed with hypertension and hyperglycemia, first-degree relatives, and had not PCOS were risk factors associated with T2DM in adult Saudi patients.

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Conflicts of interest

There are no conflicts of interest.

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