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Detection of Undiagnosed Diabetes among Saudi Female at Four Campaigns in Taif City, Saudi Arabia

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Abstract

Diabetes is one of the most common chronic endocrine disorders all over the world. The Kingdome of Saudi Arabia found to be among the ten countries with the highest prevalence of diabetes. Unfortunately, the last reported study performed in Saudi Arabia on the prevalence of undiagnosed diabetic among Saudis aged 15 and older showed 57.8% of those were undiagnosed previously, which adds to the disease medical complications and economic cost. Thus, the aim of this study was to measure the prevalence of previously undiagnosed diabetic among Saudi female age over 18 years at Taif city. This will help in early detection of the disorder, make screening program more cost effective and reduce the chance of developing of serious health complications, such as heart disease, kidney disease, and many others. Four study campaigns were arranged in public locations and blood glucose level was recorded from 200 female participants. This study showed that 8% female were provisionally undiagnosed with diabetes pending confirmation of the result by formal venous plasma glucose determination; these subjects were referred to their primary health care provider for confirmation of the diagnosis and further management. Moreover, 10% had indeterminate results and were advised to check their fasting blood glucose. The majority of participants who were undiagnosed with diabetes previously were non-smoker and un-active physically. However, 56% had family history of diabetes. The findings of the study calls for increased awareness of diabetes and undiagnosed diabetes to encourage for early detection of pre-diabetes, which might minimize the related complications.

Keywords: Undiagnosed diabetic; Saudi female; Taif

Introduction

The diabetes epidemic is accelerating in the developing world, with tremendous effects on affected individuals and health care systems [1]. Community screening programs for diabetes can identify apparently individuals with undiagnosed diabetes. They also provide a means to enhance public awareness of the seriousness of diabetes and its complications.

However, there is insufficient evidence to conclude that community screening is a cost-effective approach to reduce the morbidity and mortality associated with diabetes. In addition, community screening for diabetes is not diagnostic; all abnormal or inconclusive results should be subsequently confirmed at an accredited laboratory. Because of this lack of evidence, both the World Health Organization (WHO) and the International Diabetes Federation (IDF) do not recommend random or universal diabetes screening [1,2]. However, the national screening policies have been adopted by at least two high prevalence countries; Brazil and Mexico [1].

All over the world, it has been estimated that 366 million people have diabetes; with half unaware they have the disease, either because they have no symptoms or because such symptoms is easily attribute to the stresses of everyday life [3]. Saudi Arabia is another country with high prevalence of Diabetes Mellitus (DM). In a community-based national health survey that was conducted between 1995 and 2000 in Saudi Arabia, a total of 16917 Saudi subjects in the age group of 30-70-years were screened for DM by fasting plasma glucose levels [4]. The overall prevalence of DM obtained from this study was 23.7%. The prevalence in males and females were 26.2% and 21.5% (P<0.00001) respectively. Despite the readily available access to healthcare facilities in Saudi Arabia, a large number of diabetics (27.9%) were unaware of having DM [4]. The last reported study performed in Saudi Arabia on the prevalence of undiagnosed diabetic among Saudis aged 15 and older was in 2014 and showed 57.8% of those were undiagnosed previously [5].

In an analysis of the Saudi Ministry of Health database, approximately 0.9 million people in 1992 and 2.5 million people in 2010 have been diagnosed with diabetes [6]. These data suggest that the number of people diagnosed with diabetes increased by 1.6 million (or 183%) during the last 18 years, equivalent to approximately 0.1 million per year. Major healthcare service providers were not included in this analysis (e.g. Universities hospitals, Armed Forces Medical Services, Security Forces Hospital, National Guard Medical Services, Royal Commission Hospitals and ARAMCO). The incidence of DM is probably much higher than stated figures [6].

The same analysis revealed that people diagnosed with diabetes, on average, have medical healthcare expenditures that are ten times higher ($3,686 vs. $380) than what expenditures would be in the absence of diabetes [6]. Omitted from the cost estimates is the indirect cost associated with lost productivity due to disease-related absenteeism, unemployment and disability as well as the social cost of care provided by non-paid caregivers [6].

The increasing prevalence of DM in Saudi Arabia is largely attributable to rapid socio-economic development associated with increased obesity, smoking and less physical activities. However, it may

also be attributed to increased awareness programs, community screening campaigns and better diagnostic facilities [4,6].

Several community-based screening campaigns for DM and hypertension were conducted in different parts of Saudi Arabia. They revealed that a large percentage of diabetic subjects remained asymptomatic and were not detected for long times. These studies concluded that community-based screening campaigns are extremely efficient in identifying undiagnosed diabetic individuals in the society [7,8].

Determining the prevalence of undiagnosed diabetes and the number of people affected by diabetes, now and in the future, is important to allow for rational planning and allocation of resources. Thus, this study aims to evaluate the prevalence of undetected diabetes among Saudi females at Taif city.

Methods and materials

The survey was conducted in four campaigns which arranged in four public locations including; elderly female home care (Alyagiza Society Charity for female), Algaida Algwaia Club Women, shopping mall (Taif Heart Mall), and Okaz annual festival among Saudi females at Taif city in the time period between December 2014 to March 2015.

Data were collected by interviewing the participants: information of demographic characteristics, smoking, performing exercise, family history of diabetes (first-degree and/or second-degree relatives) and time since last meal were collected. Subjects under 18 years old and individuals with diagnosed diabetes were excluded from the survey.

The random capillary blood glucose level was measured by using a blood glucose monitoring (Accu-CHEK Performa Blood Glucose meter, Roche, US). Interpretation of the blood glucose level was based on whether it was a fasting or non-fasting sample.

Subjects with fasting blood glucose level<100 mg/dl or non-fasting levels<140 mg/dl were considered non-diabetic and offered healthy lifestyle advice. Subjects with fasting blood glucose ≥ 126 or non-fasting blood glucose ≥ 200 were considered diabetic and referred to their primary health care provider for confirmation of the diagnosis and further management. Subjects with figures between these two cut-offs were considered indeterminate and advised to have their fasting blood glucose level checked at a nearby health facility.

These cut-off values are similar to those adopted by the previously mentioned national surveys conducted in Brazil and Mexico [1], which also relied on random capillary blood glucose measurements.

Prior to screening, the participants were informed about the importance of establishing early detection and treatment for diabetes to minimize the related complications such as coronary artery and peripheral vascular disease, stroke, diabetic neuropathy, and amputations. The data was collected and analyzed statistically using SPSS version 16.

Results

A total of 200 females were screened, 18 subjects (9%) provided fasting capillary blood glucose samples after at least 8 hours fast while 182 subjects (91%) provided non-fasting capillary blood glucose samples.

Sixteen subjects (8%) were provisionally undiagnosed to have diabetes pending confirmation of the result by formal venous plasma glucose determination; these subjects were referred to their primary health care provider for confirmation of the diagnosis and further management. Twenty subjects (10%) had indeterminate results and were advised to have their fasting blood glucose checked in the nearby healthcare center (Table 1).

The group of subjects that provided fasting blood samples yielded more cases of newly diagnosed diabetes (22.2% versus 6.6%) and more cases with indeterminate results (27.8% versus 8.2%) than the group with non-fasting blood samples (P = 0.001) (Table 2).

Subjects with family history of diabetes tended to have a higher rate of the newly diagnosed diabetes (10.7% versus 6%, P = 0.3) (Table 3), however, the difference was not statistically significant. Similarly, there was no significant difference in the proportion of newly diagnosed diabetes between patients aged<45 or ≥45 years (8.4% versus 7.0%, P = 0.8) (Table 4). There was also no difference in the proportion of detected cases in relation to education level (Table 5), exercise pattern (Table 6), or smoking (Table 7).

Classification	Particulars	Frequency	Percentage
	Non-diabetic	164	82
	Indeterminate result	20	10
	Undiagnosed Diabetic*	16	8
	Total	200	100

Table 1: Frequency and percentage of newly diagnosed DM cases among surveyed individuals (N=200). *Provisional diagnosis pending confirmation of the abnormal result.

Discussion

Worldwide, it has been estimated that 366 million people have diabetes; with half unaware they have the disease [3]. In the Kingdom of Saudi Arabia there is some uncertainty about the prevalence of undiagnosed diabetes. In 2014, Bcheraoui and others reported 13.4 % Saudis aged 15 years or older had diabetes, among those, 57.8% were undiagnosed previously [5]. This study showed that 8% of the female participant were having undiagnosed diabetes and 10% had indeterminate results. Family history with diabetes was reported in more then half of the participants who were newly diagnosed with diabetes. This concurred with number of different studies that linked the diabetic patients history with a higher incidence of this disorder [8,9].

In 2001, Choi and Shi were reported that the prevalence of diabetes increased with age, from 0.5% in the 12 to 34 year age group to about10 to14% in the 75 and older age group. The odds of diabetes

increased by 9% per year increase in age [10]. However, this study showed no significant difference in the proportion of newly diagnosed diabetes and participants age.

In Western European countries it has been found that the risk of type 2 diabetes mellitus (T2DM) inversely related to the educational level [11].

Particulars			Classification			
			Non-Diabetic	Indeterminate	Previously undiagnosed	Total
Sample type	Fasting	Count	9	5	4	18
		%	50.0%	27.8%	22.2%	100.0%
	Non-fasting	Count	155	15	12	182
		%	85.2%	8.2%	6.6%	100.0%
Total		Count	164	20	16	200
		%	82.0%	10.0%	8.0%	100.0%

Table 2: Proportion of newly diagnosed DM cases among surveyed individuals according to sample type; fasting versus non-fasting (N=200). *P = 0.001.

Particulars			Classification			Total
			Non-diabetic	Indeterminate	Previously undiagnosed	
Family history of diabetes	No	Count	99	10	7	116
		%	85.30%	8.60%	6.00%	100.00%
	Yes	Count	65	10	9	84
		%	77.40%	11.90%	10.70%	100.00%
Total		Count	164	20	16	200
		%	82.00%	10.00%	8.00%	100.00%

Table 3: The number and percentages of Non-diabetic, Indeterminate, previously undiagnosed diabetes female participants with or without family history of diabetic.

Particulars			Classification			Total
			Non-diabetic	Indeterminate	Previously undiagnosed	
Age group	<45	Count	118	13	12	143
(Year)		%	82.50%	9.10%	8.40%	100.00%
	45 or more	Count	46	7	4	57
		%	80.70%	12.30%	7.00%	100.00%
Total		Count	164	20	16	200
		%	82.00%	10.00%	8.00%	100.00%

Table 4: The number and percentages of Non-diabetic, Indeterminate, previously undiagnosed diabetes female participants according to their age groups (<45 or 45 years and more.

Additionally, there was a general trend of an increase in the prevalence of diabetes among people with lower education in both males and females [10], whereas this study did not report any significant link between participant educational level and previously undiagnosed diabetes.

For decades, physical inactivity has been considered as one of the main determent of diabetes and increase the physical activity has shown to control glycemic level among normal non-diabetic individuals and improve insulin sensitivity among diabetic patients [12,13].

Particulars			Classification			Total
			Non-diabetic	Indeterminate	Previously undiagnosed	
Education	Illiterate	Count	29	4	4	37
		%	78.40%	10.80%	10.80%	100.00%
	Primary	Count	10	1	0	11
		%	90.90%	9.10%	0.00%	100.00%
	High school	Count	40	5	6	51
		%	78.40%	9.80%	11.80%	100.00%
	College	Count	82	9	6	97
		%	84.50%	9.30%	6.20%	100.00%
	Post graduate	Count	3	1	0	4
		%	75.00%	25.00%	0.00%	100.00%
Total		Count	164	20	16	200
		%	82.00%	10.00%	8.00%	100.00%

Table 5: The number and percentages of Non-diabetic, Indeterminate, previously undiagnosed diabetes female participants according to their educational level.

Particulars			Classification			Total
			Non-diabetic	Non-diabetic	Non-diabetic	
Exercise	No	Count	101	14	11	126
		%	80.20%	11.10%	8.70%	100.00%
	Yes	Count	63	6	5	74
		%	85.10%	8.10%	6.80%	100.00%
Total		Count	164	20	16	200
		% within exercise	82.00%	10.00%	8.00%	100.00%

Table 6: The number and percentages of Non-diabetic, Indeterminate, previously undiagnosed diabetes female participants according to their Physical activity.

Particulars			Classification			Total
			Non-diabetic	Non-diabetic	Non-diabetic	
Smoking	No	Count	144	18	15	177
		%	81.40%	10.20%	8.50%	100.00%
	Yes	Count	20	2	1	23
		%	87.00%	8.70%	4.30%	100.00%
Total		Count	164	20	16	200
		%	82.00%	10.00%	8.00%	100.00%

Table 7: The number and percentages of Non-diabetic, Indeterminate, previously undiagnosed diabetes female participants according to their smoking situation.

This study reported that the majority of participants with previously undiagnosed diabetic cases were reported amongst female who were physically inactive.

Several publications in the last years addressed the link between smoking among diabetic individuals and mortality rate [14]. A study, found that cigarette smoking was associated in a dose-response manner with an increased mortality among women with type 2 diabetes at United State [15]. The finding of this study was reported only one female was smoker with previously undiagnosed diabetic, whereas the non-smokers were 15. This could be because female smoking is not a major habit in Taif city.

This study has a number of limitations. Firstly, capillary blood glucose level was used rather than venous plasma glucose or HbA1c for practical reasons. Although less accurate than formal laboratory testing, hand held glucometers are convenient to use in community screening program and their use was adopted by other large national surveys in Brazil and Mexico. Secondly, random blood sampling was used for practical reasons. Subjects were interviewed at various times during the day and a fasting blood sample was not feasible. To minimize the limitations resulting from this, we timed each subject's last meal and divided participants into fasting and non-fasting groups for the final analysis. Thirdly, body mass index was not calculated. This is an important aspect of any diabetes screening program that aims to promote healthy life style changes. Lastly, sample size was small, accordingly no significant association was found with known risk factors for DM (e.g. age ≥ 45 years and exercise).

Conclusion

This study was the first to assess the prevalence of undiagnosed diabetic among Saudi female at Taif city. The findings of the study calls for increased awareness of diabetes and undiagnosed diabetes also to encourage for early detection of pre-diabetes, which might minimize the related complications such as coronary artery and peripheral vascular disease, stroke, diabetic neuropathy, and amputations in the Kingdom of Saudi Arabia. Moreover, this study recommends that diabetes prevention and control strategies should be targeted for people at all education levels.

Ethical Consideration

Ethical approval for this study was obtained from the ethics review committee of Applied Medical Sciences College at Al-Taif University. All information obtained at each course of the study was kept confidential.

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