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KNOWLEDGE AND AWARENESS LEVEL OF DIABETES MELLITUS DISEASE RISK FACTORS AMONG NON-DIABETIC PEOPLE IN KSA

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Abstract

Introduction: Diabetes Mellitus is one of the most common noncommunicable diseases (NCDs) affecting the world, regardless of geography, nationality, race, ethnic background, or gender It is one of the chronic metabolic disorders associated with a variety of complications and death, and its prevalence has been increasing not only in Saudi Arabia but also globally. **Objective:** Our study aimed to assess patient awareness and knowledge level of DM disease risk factors among non-diabetic people in KSA **Methodology:** This is a cross-sectional study conducted in Saudi Arabia between July – December 2024. The study population comprised adult individuals over the age of 18 residing in Saudi Arabia. Participants recruited in July 2024 through the distribution of an online questionnaire. Using the Rao soft sample size calculator, the sample size was determined using the following formulas: (the response distribution was estimated to be 20%, the margin of error was 5%, and the confidence level was 95%) the minimum 384. A structured questionnaire has been used as a research tool which was based on previous research. **Results**: In this study assessing knowledge and awareness of diabetes mellitus risk factors among 443 non-diabetic individuals in Saudi Arabia, findings reveal critical gaps in education and awareness. Despite a high recognition of diabetes and its definitions, only 71.3% had received relevant health education. Alarmingly, 41.5% demonstrated low knowledge levels regarding risk factors, while only 33.2% showed high awareness. Participants acknowledged obesity (88.5%) and genetic predisposition (83.1%) as significant risk factors, yet many were unaware of symptoms like extreme hunger (46.7%). **Conclusion**: In conclusion, the findings from our study highlight a significant

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gap in knowledge and awareness regarding diabetes mellitus and its risk factors among the non-diabetic population in Saudi Arabia. While awareness of diabetes is high, the lack of comprehensive knowledge poses challenges for effective disease management and prevention.

Keywords: Knowledge, Awareness, Diabetes Mellitus Disease Risk Factors, Saudi Arabia.

Introduction:

Diabetes mellitus (DM) causes high blood glucose levels and disrupts carbohydrate, lipid, and protein metabolism due to a lack of insulin-producing cells, insufficient insulin action, or both [1]. Undiagnosed or uncontrolled type 2 diabetes can lead to incapacitating problems like heart, eye, kidney, and nerve damage. Diabetes is a leading cause of blindness, kidney failure, heart attack, stroke, and lower limb amputation [2].To reduce the burden of this medical condition, global standards for the management of Diabetes mellitus (DM) have been devised and put into effect [3]. Adequate Diabetes Mellitus (DM) knowledge enhances life quality and reduces complications, and it may aid in diabetes management, complications prevention, and diabetes development in those at risk. However, illiteracy raises the risk of diabetes mellitus [4].

In 2019, non-communicable diseases constituted approximately 74% of global mortality, resulting in an estimated 40 million deaths, emphasizing the imperative for healthcare strategies aimed at reducing their prevalence[5].According to the International Diabetes Federation (IDF), 10% of persons worldwide had diabetes, furthermore, global hotspot for diabetes has arisen in the Middle East and North Africa, which includes Saudi Arabia [6].

The prevalence of diabetes in Saudi Arabia is currently among the highest in the world (18.7%), and projections suggest that by 2040, it will have risen to 21.4% [7].

Out of the 1324 participants in this study, 52.5% were female. The age group of 15–23 years was the greatest among the participants (41.5%), followed by the age group of 44–53 years (18.8%). Concerning the questions that were correctly answered, the population obtained a mean score of 13.9 ± 3.6 out of 19 points (73.9 ± 19.3%). In every category, the people with diabetes scored higher than the non-diabetics [8]. The study included 538 patients without diabetes, with 363 (67.5%) being male. 34.6%, 52.4%, and 13.0% of people, respectively, had good, moderate, and inadequate awareness of Type 2 Diabetes Mellitus. There was a statistically significant difference in the knowledge level between the female and male participants (OR=2.4; p=0.0005). (r=-0.29, p=0.063) Diabetes awareness levels were inversely correlated with the diabetes risk score [9].

70.31% of respondents had at least one chronic illness, while 79.69% said they take one or more medications. Although more than 90% of them feel they know enough about diabetes and anti-diabetic medications, more than 54% of them stated they still need more information [10]. Another study was conducted in Bisha in 2021 and they found that both diabetic and non-diabetic Bisha inhabitants in southwest Saudi Arabia had a high level of awareness of various Diabetes mellitus risk factors [11].

It's still unknown in Saudi Arabia if the general public has enough knowledge about diabetes and its consequences.

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Objectives:
Our study aims set out to assess the knowledge and awareness level of Diabetes Mellitus Disease Risk Factors among non-diabetic people in KSA

Materials and Methods:

Study design:
This is a cross-sectional study conducted in Saudi Arabia between July – December 2024. To acquire individuals from around Saudi Arabia, a sample recruiting approach rely on social media platforms (such as Twitter, Snapchat, Instagram, WhatsApp, Facebook, etc.).

Inclusion and Exclusion Criteria:
All adults' Saudi men and women over the age of eighteen from all socioeconomic backgrounds were included except diabetic patient were excluded.

Sample size:
Using the Rao soft sample size calculator, the sample size was determined using the following formulas: (the response distribution was estimated to be 20%, the margin of error was 5%, and the confidence level was 95%). In light of this, the sample size is (384) secondary school students (male and female) in Makkah following formal correspondence with the institution's dean, plus an additional 10 to reduce the error margin. The lowest estimated sample, after 5% oversampling, is 384. A computer-generated basic random selection procedure was employed to choose the study participants.

Method for data collection and instrument (*Data collection Technique and Tools)*:
A structured questionnaire has been used as a research tool.which was based on previous research [12]. The questionnaire was divided into 4 main sections. Section 1, start with Sociodemographic characteristics such as sex, age, Mitral states, level of education, occupation, outcome. Also, the participants was asked about family history of DM and receiving of health education. Section 2, included question regarding the knowledge of participants about the DM, risk factors, sign and symptoms, management and the complications of Dm. In Section 3, the survey assessed participants' attitudes towards diabetes management and its impact on daily life. Participants were asked about their comfort in discussing diabetes with others, the necessity of being tested for diabetes, and the importance of screening family members. The survey also explored the critical role of support from family and friends, the significance of avoiding excessive sugar intake, and the impact of diabetes on marital relationships and daily activities. Additionally, it examined the role of regular physical activity in preventing diabetes, the importance of discussing quitting smoking with healthcare providers, and maintaining a healthy weight for managing diabetes. In Section 4, the survey focused on specific questions regarding the prevention of diabetes, including the consumption of fatty foods, the average level of physical activity, alcohol and smoking habits, and regular monitoring of blood sugar levels.

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Scoring system:
The assessment comprmised 30 statements designed to measure participants' attitudes and knowledge levels, comprising 9 statements for demographics, 5 for knowledge, and 16 for awareness. One point was awarded for correct answers, two points for incorrect answers, and three points for "I don't know" responses. The scoring system used various Likert scales, including Dichotomous, Three-Point, and Quality Scales. The maximum score was (170) and divided as follows: The original Bloom's cut-off points, 80.0%-100.0%, 60.0%-79%, and 59.0%, The participants divided into three groups based on their scores. Knowledge scores ranged from 0 to 30 points and were classified into three levels: low knowledge (scores of 17 or below), moderate knowledge (scores between 18 and 23), and high knowledge (scores of 24 or higher). Attitude scores ranged from 0 to 80 points and were also classified into three levels: low awareness (scores of 47 or below), moderate awareness (scores between 48 and 63), and high awareness (scores of 64 or above).

Pilot test:
The survey had been sent to 22 people who were asked to fill out. This was done in order to assess the practically of the study and questionnaire's simplicity. The conclusions of the final analysis didn't include data from the pilot study.

Analyzes and entry method:
The data had been entered into the device using the "Microsoft Office Excel Software" Windows (2021). The collected data was subsequently transmitted to the Statistical Package of Social Science Software (SPSS) application, version 20 (IBM SPSS Statistics for Microsoft Windows, Version 21.0.) for statistical analysis.

Results:
Table (1) displays various demographic parameters of the participants with a total number of (443). This is demonstrated by a mean age of 32.9 years (SD = 13.0 years), a majority of whom are young (29.6% aged 22 years or younger) and require proactive health education. Analysis of gender distribution shows higher proportion of females (62.8%) than of males (37.2%) and may imply the need for targeted health interventions. Notably, single (50.3%) and married (46.5%) participants are most, respectively, endorsing the need for educational programs tailored towards the different relational status of individuals. Educationally, the population is extremely prostate in bachelor degree holders (56.4%), arguably providing a decent foundation for effective health communication. Sadly 99.3% of participants have heard of DM, yet only 71.3% have received health education about it.

Table (1): Sociodemographic characteristics of participants (n=443)

Parameter		***No.***	***Percent (%)***
Age	22 or less	131	29.6
(Mean:32.9, STD:13.0)	23 to 29	106	23.9
	30 to 49	130	29.3

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	50 or more	76	17.2
Gender	Female	278	62.8
	Male	165	37.2
Marital status	Single	223	50.3
	Married	206	46.5
	Divorced	8	1.8
	Widowed	6	1.4
Educational level	Primary school	7	1.6
	Middle school	15	3.4
	High school	112	25.3
	Diploma	28	6.3
	University	2	.5
	Bachelor's degree	250	56.4
	Postgraduate degree	26	5.9
	Uneducated	3	.7
Occupation	Student	151	34.1
	Employee	124	28.0
	Health sector employee	2	.5
	Unemployed	91	20.5
	Freelancer	19	4.3
	Housewife	7	1.6
	Retired	49	11.1
Monthly income	Less than 5000	191	43.1
	5000 to 10000	101	22.8
	10000 to 15000	67	15.1
	More than 15000	60	13.5
	I have no income	24	5.4
Have you heard about DM?	No	3	.7
	Yes	440	99.3
If (YES), what is your source? *	Social media	266	60.0
	Health care workers	218	49.2
	Friends or relatives	334	75.4
	Others	88	19.9
Do you have family history of DM?	No	163	36.8
	Yes	280	63.2
Have you received any health education about DM?	No	127	28.7
	Yes	316	71.3

Results may overlap

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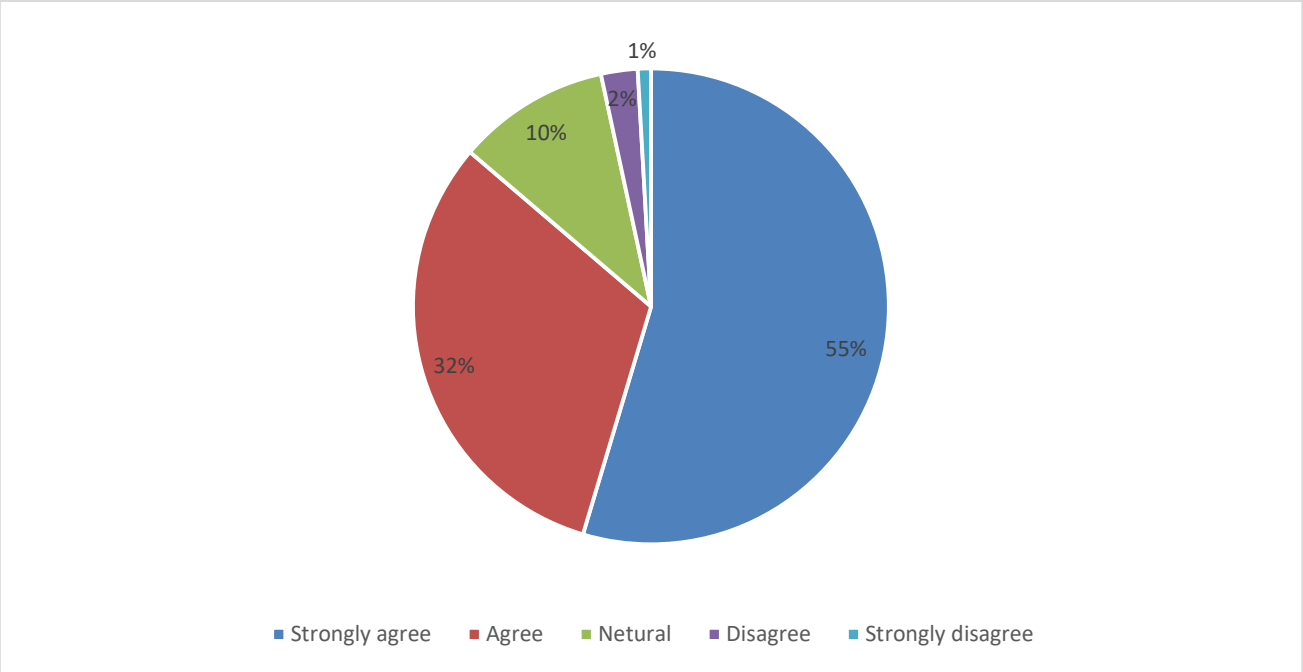
As shown in figure 1, As presented in the data regarding the sentiment toward diabetes test in total of 443 participants, there is no doubt to have a wide awareness as well as an alertness toward testing for diabetes, a commonly known health disorder. A substantial majority (242 respondents or about 54.5 percent) strongly agree that diabetes should be tested, an additional 140 (or 30.9 percent) agree and together they account for 86.4 percent saying diabetes should be tested. The type of agreement they have reached is a proactive approach towards personal responsibility towards their health management in an era where diabetes rate is growing very much anywhere in the world. Instead, very few of the participants disagreed with the need for testing and only 11 (2.5%) disagreed; and only 4 (0.9%) disagreed strongly. In addition, 46 people (10.4%) were neutral, probably indicative of a potential target of education to increase awareness and knowledge about the need for diabetes test as an integral part of preventive care.

Figure (1): Illustrates if it is necessary to be tested for diabetes among participants.



In Table (2), we have presented data based on a comprehensive assessment of knowledge on diabetes mellitus among a sample of 443 individuals. Overall, our findings are a commendable awareness of key diabetes definitions, with a large majority identifying that diabetes is defined by lacking sufficient insulin production (66.1%) and ineffective insulin response (67.0%). However, while only 45.6% realized that diabetes can affect many systems of the body. The risk factors identified emphasize the importance of obesity (and the role of genetic predisposition)—88.5% acknowledge, 83.1% genetic predisposition. Most reports of symptoms were of frequent urination (84.7%), elevated blood sugar levels (75.8%) but a large segment found it difficult to know if they had symptoms such as extreme hunger (46.7%) and persistent weakness (46.3%). Particularly, healthy dietary habits (85.6%) and regular physical exercise (79.7%) were well understood, and it was also understood that control and

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management strategies were well understood. However, education concerning prevention, as well as about complications with kidney failure (59.8%) and heart disease (48.3%), still seems to be lacking.

Table (2): Parameters related to knowledge regarding diabetes mellitus (n=443).

Parameter		***No.***	***Percent (%)***
What is DM? *	DM occurs when the body produces too little insulin.	293	66.1
	DM is when the body does not respond to insulin properly.	297	67.0
	DM is characterized by elevated blood sugar levels.	266	60.0
	DM can affect any part of the body.	202	45.6
What factors increase the risk of developing DM? *	Advanced age	241	54.4
	Genetics or family history	368	83.1
	Obesity or overweight	392	88.5
	Pregnancy	198	44.7
	Sedentary life style	291	65.7
	Lack of exercise	228	51.5
What are the symptoms and signs of diabetes mellitus? *	Frequent urination	375	84.7
	Intense thirst	319	72.0
	Extreme hunger	207	46.7
	Weight loss	250	56.4
	Elevated blood sugar levels	336	75.8
	Blurred vision	299	67.5
	Cuts and wounds that heal slowly	322	72.7
	Persistent weakness	205	46.3
Ways to Control and Manage Diabetes Mellitus? *	Insulin administration	349	78.8
	Prescription medications	315	71.1
	Regular physical exercise	353	79.7
	Healthy dietary habits	379	85.6
	Periodic eye check-ups	220	49.7
	Foot care and monitoring	252	56.9
	Weight management	282	63.7
What are the Potential Complications of Diabetes? *	Vision problems or blindness.	354	79.9
	Kidney failure	265	59.8
	Heart failure	214	48.3
	Stroke or other brain diseases.	229	51.7
	Amputation of limbs	326	73.6

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Results may overlap

As shown in figure (2) in the data presented here, a total of 443 respondents were asked to determine the level of importance of sugar intake avoidance as part of the screening and treatment for diabetes. A great majority, equal to 292 people or 66 percent of the respondents, agree on point that minimising sugar consumption plays a major role in diabetes management. In addition, 96 participants, or 22 percent, say they agree with the statement about this public health issue, meaning that there is a robust consensus among most participants. On the other hand, 38 of the respondents (approximately 9%) remain neutral, 10 participants (approximately 2%) disagree, and 7 respondents (1.5%) strongly disagree.

Figure (2): Illustrates managing sugar intake and its effect on diabetes among participants.

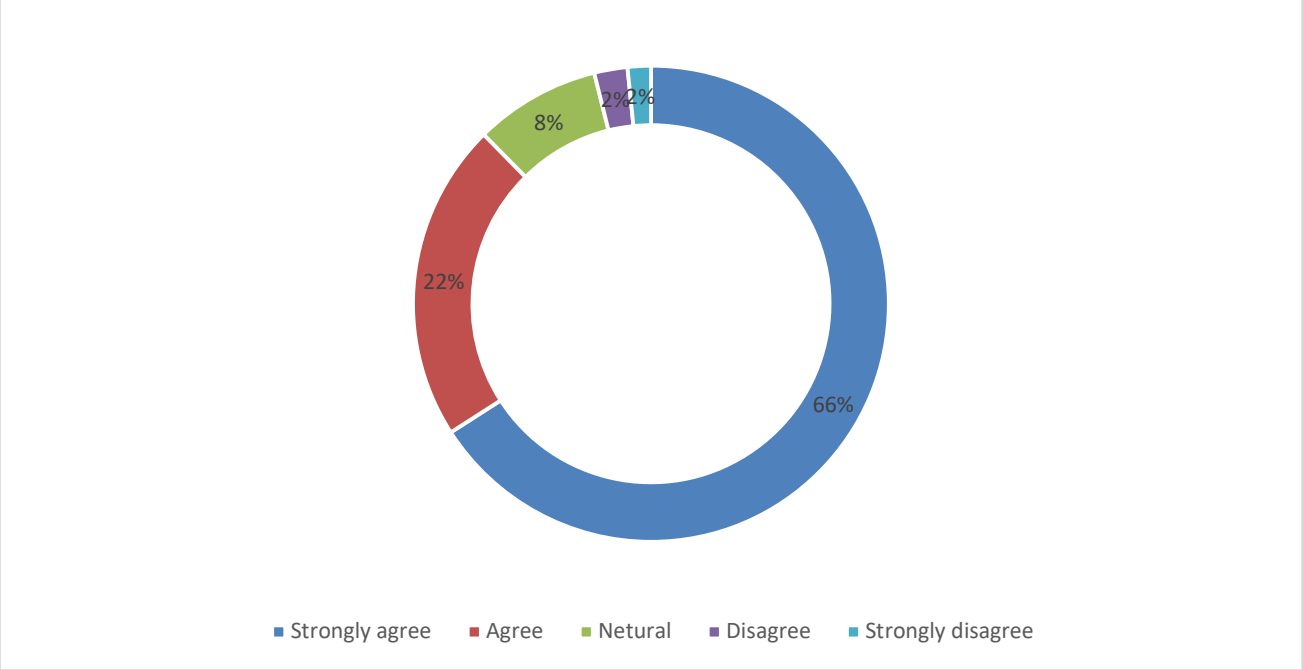

Table 3 reveals several important observations regarding individuals' attitudes and behaviors regarding lifestyle choices to prevent of diabetes, in a sample of 443 people. Bearing testimony to a high level of awareness of the need for early detection, 54.6% and 31.6% expressed strong agreement and strong consensus, respectively, on the significance of testing for diabetes. Similar to this, 57.1% strongly agree in their perceived importance of familial screening. The social dimension in diabetes management is further highlighted by the acknowledgement of the extensive importance of support from family and friends (who are psychologically and emotionally engaged in health management), by 59.6%. The data also widely demonstrates strong agreement on dietary management where 65.9 percent suggest they should avoid excessive sugar intake. Nevertheless, the correlation of these views with the perceptions of diabetes' influence on daily life appears tainted for different views; Only 25.5% strongly agreed that diabetes doesn't make a considerable difference to the marital relationships, indicating that more research on the psychosocial implications is needed. Additionally,

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62.5% knew they needed to keep healthy weight, indicating that there is a link between lifestyle and diabetes management as 55.1% of participants were abstaining from smoking and alcohol drinking.

Table (3): participants' attitude and practice on healthy lifestyle choices for diabetes prevention (n=443).

Parameter		***No.***	***Percent (%)***
I am not concerned if others know that I have diabetes.	Strongly agree	212	47.9
	Agree	82	18.5
	Netural	85	19.2
	Disagree	40	9.0
	Strongly disagree	24	5.4
Do you think it is necessary for you to be tested for diabetes?	Strongly agree	242	54.6
	Agree	140	31.6
	Netural	46	10.4
	Disagree	11	2.5
	Strongly disagree	4	.9
Should family members be screened for diabetes?	Strongly agree	253	57.1
	Agree	124	28.0
	Netural	50	11.3
	Disagree	13	2.9
	Strongly disagree	3	.7
Is support from family and friends crucial for managing diabetes?	Strongly agree	264	59.6
	Agree	126	28.4
	Netural	41	9.3
	Disagree	9	2.0
	Strongly disagree	3	.7
Is it important to avoid excessive sugar intake to manage diabetes?	Strongly agree	292	65.9
	Agree	96	21.7
	Netural	38	8.6
	Disagree	10	2.3
	Strongly disagree	7	1.6
Diabetes does not significantly impact marital relationships.	Strongly agree	113	25.5
	Agree	93	21.0
	Netural	124	28.0
	Disagree	72	16.3
	Strongly disagree	41	9.3
Diabetes does not have a major effect on daily activities	Strongly agree	116	26.2
	Agree	109	24.6

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	Netural	81	18.3
	Disagree	100	22.6
	Strongly disagree	37	8.4
Can regular physical activity help prevent diabetes?	Strongly agree	214	48.3
	Agree	158	35.7
	Netural	58	13.1
	Disagree	8	1.8
	Strongly disagree	5	1.1
Do you discuss the importance of quitting smoking with your healthcare provider?	Strongly agree	264	59.6
	Agree	113	25.5
	Netural	53	12.0
	Disagree	9	2.0
	Strongly disagree	4	.9
Is maintaining a healthy weight important for diabetes management?	Strongly agree	277	62.5
	Agree	128	28.9
	Netural	30	6.8
	Disagree	3	.7
	Strongly disagree	5	1.1
Can well-controlled blood glucose levels prevent complications of diabetes?	Strongly agree	273	61.6
	Agree	129	29.1
	Netural	28	6.3
	Disagree	8	1.8
	Strongly disagree	5	1.1
Do you eat fatty foods?	Very frequent	119	26.9
	Frequent	163	36.8
	Not sure	55	12.4
	Less frequent	102	23.0
	Not at all	4	.9
Do you engage in 30-60 minutes of physical activity each day, such as brisk walking, household chores, or climbing stairs?	Very frequent	109	24.6
	Frequent	136	30.7
	Not sure	68	15.3
	Less frequent	104	23.5
	Not at all	26	5.9
Do you work on maintaining a healthy weight?	Very frequent	142	32.1
	Frequent	144	32.5
	Not sure	80	18.1
	Less frequent	64	14.4
	Not at all	13	2.9

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Do you consume alcohol or smoke tobacco?	Very frequent	71	16.0
	Frequent	56	12.6
	Not sure	32	7.2
	Less frequent	40	9.0
	Not at all	244	55.1
Do you regularly monitor your blood sugar levels?	Very frequent	91	20.5
	Frequent	61	13.8
	Not sure	70	15.8
	Less frequent	105	23.7
	Not at all	116	26.2

Table 4 revealed a significant disparity in the knowledge levels, with only 34.3% of participants demonstrating a high knowledge level, while 41.5% exhibited low knowledge. Additionally, 24.2% of the respondents had a moderate understanding of the disease's risk factors.

Table (4): Shows knowledge of diabetes mellitus disease risk factors score results.

	Frequency	**Percent**
High knowledge level	152	34.3
Moderate knowledge level	107	24.2
Low knowledge level	184	41.5
Total	443	100.0

As shown in table 5, the results indicated that 33.2% of the participants reported a high level of awareness, whereas a substantial 64.8% fell into the moderate awareness category. Remarkably, only 2.0% of respondents showed low awareness regarding diabetes risk factors. These findings highlight a critical concern: while there is a notable proportion of individuals with high awareness and knowledge levels, a substantial 65.5% of participants either possess moderate knowledge (24.2%) or significantly lack knowledge (41.5%).

Table (5): Shows awareness about diabetes mellitus disease risk factors score results.

	Frequency	**Percent**
High level of awareness	147	33.2
Moderate awareness level	287	64.8
Low awareness level	9	2.0
Total	443	100.0

Table (6) shows that knowledge level regarding diabetes mellitus risk factors has statistically significant relation to hearing about DM (P value=0.039) and receiving any health education about DM (P value=0.0001). It also shows statistically insignificant relation to gender, age, marital status, educational

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level, occupation, monthly income and family history of DM. Participants who received health education about DM were found to have higher knowledge level regarding diabetes risk factors.

Table (6): Relation between knowledge level regarding diabetes mellitus risk factors and sociodemographic characteristics.

Parameters		***Knowledge level***		***Total (N=443)***	***P value****
		High or moderate knowledge level	**Low knowledge level**		
Gender	Female	160	118	278	0.613
		61.8%	64.1%	62.8%	
	Male	99	66	165	
		38.2%	35.9%	37.2%	
Age	22 or less	71	60	131	0.273
		27.4%	32.6%	29.6%	
	23 to 29	59	47	106	
		22.8%	25.5%	23.9%	
	30 to 49	85	45	130	
		32.8%	24.5%	29.3%	
	50 or more	44	32	76	
		17.0%	17.4%	17.2%	
Marital status	Single	129	94	223	0.199
		49.8%	51.1%	50.3%	
	Married	124	82	206	
		47.9%	44.6%	46.5%	
	Divorced	5	3	8	
		1.9%	1.6%	1.8%	
	Widowed	1	5	6	
		0.4%	2.7%	1.4%	
Educational level	Primary school	5	2	7	0.777
		1.9%	1.1%	1.6%	
	Middle school	9	6	15	
		3.5%	3.3%	3.4%	
	High school	68	44	112	
		26.3%	23.9%	25.3%	
	Diploma	16	12	28	
		6.2%	6.5%	6.3%	
	University	1	1	2	
		0.4%	0.5%	0.5%	

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	Bachelor's degree	139	111	250	
		53.7%	60.3%	56.4%	
	Postgraduate degree	19	7	26	
		7.3%	3.8%	5.9%	
	Uneducated	2	1	3	
		0.8%	0.5%	0.7%	
Occupation	Student	90	61	151	0.304
		34.7%	33.2%	34.1%	
	Employee	82	42	124	
		31.7%	22.8%	28.0%	
	Health sector employee	1	1	2	
		0.4%	0.5%	0.5%	
	Unemployed	45	46	91	
		17.4%	25.0%	20.5%	
	Freelancer	9	10	19	
		3.5%	5.4%	4.3%	
	Housewife	4	3	7	
		1.5%	1.6%	1.6%	
	Retired	28	21	49	
		10.8%	11.4%	11.1%	
Monthly income	Less than 5000	108	83	191	0.114
		41.7%	45.1%	43.1%	
	5000 to 10000	63	38	101	
		24.3%	20.7%	22.8%	
	10000 to 15000	45	22	67	
		17.4%	12.0%	15.1%	
	More than 15000	34	26	60	
		13.1%	14.1%	13.5%	
	I have no income	9	15	24	
		3.5%	8.2%	5.4%	
Have you heard about DM?	No	0	3	3	0.039
		0.0%	1.6%	0.7%	
	Yes	259	181	440	
		100.0%	98.4%	99.3%	
Do you have family history of DM?	No	90	73	163	0.290
		34.7%	39.7%	36.8%	
	Yes	169	111	280	
		65.3%	60.3%	63.2%	

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Have you received any health education about DM?	No	51	76	127	0.0001
		19.7%	41.3%	28.7%	
	Yes	208	108	316	
		80.3%	58.7%	71.3%	

P value was considered significant if ≤ 0.05.

Table (7) shows awareness and practice regarding diabetes mellitus risk factors has statistically significant relation to family history of DM (P value=0.011) and receiving any health education about DM (P value=0.041). It also shows statistically insignificant relation to gender, age, marital status, educational level, occupation, monthly income and hearing about DM. Participants with positive family history of DM and those received health education about DM were found to have higher awareness and practice level regarding diabetes risk factors.

Table (7): Awareness and practice regarding diabetes mellitus risk factors in association with sociodemographic characteristics.

Parameters		***Awareness and practice level***		***Total (N=443)***	***P value****
		High level of awareness	**Moderate or low awareness level**		
Gender	Female	94	184	278	0.715
		63.9%	62.2%	62.8%	
	Male	53	112	165	
		36.1%	37.8%	37.2%	
Age	22 or less	43	88	131	0.470
		29.3%	29.7%	29.6%	
	23 to 29	30	76	106	
		20.4%	25.7%	23.9%	
	30 to 49	44	86	130	
		29.9%	29.1%	29.3%	
	50 or more	30	46	76	
		20.4%	15.5%	17.2%	
Marital status	Single	67	156	223	0.244
		45.6%	52.7%	50.3%	
	Married	77	129	206	
		52.4%	43.6%	46.5%	
	Divorced	1	7	8	
		0.7%	2.4%	1.8%	
	Widowed	2	4	6	
		1.4%	1.4%	1.4%	

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Educational level	Primary school	0	7	7	0.355
		0.0%	2.4%	1.6%	
	Middle school	2	13	15	
		1.4%	4.4%	3.4%	
	High school	38	74	112	
		25.9%	25.0%	25.3%	
	Diploma	12	16	28	
		8.2%	5.4%	6.3%	
	University	1	1	2	
		0.7%	0.3%	0.5%	
	Bachelor's degree	85	165	250	
		57.8%	55.7%	56.4%	
	Postgraduate degree	8	18	26	
		5.4%	6.1%	5.9%	
	Uneducated	1	2	3	
		0.7%	0.7%	0.7%	
Occupation	Student	47	104	151	0.258
		32.0%	35.1%	34.1%	
	Employee	40	84	124	
		27.2%	28.4%	28.0%	
	Health sector employee	1	1	2	
		0.7%	0.3%	0.5%	
	Unemployed	33	58	91	
		22.4%	19.6%	20.5%	
	Freelancer	2	17	19	
		1.4%	5.7%	4.3%	
	Housewife	3	4	7	
		2.0%	1.4%	1.6%	
	Retired	21	28	49	
		14.3%	9.5%	11.1%	
Monthly income	Less than 5000	63	128	191	0.562
		42.9%	43.2%	43.1%	
	5000 to 10000	29	72	101	
		19.7%	24.3%	22.8%	
	10000 to 15000	22	45	67	
		15.0%	15.2%	15.1%	
	More than 15000	22	38	60	
		15.0%	12.8%	13.5%	

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	I have no income	11	13	24	
		7.5%	4.4%	5.4%	
Have you heard about DM?	No	0	3	3	0.221
		0.0%	1.0%	0.7%	
	Yes	147	293	440	
		100.0%	99.0%	99.3%	
Do you have family history of DM?	No	42	121	163	0.011
		28.6%	40.9%	36.8%	
	Yes	105	175	280	
		71.4%	59.1%	63.2%	
Have you received any health education about DM?	No	33	94	127	0.041
		22.4%	31.8%	28.7%	
	Yes	114	202	316	
		77.6%	68.2%	71.3%	

P value was considered significant if ≤ 0.05.

Discussion:

The purpose of this present study was to determine the degree of knowledge and awareness on DM and DM risk factors among non-diabetics in Saudi Arabia. Our research finds a troubling gap in knowledge and awareness among participants despite a high level of recognition that diabetes is a health issue.

Of those that have heard of diabetes mellitus (our results show that a majority, 99.3%, have), only 34.3% demonstrate a high level of knowledge about the disease. This finding is consistent with previous research attesting to a similar pattern of high awareness and low knowledge in relation to diabetes among many populations. For example, a study conducted in Pakistan showed that participants felt they knew about diabetes, yet had only 20% of the knowledge required to define diabetes risk factor and complications [13]. Research in Nepal found that diabetic patients were aware of disease but had little knowledge about treatment and complications of the disease [14]. These studies underscore a common theme: Knowledge that accompanies awareness is not necessarily comprehensive enough for the effective management and prevention of disease.

In addition, we found that only 71.3% of participants had been informed on health education related to diabetes. It is particularly worrying, however, as previous research has demonstrated a clear correlation between health education and better levels of knowledge. For instance, in Rodrigues et al. it was shown that structured diabetes education programs increased patients' understanding of diabetes management and risk factors [15]. Additionally, a quasi experimental study showed marked improvements in the knowledge and self care behaviors of people with diabetes who received diabetes education [16]. They indicate that educational initiatives could play an important role in closing the knowledge gap that we uncovered in our study.

Participants did have notably higher awareness of specific risk factors for diabetes, 88.5 percent recognized obesity as a specific risk factor. Consistent with past studies which have revealed obesity as

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a major risk factor for diabetes in different populations, this finding is. For instance, in India a study found that a notable percentage of participants regarded obesity as the most important risk factor for diabetes [17]. Despite this, our respondents were aware of some of the more common risk factors, though were less well informed of less well publicised symptoms and complications of diabetes such as extreme hunger and persistent weakness recognized by only 46.7% of respondents and 46.3% of respondents respectively. Similarly, the literature emphasises the gap in information regarding less common symptoms of diabetes, as it has been reported that many people are unaware of the entire spectrum of symptoms and complication of diabetes and delayed diagnosis and management [18].

We found, however, that demographic factors like gender, age, marital status and educational level were not significantly related to a person's knowledge of diabetes. Although some studies have reported variations in diabetes knowledge that are related to demographic factors, this finding is contrary to that. For example, a study conducted in Brazil showed women scored higher on knowledge scores related to diabetes than men [18]. Educational attainment also provided a positive influence for diabetes knowledge in Sri Lanka as well [19]. The lack of any significant demographic correlations in our study could be interpreted to indicate that beyond demographic boundaries there may be a need for diabetes education.

The attitudes and behaviors of participants regarding lifestyle choices for diabetes prevention were generally positive, with over half of the respondents recognizing the importance of diabetes testing and familial screening. Consistent with past research which has noted the importance of family support and consciousness in diabetes management, [20]. While there are positive attitudes toward testing and screening, for example, there remains a very important need for actionable knowledge that leads to preventive behavior. Specifically, although 65.9% stated the necessity for restricting sugar intake, such necessity might not translate into a reality in one's daily practices. A number of authors note this gap between what is known and practiced in diabetes management, where knowledge is clearly present, but practices vary with individuals failing to translate knowledge to effective self-care behaviors [21].

Our study is limited in terms of limitations and limitations which may not allow findings to be generalized. By using a cross sectional design we are unable to establish causal relationships between knowledge and awareness levels and other variables. In addition, the questionnaire self-reported nature may cause response bias among participants who tend to overestimate their level of knowledge and awareness. Future studies should address longitudinal design and broad recruitment strategies that will increase the validity and reliability of findings.

Conclusion:

We conclude that knowledge and awareness about diabetes mellitus and its risk factors are poor in the Saudi Arabian non diabetic general population. Although diabetes awareness is high, there are also needs for comprehensive knowledge that will assist in disease control and prevention. These results highlight the pressing need for targeted health education campaigns aimed at not only heightening awareness, but also improving knowledge of diabetes risk factors, symptoms, and complications. Eliminating the educational gap related to diabetes will be beneficial to empowering people to initiate proactive steps to lower diabetes prevalence in the population.

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Ethical approval:
After fully explaining the study and emphasizing that participation is optional, each participant gave their informed consent. The information gathered was safely stored and utilized exclusively for study.

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The authors declare no conflict of interest.

Informed consent:
Written informed consent was acquired from each individual study participant.

Data and materials availability:
All data associated with this study are present in the paper.

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