

Awareness of diabetes risk factors among Bisha Residents Southwestern Saudi Arabia

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ABSTRACT

Introduction: In the past few decades, the prevalence of type 2 diabetes has increased dramatically in many countries. While primary preventive measures can reduce the prevalence of diabetes, knowledge of the risk factors of diabetes mellitus has many benefits for patients with diabetes. The study aimed to assess diabetes mellitus risk factors (DM-RFs) awareness among adults residing in Bisha, Southwestern Saudi Arabia. Awareness of the risk factors of diabetes mellitus was reported to be highest for obesity, sweet intake, and family history of diabetes. **Methods:** The study participants were 404 adults (225 males and 179 females) with an age range of 18–65 (mean age: 40.83+/-9.3). People with diabetes and those without diabetes were involved in the study. The study was conducted in Bisha city, southwestern Saudi Arabia, using an online random sampling technique and a structured and validated questionnaire, and analysis was by SPSS V 24. **Results:** This study showed that 168 (41.6%) participants had diabetes and 236 (58.4%) were non-diabetics; 64.9% of the respondents were aware of the DM-RFs. Among the people with diabetes, 128 (76.2%) agreed that obesity is a DM-RF, while 210 (89%) of the non-diabetics were aware that obesity was a DM-RF. Further, 77.7% of the respondents agreed that the risk factors were avoidable, with 50.7% willing to know more about DM-RFs. **Conclusion:** The study found a high level of awareness of DM-RFs among diabetes and non-diabetics in Bisha, southwestern Saudi Arabia.

Keywords: Awareness, Bisha, diabetes, risk factors, Saudi Arabia

Introduction

Diabetes Mellitus (DM) is associated with damage to vital organs and systems and is associated with high blood glucose.^[1] DM type 2 is the commonest type of diabetes among adults, which occurs when the body becomes resistant to insulin or makes insufficient amounts of insulin. In the past few decades, the prevalence of type 2 diabetes has increased dramatically in countries of all income levels. Worldwide, 422 million people have diabetes, particularly in low- and middle-income

countries, and every year, 1.6 million deaths are directly attributed to diabetes. The number of people with DM is expected to increase by 40% over the coming decade. The majority (40%–60%) of type 2 diabetes patients in routine general practice have poor metabolic control (HbA1c of >8% or fasting blood glucose of >11 mmol/l).^[2] In Saudi Arabia, noncommunicable diseases (NCDs) kill more than 90,000 people annually, constituting more than 78% of all deaths. DM accounts for 4.6% of these deaths. Therefore, cardiovascular disease (CVD) and diabetes are the two leading chronic diseases in Saudi Arabia. They are expected to continue to increase in prevalence in the future.^[3] Diabetes risk calculators have a high negative predictive value and help define patients who are unlikely to have diabetes.

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A complicating factor is that lifestyle changes do not have immediate benefits for patients; the effects reduce long-term complications. The cornerstones of healthcare to support active patient participation are guaranteeing the continuity of care, integrating education in healthcare, and encouraging patient attendance. It is challenging for physicians to give type 2 diabetes patients the tools to manage the disease actively.^[2]

Generally, the World Health Organization perceives primary health care services as best situated inside the health system to distinguish and treat chronic illnesses involving diabetes, from both an access and a financial point of view, even though at various phases of execution, discovering and treating chronic diseases are very much installed in the primary health care sitting in high-salary nations like Australia, NZ, Canada, and the US.^[3] In addition to that, primary care doctors have a significant role in diabetes treatment. They are accountable for applying evidence-based guidelines that can further develop outcomes for individuals with diabetes.^[4]

A national prevention program at the community level targeting high-risk groups is recommended to prevent DM. A strategy to demonstrate the importance of modifying risk factors for the development of DM and reducing its prevalence in Saudi Arabia should also be encouraged. This is because many people with diabetes (27%–40%) are unaware of their condition.^[5]

There are different tools for risk assessment based on self-assessed biochemical measures or genetic markers used to predict type 2 DM. These assessment methods are arguably more practicable and valuable than conventional blood glucose screening tests. These include prediction models that incorporate age, sex, BMI, physical activity, and healthy eating.^[6]

In a study conducted to compare income with the prevalence of DM, it was found that the association differed in men and women; increased income was associated with decreased prevalence among women, while the reverse was seen in men (however, the association was not significant). Regarding residence, rural women had significantly higher awareness and rural men had significantly lower levels of awareness than their urban counterparts.^[7] It was also reported that among all people with diabetes, older people had a higher educational level, and those with more comorbidities were more aware. Compared with married or cohabiting participants, separated, divorced, or widowed participants had a higher risk of diabetes, even after adjusting for other factors.^[8] Primary preventive measures have been shown to have many benefits in DM patients; weight reduction and physical exercise may help to counteract the increased risk to first-degree relatives of affected patients.^[9]

In terms of attitudes toward the diabetes mellitus risk factors (DM-RFs), most respondents agreed that it is possible to prevent diabetes with dietary management; however, several respondents thought that regular exercise requires a lot of effort. Daily cigarette smoke exposure, a sedentary lifestyle,

junk food consumption, and physical inactivity have been shown to have a high association with DM.^[10] In another study, many respondents were not aware of other major risk factors of DM, such as gestational DM, impaired glucose tolerance, hypercholesterolemia, hypertension, and smoking.^[11] Regarding awareness of the DM-RFs, it was reported that awareness was highest for the following risk factors:

- Obesity (63.7% of respondents indicated awareness)
- Eating a lot of sweets (68.1%)
- Family history of diabetes (63.2%)
- Older age (“found most often in adults over 45 years of age”; 60.2%)

Awareness was lower for the following risk factors: little or no exercise (40.5%) and hypertension (47.2%).^[12]

Depressed people are less likely to succeed at lifestyle change efforts, and depression may independently contribute to the development of diabetes.^[13] The prevalence of type 2 diabetes concerning ethnicities and sexes has also been studied. It was suggested that variations in genotypes and their phenotypic expression play a role in diabetes type 2 levels between population groups.^[14]

The study aimed to assess the awareness of DM-RFs among adults residing in Bisha, southwestern Saudi Arabia; determine the relationship between the DM-RFs and sociodemographic parameters; assess the associations between the various DM-RFs among Bisha residents, and compare the knowledge of DM-RFs between diabetic and non-diabetic residents of Bisha.

Material and Methods

Study design

A community-based cross-sectional awareness study was conducted from August 2020 to October 2020 among the Bisha city population in Saudi Arabia. A structured and validated online questionnaire was sent to the participants using Google Forms to collect the information. The questionnaire was designed based on possible awareness of DM-RFs and was pretested on 45 subjects similar to the study participants for validity. The questionnaire included questions ascertaining personal characteristics and awareness of DM-RFs.

Sample size

The following formula used to calculate sample size: $Z^2 p(1-p)/d^2$ with assumptions $P = 50\%$, 95% confidence, and margin of error 5% (d). The sample size obtained was 384 individuals. We increased the sample size to 500 to enhance the study's precision.

Study area

Bisha city is in southwest Saudi Arabia. It is located in the Asir region and is the capital of Bisha province. It stands at an altitude of ~2,000 feet above sea level. Bisha province has ~240 villages, including many historical and archaeological sites.^[11] The

University of Bisha is a public university that was established in 2013.

Study population

All the participants were adult males and females (age ≥ 18 years), both diabetic and non-diabetic, and residents of Bisha province after their informed consent. Out of 500 questionnaires, 404 were completed, giving a response of 80.8%. Of the 404 participants, 225 (55.7%) were male and 179 (44.3%) were female.

Study instrument

A self-administered questionnaire was created in Arabic based on the most recently available information after a deep search of the medical literature. In total, 45 participants were involved in a pretest that was not included in the study sample to test the validity and any needed modifications before the questionnaire was finalized. The first part of the questionnaire ascertained the participants' sociodemographic characteristics. The second determined the respondents' source of information about DM-RFs, and the third measured participants' level of awareness.

To measure the participants' level of awareness, they were asked to respond to a maximum of 27 questions with "yes," "no," or "I don't know." Correct answers were given 1 point and incorrect answers or "I don't know" 0 points. The range of awareness was scored as 0–27. These scores were categorized into good awareness, aware, and not aware based on 50% and 75% cut-off points out of the total possible score.

Statistical analysis

Data on the awareness of DM-RFs were analyzed using SPSS 24. Descriptive analysis was performed, and the association between sociodemographic characteristics and awareness of DM-RFs was tested. Numbers and percentages were used to present nominal data. A univariate analysis was run to study the independent associations between variables (age, gender, residence, marital status, level of education, job, income, source of information, history of diabetes and hospitalization, and family history of diabetes) and awareness of DM-RFs using the Chi-squared test. A 95% CI was used to measure association strength, and a *P* value of <0.05 was considered statistically significant. The level of awareness of DM-RFs was determined by logistic regression. Independent variables included in the model were participants' age, gender, residence, marital status, level of education, job, income, history of diabetes, and family history of diabetes. A dependent variable introduced to the model was the awareness level (i.e., "aware" vs. "not aware"). Determinants with a screening significance of $P < 0.05$ in the univariate analyses were selected for multivariate analyses (binary logistic regression). The full model was fitted, including all possible two-way interactions of selected variables from the univariate analyses. All *P* values were two-tailed and were considered statistically significant at <0.05 .

The scores for awareness of DM-RFs were then summed up to generate an overall score for each participant. Awareness

levels were then categorized depending on the total score into "not aware" for respondents scoring $<50\%$, "aware" for those scoring ≥ 50 and $\leq 74\%$, and "good awareness" for those scoring $\geq 75\%$.

Ethical considerations

IRB was obtained from the Research Ethics of Local Committee at the University of Bisha (Ref. No. UBCOM/H-06-BH-087 (05/18)). All the participants gave informed consent.

Results

The response rate was 80.8% (404 out of 500). The age range of the respondents was between 18 and 65 years. The mean age of the respondents was 40.83 ± 9.3 years. In total, 168 (41.6%) of the respondents had diabetes, and 236 (58.4%) were non-diabetics. Out of the 404 respondents, 67.8% had a family history of diabetes, with many reporting that their fathers, mothers, and grandparents had diabetes. Regarding educational level, most diabetic participants were school leavers, constituting 30.4% [Table 1]. The monthly income median was 11,578.6 SAR (USD3,091).

Further, 64.9% of the participants agreed that diabetes had risk factors, 22.8% did not know about DM-RFs, and 12.4% said that diabetes had no risk factors. Regarding preventive measures, 46.8% agreed that DM is preventable, 33.4% did not know DM preventive measures, and 19.8% believed that diabetes was unpreventable. Related to the above, 77.7% agreed that the risk factors were avoidable and 22.3% believed that the DM-RFs were unavoidable. Interestingly, 50.7% of the respondents were willing to know more about DM-RFs, and 49.3% had no desire to learn more; 33.9% agreed that doctors at primary healthcare centers (PHCCs) discuss DM-RFs, 33.4% disagreed, and 32.8% had no idea. Furthermore, 137 (33.9%) had risk factors, and 167 (41.3%) had no risk factors [Table 2].

The highest percentage of diabetics in the study population was among the age group 51 years and older, constituting $\sim 52.4\%$ of those with diabetes. The lowest percentage was among the age group 18–30, comprising 8.33%, which shows that advancing age is a major DM-RF. Consistent with a study that found that the age group most affected by type 2 DM was 45 years and older,^[22,23] our study showed that the majority of the people with diabetes were urban residents [Table 3].

Among the people with diabetes, 128 (76.2%) agreed that obesity is a DM-RF, while 40 (23.8%) disagreed. 210 (89%) of the non-diabetics agreed that obesity is a DM-RF, while 26 (11%) disagreed. Moreover, 94% of the people with diabetes agreed that genetics are a DM-RF, while 6% disagreed. For the non-diabetics, 223 (94.5%) agreed and 13 (5.5%) disagreed. 167 (97.6%) of the people with diabetes agreed that the consumption of sweets is a DM-RF, and 2.4% disagreed. Among the non-diabetics, 99.2% agreed and only 0.8% disagreed. More awareness of this

Table 1: Sociodemographic features of Bisha Residents Regarding Awareness of Diabetes Risk Factors

Sociodemographic features	Frequency (n=404)	Percentage
Age (years)		
18-30	135	33.4
31-40	53	13.1
41-50	96	23.8
51-60	72	17.8
>60	48	11.9
Sex		
Male	225	55.7
Female	179	44.3
Residence		
Urban	278	68.8
Rural	126	31.2
Marital status		
Single	132	32.7
Married	164	40.6
Divorced	71	17.6
Widowed	32	7.9
Separated	5	1.2
Occupation		
Military	40	9.9
Civil employment	86	21.3
Private sector	77	19.1
Unemployed	183	45.3
Businessperson	18	4.5
Education		
None	11	2.7
Primary	11	2.7
Intermediate	28	6.9
Secondary	127	31.5
Diploma	59	14.6
Bachelor's degree	148	36.6
Postgraduate	20	5
Diabetic respondent		
Yes	168	41.6
No	236	58.4
History of diabetes (years)		
Not diabetic	236	58.4
<1	20	5.0
1-5	89	22
6-10	38	9.4
>10	21	5.2

factor among the latter group could be one of the reasons for their non-diabetic status. Concerning smoking, 164 (99.4%) of the people with diabetes agreed that it is a DM-RF, while 0.6% disagreed. Similarly, 234 (99.2%) of the non-diabetics agreed, and just 2 (0.8%) disagreed. Further, 153 (98.1%) of the people with diabetes agreed that increased age is a DM-RF, and 1.9% disagreed. 228 (96.63%) non-diabetics agreed with this factor, while 8 (3.4%) disagreed. In addition, 163 (97.0%) of the people with diabetes agreed that hypertension is a risk factor and 5 (3%) disagreed; 100% of the non-diabetics agreed with this. Moreover, 163 (97%) of the people with diabetes agreed that CVDs are a DM-RF, and 5 (3%) disagreed. For non-diabetics, 235 (99.6%) agreed and 1 (0.4%) disagreed. Also, 167 (99.4%) of the people with diabetes agreed that a sedentary lifestyle is a DM-RF, and 1 (0.6%) disagreed. Similarly, among the non-diabetics, 234 (99.2%) agreed and 1 (0.8%) disagreed.

Male and female diabetics' knowledge of DM-RFs was in the ratio of 48.6:51.2, while among non-diabetics, the ratio was 60.6:39.4. Regarding rural and urban residency, 51 (30.4%) of those with diabetes resided in rural areas and were aware of DM-RFs, while 117 (69.6%) lived in urban areas and had knowledge of DM-RFs. Among the non-diabetics, 161 (60.6%) resided in urban areas and 30.4% in rural areas. 6.6% of those with diabetes were single in terms of marital status, and the remaining 93.4% were married, divorced, widowed, or separated. If one assumes that those who are single are generally younger than those who are married, divorced, widowed, or separated, these figures suggest that as age increases, the risk of getting DM increases as well. Among the non-diabetics, 126 (53.4%) were single, and 46.3% were married, divorced, widowed, or separated, which corroborates the relationship between DM and age suggested above.

Table 4 presents the number of participants who reported endocrine disorders and psychological problems. Participants' DM-RFs were also recorded. These included previous pregnancy, advancing age, pre-diabetes, alcohol consumption, high blood pressure, unhealthy food consumption, smoking, sleep disorders, breastfeeding, and obesity during childhood. The results are shown in Table 5. Other aspects shown in Table 5 include weight problems, polycystic ovarian syndrome (PCOS), high

Table 2: Perception of Bisha residents toward risk factors of diabetes mellitus

Respondents' Perceptions of Diabetes	Frequency (n=404)		
	Yes n (%)	No n (%)	I don't know n (%)
Diabetes has complications	265 (65.6)	50 (12.4)	89 (22.0)
Diabetes has risk factors that can lead to the disease	262 (64.9)	50 (12.4)	92 (22.8)
I know all the risk factors that cause diabetes	162 (40.1)	138 (34.2)	104 (25.7)
Diabetes can be prevented when risk factors are avoided	189 (46.8)	80 (19.8)	135 (33.4)
All risk factors causing diabetes can be avoided	314 (77.7)	90 (22.3)	0 (0.0)
I'd like to know more about the risk factors for diabetes	205 (50.7)	199 (49.3)	0 (0.0)
Doctors at PHCCs discuss risk factors for diabetes	137 (33.9)	135 (33.4)	132 (32.8)
I have diabetes risk factors	137 (33.9)	167 (41.3)	0 (0.0)

Table 3: Association between sociodemographic features and diabetes mellitus among Bisha residents southwestern Saudi Arabia

Sociodemographic features	Diabetes		Test statistic	P
	Yes	No		
Age (years)				
18-30	14	121	108	0.0001*
31-40	18	35		
41-50	48	48		
51-60	53	19		
>60	35	13		
Sex				
Male	82	143	5.51	0.02*
Female	86	93		
Residence				
Urban	117	161	0.093	0.761**
Rural	51	75		
Marital status				
Single	11	121	90.02	0.0001*
Married	93	71		
Divorced	44	27		
Widowed	17	15		
Separated	3	2		
Occupation				
Military	27	13	32.61	0.0001*
Civil employment	31	55		
Private sector	45	32		
Unemployed	55	128		
Businessperson	10	8		
Education				
None	7	4	21.79	0.0001*
Primary	8	3		
Average	17	11		
Secondary	51	76		
Diploma	32	27		
Bachelor's degree	47	101		
Postgraduate	6	14		
Family history of diabetes				
Yes	128	146	9.23	0.02*
No	40	90		

*Significant: $P < 0.05$. **Not significant: $P > 0.05$

uric acid level, consumption of nuts, vitamin D deficiency, and consumption of sugar and sweetened beverages.

Another aspect included in the study was the source of information about DM-FRs. In total, 229 (56.7%) of the respondents got information from healthcare providers, 139 (34.4%) from radio and television, 118 (29.2%) from medical publications and posters, 141 (34.9%) from social media, 97 (24%) from health awareness campaigns, 153 (37.9%) from family and friends, 183 (45.3%) from the Internet, and 163 (40.3%) from other diabetics.

Discussion

Diabetes is a metabolic disorder characterized and identified by hyperglycemia in the absence of treatment, from defects in insulin

Table 4: Awareness of diabetes risk factors among Bisha residents southwestern Saudi Arabia

Risk factors reported by the respondents (n=404)	Diabetes		Test statistic	P
	Yes	No		
Obesity				
Yes	128	210	11.75	0.001*
No	40	26		
Genetics				
Yes	159	223	0.003	0.959**
No	9	13		
Consumption of sweets				
Yes	164	232	0.238	0.626**
No	4	4		
Smoking				
Yes	167	234	0.085	0.771*
No	1	2		
Older than 45				
Yes	153	228	5.61	0.02*
No	15	8		
Hypertension				
Yes	163	236	Fisher's Exact	0.012*
No	5	0		
CVD				
Yes	163	235	Fisher's Exact	0.05*
No	5	1		
Sedentary lifestyle				
Yes	167	234	Fisher's Exact	0.625**
No	1	2		
Endocrine disorder				
Yes	164	234	Fisher's Exact	0.200**
No	4	2		
Psychological problem				
Yes	161	233	Fisher's Exact	0.65**
No	7	3		

*Significant: $P < 0.05$. *Not significant: $P > 0.05$

secretion, insulin action, or both.^[15,16] Although the causes of DM are not known, many of its modifiable lifestyle-related risk factors are well known. Evidence suggests that DM is a potentially preventable disease; therefore, it is essential to understand its risk factors and preventive measures. Lifestyle interventions (e.g., physical activity and weight loss) are more effective than medication in preventing or delaying the onset of DM in persons at higher risk of developing the disease. Learning about DM-RFs and preventive measures is the first step in prevention because it will enable the public to decide to adopt a healthy lifestyle.^[17] The International Diabetes Federation has recommended that people at high risk be identified using a two-step approach to complete risk questionnaire forms and a blood glucose test. Obesity is the most important DM-RF.^[18] In addition to obesity, fast food consumption, fruit consumption, and skipping breakfast were found significantly more frequently among DM patients than in the non-diabetic population. Age, gender, and education level were associated with knowledge of DM-RFs and preventive measures. Education level was found to be a statistically significant predictive factor for patients' knowledge about DM.^[19]

There are both health and economic benefits attached to primary prevention of DM; this underscores the importance

Table 5: Knowledge of diabetes risk factors among Bisha residents southwestern Saudi Arabia

Risk factors of diabetes mentioned (n=404)	Knowledge		
	Correct knowledge n (%)	Incorrect knowledge n (%)	I don't know n (%)
Obesity	309 (76.5)	11 (2.7)	84 (20.8)
Previous gestational diabetes	241 (59.7)	105 (26.0)	58 (14.4)
Increased age	189 (46.8)	112 (27.7)	103 (25.5)
Pre-diabetes	140 (34.7)	164 (40.6)	100 (24.8)
Alcohol intake	185 (45.8)	124 (30.7)	95 (23.5)
High blood pressure	89 (22.0)	279 (69.1)	36 (8.1)
Unhealthy food consumption	138 (34.2)	138 (34.2)	128 (31.7)
CVDs	167 (41.3)	132 (32.7)	105 (26.0)
Smoking	175 (43.3)	115 (28.5)	114 (28.2)
Sleep disorders	240 (59.4)	60 (14.9)	104 (25.7)
Breastfeeding	157 (38.9)	111 (27.5)	136 (33.7)
Use of certain medications (cortisone)	152 (37.6)	164 (40.6)	88 (21.8)
Obesity during childhood	212 (52.5)	111 (27.5)	81 (20.0)
Weight problems	75 (18.6)	149 (36.9)	180 (44.6)
PCOS	97 (24.0)	142 (35.1)	165 (40.8)
High level of uric acid	183 (45.3)	85 (21.0)	126 (31.2)
Coffee and caffeinated drinks	209 (51.7)	78 (19.3)	117 (28.9)
Consumption of nuts	160 (39.6)	98 (24.3)	146 (36.1)
Vitamin D deficiency	57 (14.1)	303 (75.0)	44 (10.8)
Sugar and sweetened beverages	302 (74.8)	56 (13.9)	46 (11.3)

of the current study. This study shows that multiple factors contribute to the prevalence of DM and the awareness of DM-RF among Bisha residents. The male-female ratio of the respondents was 55.7%:44.3%, and the urban-rural residency ratio was 68.8%:31.2%. The urbanization pattern in Saudi Arabian society has been associated with a higher risk of DM. Rapid urbanization in the kingdom is associated with DM-RFs such as obesity, sedentary lifestyles, and physical inactivity. Our study showed that the majority of the people with diabetes were urban residents. This is in line with previous literature that showed that urbanization is one of the DM-RFs.^[20-22] It is noteworthy that the most significant proportion of respondents was between 18 and 30 years old, which shows a high percentage of young adults in the population. These young men and women are more prone to adopting westernized eating habits of consuming fast foods. These foods can lead to obesity, which is a major risk factor for DM and other NCDs.

The trend regarding knowledge of DM-RFs among the study population was similar to that obtained in a previous study,^[13] with 64.9% agreeing that diabetes had risk factors; 22.8% did not know about DM-RFs, and 12.4% said that diabetes had no risk factors.

The highest percentage of diabetics in the study population was among the age group 51 years and older, constituting ~52.4% of those with diabetes. The lowest percentage of diabetics were 18–30 years old, accounting for 8.33%. This shows that advancing age is a major DM-RF. This result contradicts previous studies that found that the age group most affected by type 2 DM was 45 years and older.^[22,23]

It is noteworthy that most of the respondents were educated, with more than 40% having a bachelor's degree, which would presumably increase the awareness of DM-RFs. This finding contrasts with a previous study that showed a significantly lower DM prevalence among persons with high school or higher education in Jamaica.^[7] This could be due to cultural or socioeconomic differences between the two population groups.

The overwhelming majority (76.2%–99.4%) of the respondents agreed that obesity, genetic factors, consumption of sweets and sweetened beverages, smoking, and older age were DM-RFs. Therefore, their awareness of these factors was high compared to the findings of prior research.^[21] Hence, the population should be encouraged to modify the modifiable factors and avoid those that can be avoided.

Leading a healthy lifestyle has been shown to lower DM incidence. The respondents' awareness regarding health problems such as hypertension, endocrine disorders, psychological issues, and sedentary lifestyles was also excellent. The vast majority (>95%) of the respondents showed a high level of awareness regarding these factors. This could be attributed to the many sources of information at their disposal. These include healthcare providers, radio and television, medical publications and posters, social media, health awareness campaigns, family and friends, and the Internet. Therefore, people in the community should be encouraged to practice healthy lifestyles and apply their knowledge and information to prevent diabetes.

This study also assessed certain risk factors among the participants and their knowledge about these as DM-RFs. These factors were pre-diabetes, high blood pressure, CVDs, sleep

disorders, smoking, the use of some types of medications, obesity during childhood, high-fat level, high level of uric acid, PCOS, previous pregnancy, vitamin D deficiency, and eating habits. Only ~50% of the respondents had correct knowledge regarding these as risk factors, and <40% perceived these as risk factors.

Conclusion

The study concluded a high level of awareness of many DM-RFs among diabetic and non-diabetic Bisha residents in southwestern Saudi Arabia. It is recommended that the DM-RF health education program continues at the community and health facility levels so that those with a low level of awareness can increase their knowledge. This would go a long way in reducing the burden of diabetes in Bisha and provide a means for both the primary and secondary prevention of the disease.

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Conflicts of interest

There are no conflicts of interest.

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