

# Diabetes Mellitus Knowledge, Attitudes, Preventive Practices and Associated Factors Among a Sample of Adult Non-Diabetic Saudi Residents

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**Purpose:** To assess the diabetes mellitus (DM) knowledge, attitudes, preventive practices, and associated factors among a sample of adult non-diabetic Saudi residents.

**Methods:** The present survey was conducted in April-June 2022. People from the general population were invited to participate in the study, and the data were collected using a validated questionnaire.

**Results:** A total of 1207 non-diabetic subjects participated in the study [females 798(66.1%) and males 409(33.9%)], and the response rate was 80% (1207/1500). Two-thirds (66.86%) of non-diabetic adult community members had good knowledge of DM, 47.8% had positive attitudes, and 62.14% maintained a healthy lifestyle to avoid DM. There was a family history of DM in more than half of the subjects 723(59.9%). Participants who had a direct relative with diabetes scored higher on the knowledge question than those who did not ( $p<0.001$ ). Practice questions responses for preventing DM showed that about 459(38%) were using fatty food less frequently, and only 338(28%) and 153(12.7%) were doing physical activities 30–60 minutes per day frequently and very frequently, respectively. Most participants were smoking tobacco, 890(73.7%), and getting checked their BP, 704(58.3%), very frequently. The participants with a master's and Ph.D. degree were likelier to have positive attitudes and good practices than students. Individuals with a history of DM in their families were 2.10 times ( $OR=2.10$ ,  $p<0.001$ ), 1.95 times ( $OR=1.95$ ,  $p<0.001$ ), and 2.03 times ( $OR=2.03$ ,  $p<0.001$ ) more likely to be knowledgeable, had positive attitudes and good practices than those with no DM in their family, respectively.

**Conclusion:** Over half of the individuals possessed a positive mindset, adequate knowledge, and good practicing behavior for preventing DM. Having Master's and Ph.D. degrees and a family history of DM were associated with a positive attitude and good practices. There is a need to expand community awareness campaigns utilizing social media channels.

**Keywords:** knowledge, attitude, practice, adult non-diabetic, community awareness, diabetes mellitus

## Introduction

Westernization of dietary patterns in the Kingdom of Saudi Arabia (KSA) has negatively affected the residents' health. It has increased the frequency of overweight and obesity among the younger generation, which is considered a significant contributing factor in the development of DM.<sup>1,2</sup> DM is among the most prevalent non-communicable diseases (NCDs) threatening the world irrespective of geography, nationality, color, race, and gender.

Diabetes is frequent in KSA, which ranks second in the Middle East and seventh worldwide. There are around seven million individuals with diabetes and three million pre-diabetes in KSA.<sup>3</sup> Prediabetes, a precursor to diabetes, affects 88 million people over 18 years, and nine out of ten people are unaware that they have prediabetes.<sup>4</sup> According to

estimates, DM was one of the top 10 causes of mortality for adults worldwide in 2017 and resulted in four million fatalities.<sup>5</sup> Of those with diabetes, one in two (50%) are unaware that they have the disease.<sup>6</sup>

A recent study reported prevalence of obesity and overweight among Saudi residents is 23% and 33%, respectively<sup>7</sup> that is alarming. They also reported fewer sleeping hours, more sedentary activities, and the use of more fizzy drinks. All of these have been linked to the progression of DM.<sup>8,9</sup> As being overweight and obese are two major risk factors for T2DM, KAP studies are more important for designing effective preventive strategies in such a population. Therefore, it is necessary to investigate what non-diabetic individuals know and think about DM. Moreover, educating the masses can avoid or delay DM and its complications.<sup>10</sup>

Chronic DM comorbidities, which substantially impact diabetic individuals' quality of life, can be avoided with proper DM education. Individuals' knowledge regarding DM may help identify their DM risk, urge them to get the treatment they need and motivate them to take care of their health.<sup>11</sup> Adequate DM knowledge improves life quality and prevents complications and may help with diabetes management, complications prevention, and diabetes development in those at risk.<sup>12</sup> However, ignorance increases DM risk.<sup>13</sup>

Several studies assessed the KAPs of non-diabetic individuals in KSA<sup>14–16</sup> and stated variable results. The assessment of non-diabetic individuals' awareness of the most common endocrinal problem in the world and its associated factors would provide baseline information on how the non-diabetic individual perceive DM, its risk factors, signs and symptoms, control and management and complications. It also describes their attitude about DM screening, avoidance of excessive use of sugar, the importance of physical activities and consumption of fatty food. Abundant literature is available for diabetic people about physical activities and dietary patterns, but less literature is known about the prevention of diabetes for non-diabetic individuals. Such type of studies not only helps to explore non-diabetic individuals' awareness of DM but also their misconceptions.

The KAP investigations provide baseline information on the topic. We may identify gaps between knowledge and practices for establishing management plans and implementing prompt measures to lessen the strain on the healthcare system. Such type of research not only serves to reduce the occurrence of the illness but also its complications. Furthermore, to establish future health policies, services, and communication campaigns, it is necessary to understand people's diabetes awareness, attitudes, and perceptions. Therefore, the study objectives were to assess the DM knowledge, attitudes, preventive practices, and associated factors among a sample of adult non-diabetic Saudi residents.

## Materials and Methods

The present cross-sectional survey was carried out at the Faculty of Medicine, Rabigh, King Abdulaziz University in Jeddah, KSA in April-June 2022. The researchers invited people from the general population to participate. People of both genders above the age of 18 were included. Those with DM, severe illness, and physically inactive were excluded. The bioethical unit of King Abdulaziz University Jeddah provided ethical approval (Reference No. 286-22). The independent variables in the current study were gender, nationality, marital status, educational level, monthly income, and family history of DM, while the dependent variables were DM knowledge, attitude toward DM, and preventive practices.

An online questionnaire was used to collect the data. The questionnaire link was sent via social media like Twitter, WhatsApp, and Facebook. The first part of the questionnaire was related to the consent and all study participants provided consent prior to the start of the survey. They could proceed if they agreed to the study objectives, non-diabetic and wanted to participate voluntarily.

The sample size was computed on a sample size calculator by Raosoft Incorporation. After employing a 5% margin of error, a 95% confidence level, and a 50% response rate, the sample size needed to reach appropriate statistical power was 383. However, looking at the nature of the study and people's non-participation in such studies, the sample size was increased to get the desired results. Selection bias, information bias, and confounding bias are the three most common biases. To avoid selection bias, we included the question "Are you diabetic?" in our online questionnaire, with the response options "Yes" or "No". If the participants answered yes, they could not proceed. We used an already tested and validated questionnaire to overcome the information bias. There are usually no significant confounders in this type of study.

A total of 1500 participants were invited to participate in this survey, and 1207 non-diabetic individuals returned completed questionnaires with an 80% response rate. The participants were chosen using the convenience sampling technique. We used an already validated questionnaire that has been translated and used in KSA previously,<sup>15</sup> and its reliability was 0.75 (Cronbach's alpha). Originally, the present questionnaire was developed by Kassahun and Mekonen.<sup>17</sup>

The validated questionnaire contained three knowledge, attitudes, and practices sections. "The scoring of the knowledge questions was done as  $\leq 50\%$  score = not knowledgeable,  $>50\%$  score = knowledgeable. For the attitude, scoring was done as correct answer = 1 score, incorrect (No) = minus score, unsure = 0 scores. The plus score was considered positive, while the 0 or minus score was considered negative. The practice questions were coded as correct (yes) answer = 1 score, incorrect (No) = zero scores, unsure = 0 scores, and  $>50\%$  score were considered good".<sup>15</sup>

## Statistical Analysis

Data were analyzed on SPSS version 26. For each variable, the frequency and percentages were calculated. The Chi-square test was performed to compare various variables. The binary logistic regression analysis assessed the relationship between DM knowledge, attitude, practice scores, and other variables. The p-values below 0.05 were deemed significant.

## Results

A total of 1207 non-diabetic subjects participated in the study [females 798(66.1%) and males 409(33.9%)]. The mean age and BMI were  $27.68 \pm 10.9$  and  $23.49 \pm 5.10$ , respectively. There was a family history of DM in more than half of the subjects, 723(59.9%) (Table 1).

Two-thirds (66.86%) of non-diabetic adult community members had a good knowledge of DM, 47.8% had positive attitudes, and 62.14% maintained a healthy lifestyle to avoid DM. Participant responses varied widely in distinct groups, such as knowledgeable and not knowledgeable ( $p < 0.001$ ), positive and negative attitudes ( $p = 0.03$ ), and good and poor practices ( $p < 0.001$ ) (Figure 1).

Table 2 depicts the difference between knowledgeable and not knowledgeable participants across different study variables. The participants with a family history of DM (type 1 or type 2) had significantly higher scores than those without a family history of DM ( $p < 0.001$ ).

**Table 1** General Characteristics of the Study Participants (n = 1207)

Demographics	Mean $\pm$ SD	
Age (years)	27.68 $\pm$ 10.9	
Weight in Kg	62.02 $\pm$ 14.0	
Height (Cm)	162.54 $\pm$ 10.0	
BMI	23.49 $\pm$ 5.10	
Variables	Frequency	Percent
Gender		
Female	798	66.1
Male	409	33.9
Nationality		
No- Saudi	112	9.3
Saudi	1095	90.7

(Continued)

**Table 1** (Continued).

Marital Status		
Divorced	29	2.4
Married	321	26.6
Single	857	71.0
Educational Level		
Students	616	50.5
Primary	8	0.2
High School	407	7.9
Graduate	95	33.7
Masters	66	0.5
PhD	18	5.5
Family income/month (SR)		
(10,000–15,000)	113	9.4
(15,000–20,000)	78	6.5
(5000–10,000)	156	12.9
Less than 5000	801	66.4
More than 20,000	59	4.9
Do you have family history of DM (type 1 or type 2)?		
Yes	723	59.9
No	484	40.1

**Abbreviation:** BMI, Body mass index.

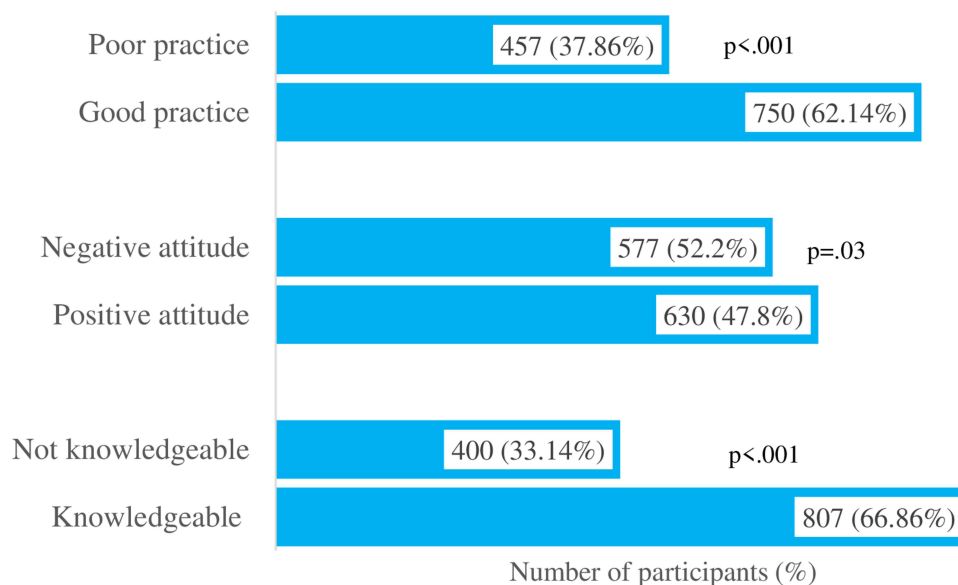
The difference between participants' positive and negative attitude scores, good and poor practice scores, and across different study variables are depicted in [Table 3](#). Participants with a family history of diabetes had significantly higher positive attitude scores and good practice scores than those without a family history of DM ( $p < 0.001$ ).

The frequency distribution of participants' responses of knowledge towards DM showed that 753(62.39%) stated DM is a condition of high blood sugar level, 842(69.76%) said its incurable, and 512(42.2%) considered it a condition of insufficient insulin production. The participants' responses regarding various categories of DM knowledge are shown in [Table 4](#).

Participants' responses to attitude questions showed that more than two-thirds agreed to DM examination, screening, avoiding too much sugar, preventing DM by physical activity, and maintaining a healthy weight ([Table 5](#)).

Practice questions responses for preventing DM showed that about 459(38%) were using fatty food less frequently, and only 338(28%) and 153(12.7%) were doing physical activities 30–60 minutes per day frequently and very frequently, respectively. The majority of the participants were smoking tobacco, 890(73.7%), and getting checked their BP, 704 (58.3%), very frequently ([Table 6](#)).

The participants with a master's and Ph.D. degree were 2.35 times ( $OR=2.35$ ,  $p=0.036$ ) and 1.91 times ( $OR=1.91$ ,  $p=0.001$ ) likely to have positive attitudes compared to students. Likewise, the participants with a master's and Ph.D. degree were 3.21 times ( $OR=3.21$ ,  $p=0.001$ ), and 3.15 times ( $OR=3.15$ ,  $p=0.028$ ) good practices compared to



**Figure 1** Comparison of participants responses according to knowledgeable and not knowledgeable, positive and negative attitudes and good and poor practices groups.

students. Individuals with a history of DM in their families were 2.10 times (OR=2.10,  $p<0.001$ ) more likely to be knowledgeable than those with no family history. Similarly, such individuals have 1.95 times (OR=1.95,  $p<0.001$ ) positive attitudes and 2.03 times (OR=2.03,  $p<0.001$ ) more good practices than those with no family history of DM (Table 7).

**Table 2** Difference Between Knowledgeable and Not Knowledgeable Participants Scores Across Different Study Variables (N = 1207)

Demographics	Knowledgeable (n=807)	Not Knowledgeable (n=400)	P-value
Age (years)			
=<35	641(79.4)	320(80)	0.817
>35	166(20.6)	80(20)	
Gender			
Female	542(67.2)	256(64)	0.275
Male	265(32.8)	144(36)	
Nationality			
No- Saudi	75(9.3)	37(9.3)	0.980
Saudi	732(90.7)	363(90.7)	
Marital Status			
Divorced	18(2.2)	11(2.8)	0.734
Married	219(27.1)	102(25.5)	
Single	570(70.6)	287(71.8)	

(Continued)

**Table 2** (Continued).

Demographics	Knowledgeable (n=807)	Not Knowledgeable (n=400)	P-value
Educational level			
Students	408(50.6)	202(50.5)	0.437
High School	270(33.5)	137(34.3)	
Graduate	67(8.3)	28(7)	
Masters	44(5.5)	22(5.5)	
PhD	12(1.5)	6(1.5)	
Monthly income (SR)			
(10,000–15,000)	73(9)	40(10)	0.918
(15,000–20,000)	52(6.4)	26(6.5)	
(5000–10,000)	102(12.6)	54(13.5)	
Less than 5000	538(66.7)	263(65.8)	
More than 20,000	42(5.2)	17(4.3)	
Do you have family history of DM (type 1 or type 2)?			
Yes	532(65.9)	191(47.8)	<0.001*
No	275(34.1)	209(52.2)	

Note: \*p is significant (p<0.05).

**Table 3** Difference Between Participants' Positive and Negative Attitude Scores, Good and Poor Practice Scores Across Different Study Variables (N = 1207)

Demographics	Attitude		P-value	Practice		P-value
	Positive Attitude (n=630)	Negative Attitude (n=577)		Good Practice (n=750)	Poor Practice (n=457)	
Age (years)						
=<35	494 (78.4)	467 (80.9)	0.277	595 (79.3)	366 (80.1)	0.752
>35	136 (21.6)	110 (19.1)		155 (20.7)	91 (19.9)	
Gender						
Female	419 (66.5)	379 (65.7)	0.763	503 (67.1)	295 (64.6)	0.371
Male	211 (33.5)	198 (34.3)		247 (32.9)	162 (35.4)	
Nationality						
No- Saudi	50 (7.9)	62 (10.7)	0.093	63 (8.4)	49 (10.7)	0.177
Saudi	580 (92.1)	515 (89.3)		687 (91.6)	408 (89.3)	

(Continued)

**Table 3** (Continued).

Demographics	Attitude		P-value	Practice		P-value
	Positive Attitude (n=630)	Negative Attitude (n=577)		Good Practice (n=750)	Poor Practice (n=457)	
Marital Status						
Divorced	15 (2.4)	14 (2.4)	0.623	18 (2.4)	11 (2.4)	0.829
Married	175 (27.8)	146 (25.3)		204 (27.2)	117 (25.6)	
Single	440 (69.8)	417 (72.3)		528 (70.4)	329 (72.0)	
Educational level						
Students	325 (51.6)	285 (49.4)	0.576	382 (50.9)	228 (49.9)	0.44
High School	206 (32.7)	201 (34.8)		247 (32.9)	160 (35)	
Graduate	50 (7.9)	45 (7.8)		62 (8.3)	33 (7.2)	
Masters	34 (5.4)	32 (5.5)		43 (5.7)	23 (5)	
PhD	9 (1.4)	9 (1.6)		10 (1.3)	8 (1.8)	
Monthly income (SR)						
(10,000–15,000)	61 (9.7)	52 (9)	0.963	70 (9.3)	43 (9.4)	0.999
(15,000–20,000)	41 (6.5)	37 (6.4)		48 (6.4)	30 (6.6)	
(5000–10,000)	84 (13.3)	72 (12.5)		96 (12.8)	60 (13.1)	
Less than 5000	412 (65.4)	389 (67.4)		499 (66.5)	302 (66.1)	
More than 20,000	32 (5.1)	27 (4.7)		37 (4.9)	22 (4.8)	
Do you have family history of DM (type 1 or type 2)?						
Yes	425 (67.5)	298 (51.6)	<0.001*	498 (66.4)	225 (42.9)	<0.001*
No	205 (32.5)	279 (48.4)		252 (33.6)	232 (50.8)	

**Notes:** The table format and questions have been adapted from a previously published study by Kassahun CV, Mekonen AG. Knowledge, attitude, practices and their associated factors towards diabetes mellitus among non diabetes community members of Bale Zone administrative towns, South East Ethiopia. A cross-sectional study. *PLoS One*. 2017;12:e0170040.<sup>17</sup> \*p is significant (p<0.05).

**Table 4** Frequency Distribution of Participants' Response of Knowledge Towards Diabetes Mellitus (n = 1207)

Knowledge Questions	Responses					
	Yes		No		Do Not Know	
What is/are DM	Frequency	%	Frequency	%	Frequency	%
DM is a condition of insufficient insulin production	512	42.42	265	21.96	430	35.63
DM is a condition of the body which not respond to insulin	654	54.18	132	10.94	421	34.88
DM is a condition of a high level of sugar in the blood	753	62.39	211	17.48	243	20.13
DM is not curable	842	69.76	250	20.71	115	9.53
DM is a disease that affects any part of the body	749	62.05	188	15.58	270	22.37

(Continued)

**Table 4** (Continued).

Knowledge Questions	Responses					
	Yes		No		Do Not Know	
What is/are DM	Frequency	%	Frequency	%	Frequency	%
What are the risk factors for DM						
Older age	712	58.99	265	21.96	230	19.06
Genetic or family history of diabetes mellitus	603	49.96	361	29.91	243	20.13
Being overweight /Obesity	810	67.11	119	9.86	278	23.03
Pregnancy	542	44.90	214	17.73	451	37.37
Sedentary lifestyle	555	45.98	365	30.24	287	23.78
Poor dietary habits	922	76.39	127	10.52	158	13.09
Not getting enough exercise can predispose to diabetes	623	51.62	269	22.29	315	26.10
Signs and symptoms of DM		0.00		0.00	1207	100.00
Frequent urination	651	53.94	122	10.11	434	35.96
Excessive thirst	569	47.14	255	21.13	383	31.73
Excessive hunger	256	21.21	365	30.24	586	48.55
Weight loss	351	29.08	456	37.78	400	33.14
High blood sugar	514	42.58	325	26.93	368	30.49
Blurred vision	663	54.93	411	34.05	133	11.02
Slow healing of cuts and wounds	561	46.48	319	26.43	327	27.09
Feeling of weakness	822	68.10	254	21.04	131	10.85
Control and management of DM is possible by						
Insulin injection	541	44.82	452	37.45	214	17.73
Tablets	488	40.43	446	36.95	273	22.62
Regular Exercise	652	54.02	421	34.88	134	11.10
Practices healthy diet	523	43.33	362	29.99	322	26.68
Regular eye checkups and care	451	37.37	321	26.59	435	36.04
Regular feet and toes medical checkups and care	321	26.59	259	21.46	627	51.95
Weight reduction	259	21.46	361	29.91	587	48.63
DM can cause						
Eye problems or even blindness	553	45.82	332	27.51	322	26.68
Kidney failure	652	54.02	442	36.62	113	9.36
Heart failure	521	43.16	310	25.68	376	31.15
Brain diseases like Stroke	361	29.91	442	36.62	404	33.47
Amputation of limb	349	28.91	320	26.51	538	44.57

**Notes:** The table format and questions have been adapted from a previously published study by Kassahun CW, Mekonen AG. Knowledge, attitude, practices and their associated factors towards diabetes mellitus among non diabetes community members of Bale Zone administrative towns, South East Ethiopia. A cross-sectional study. *PLoS One*. 2017;12:e0170040.<sup>17</sup>



**Table 5** Frequency Distribution of Participants' Response to Attitude Questions Towards Diabetes Mellitus (n = 1207)

Attitude Questions	Responses					
	Agree		Disagree		Neutral	
	Frequency	%	Frequency	%	Frequency	%
Do you think that you should be examined for DM?	800	66.3	118	9.8	289	23.9
Do you think family members should be screened for DM?	899	74.5	59	4.9	249	20.6
Do you think we should avoid consuming too much sugar to control DM?	979	81.1	37	3.1	191	15.8
DM is not seriously affecting the marital relationship.	301	24.9	388	32.1	518	42.9
I do not think DM seriously affects daily activities.	307	25.4	519	43.0	381	31.6
Do you think physical activity can prevent the risk of DM?	907	75.1	39	3.2	261	21.6
Do you think maintaining a healthy weight is important in managing diabetes?	1035	85.7	23	1.9	149	12.3

**Notes:** The table format and questions have been adapted from a previously published study by Kassahun CW, Mekonen AG. Knowledge, attitude, practices and their associated factors towards diabetes mellitus among non diabetes community members of Bale Zone administrative towns, South East Ethiopia. A cross-sectional study. *PLoS One*. 2017;12:e0170040.<sup>17</sup>

**Table 6** Frequency Distribution of Participants' Response to Practice Questions Regarding Diabetes Mellitus (n = 1207)

Practice Questions	Responses									
	Not at All	%	Less Frequent	%	Not Sure	%	Frequent	%	Very Frequent	%
Do you consume fatty foods?/	145	12	459	38	237	19.6	320	26.5	46	3.8
Do you do 30–60 mins physical activity daily? Eg, Brisk walking, house activities, climbing stairs.	208	17.2	290	24	218	18.1	338	28	153	12.7
Do you try to maintain a healthy weight?	385	31.9	354	29.3	223	18.5	156	12.9	89	7.4
Do you smoke tobacco?	77	6.4	94	7.8	74	6.1	72	6	890	73.7
Do you check your blood sugar regularly?	48	4	74	6.1	128	10.6	253	21.0	704	58.3

**Notes:** The table format and questions have been adapted from a previously published study by Kassahun CW, Mekonen AG. Knowledge, attitude, practices and their associated factors towards diabetes mellitus among non diabetes community members of Bale Zone administrative towns, South East Ethiopia. A cross-sectional study. *PLoS One*. 2017;12:e0170040.<sup>17</sup>

**Table 7** Binary Logistic Regression Predicting Diabetes Mellitus-Related Knowledge, Attitudes, and Practices Among Study Participants (N = 1207)

Variables	Responses	Knowledge vs Demographics		Attitude vs Demographics		Practices vs Demographics	
		P-value	Odds Ratio	P-value	Odds Ratio	P-value	Odds Ratio
Gender	Male		Reference		Reference		Reference
	Female	0.418	0.897	0.961	1.006	0.587	0.932
Nationality	Non-Saudi		Reference		Reference		Reference
	Saudi	0.873	1.035	0.069	1.458	0.140	1.360

(Continued)

**Table 7** (Continued).

Variables	Responses	Knowledge vs Demographics		Attitude vs Demographics		Practices vs Demographics	
		P-value	Odds Ratio	P-value	Odds Ratio	P-value	Odds Ratio
Marital status	Single		Reference		Reference		Reference
	Married	0.714	1.159	0.837	0.923	0.811	0.908
	Divorced	0.290	0.842	0.391	0.877	0.382	0.871
Education level	Students		Reference		Reference		Reference
	High School	0.023*	1.563	0.223	0.621	0.541	0.521
	Graduate	0.564	0.984	0.447	0.321	0.851	0.555
	Masters	0.361	0.756	0.036*	2.356	0.001*	3.214
	PhD	0.514	0.884	0.001*	1.911	0.028*	3.156
Monthly income (SR)	<5000		Reference		Reference		Reference
	5000–10,000	0.426	1.331	0.964	1.015	0.935	1.028
	10,001–15,000	0.520	1.280	0.722	1.134	0.787	1.104
	150,001–20,000	0.468	1.282	0.992	1.003	0.926	1.031
	>20,000	0.838	1.066	0.967	1.012	0.720	0.901
Do you have family history of DM (type 1 or type 2)?	No		Reference		Reference		Reference
	Yes	<0.001*	2.105	<0.001*	1.950	<0.001*	2.036
Positive attitude		0.565	0.951				
Good practice		0.696	0.882	0.551	0.741		

**Note:** \*p is significant (p<0.05).

## Discussion

According to this community-based survey, two-thirds (66.86%) of non-diabetic adult community members had a favorable knowledge of DM, 47.8% had positive attitudes, and 62.14% maintained a healthy lifestyle to avoid DM. Our KAP results are similar to other studies<sup>17,18</sup> while different from several other studies.<sup>19–21</sup> The difference in the percentage of knowledge can be attributed to a variation in the analysis's score, the number of items utilized to measure knowledge, sociocultural traits, and the use of the different questionnaires. Among study participants, responses were better in several questions regarding DM knowledge than in an Ethiopian study.<sup>17</sup> A study reported moderate knowledge among healthy adults regarding DM, while the attitude and practices were good and poor, respectively.<sup>22</sup> An Indian study reported adequate DM knowledge among study participants, while their attitude and practices toward DM prevention were not good.<sup>23</sup> The disparity in results may be attributed to educational level differences. The literacy rate in KSA is 99.38%,<sup>24</sup> which is substantially higher than in several other countries and could be one of the causes for superior knowledge among our study participants.

In the current study, less than half of the participants had positive attitudes, while two-thirds practiced good DM-avoidance behavior. This contrasts with the fact that fewer people had positive attitudes than those who demonstrated good practicing behavior. In most cases, the attitude is mirrored in practice. One plausible explanation is that

approximately half of the study participants were students, and the younger generation is more physically active and goes to gyms to stay fit and healthy. According to a recent Ethiopian study, two-thirds of the participants were knowledgeable about DM, nearly half had positive attitudes, and one-third had good practicing behavior.<sup>25</sup> This study's KAP results were favorable because 89% of study participants had a family history of diabetes and 6% had diabetes.

Our study results regarding participants with a family history of DM concur with a few other studies.<sup>26,27</sup> In our study, about 60% of the participants had a family history of DM, which is a much higher percentage than in a few other studies.<sup>22,28</sup> The greater incidence of diabetes in SA could be one factor for the higher frequency of diabetes in the family. In contrast to our study, one study found that 89% of study participants had a family history of diabetes.<sup>25</sup> This is the highest percentage of participants with a family history of diabetes reported in the literature. The authors did not explain the high percentage of diabetes in the family, despite the fact that the overall DM prevalence in Ethiopia is around 6.5%.<sup>29</sup> The reason could be a small size (less than 400), and selection criteria.

In the current study, participants with a family history of DM were likelier to have better knowledge, positive attitudes, and good preventive practices than those without DM family history. Our results are like another Saudi study.<sup>15</sup> These results were expected because they had someone with the disease in the family and found them having various food restrictions and not enjoying the religious and non-religious festivities. Their celebrations on different occasions were generally limited due to their DM problems.<sup>30</sup> As a result, their implicit knowledge and attitude towards diabetes, as well as prevention strategies, improved compared to individuals who did not have a DM member in their family. Another reason could be that they want to take diligent care of their loved ones; therefore, they educate themselves on diabetes. According to Karim and Habib (2022), having a close friend or family member who has diabetes can pique a person's interest in learning more about the disease.<sup>31</sup>

Most participants had good preventive practices. Our study results are higher than a Kenyan study<sup>32</sup> because Kenyan comprised both urban and rural communities, each with a varied level of knowledge. In contrast to the present study results, a Pakistani study reported that self-care in the form of a yearly checkup by the physician, monitoring their body weights, avoiding tobacco, taking adequate sleep, and doing moderate exercise was not up to the mark among students.<sup>33</sup>

Similar to our results, no gender-wise differences have been reported in participants knowledge by various studies.<sup>23,34,35</sup> Unlike our findings, a Saudi study reported better knowledge scores among females than males and a significant association of the feminine gender with knowledge and attitude.<sup>15</sup> Pakistani and Bangladeshi studies have reported higher knowledge among men than women.<sup>18,36</sup> The lack of gender differences could be explained by the fact that males and females have more than 90% literacy rate and equal access to knowledge resources.

The present study found that master's and Ph.D. degree holders were likelier to have positive attitudes and good practices for averting DM. These results are understandable because people with higher qualifications generally have better attitudes and practices for preventing communicable and non-communicable diseases. Because of their education, they have more awareness and access to knowledge. Another reason could be that people with lower levels of education may be less able to read and comprehend the information they encounter.

Our results are similar to another study that explained patients with higher levels of education are more likely to acquire diabetes-related informative resources such as brochures and manuals.<sup>17</sup> Additionally, they have better time management skills and give time to themselves by performing physical activities and excursions. They can also easily interact with medical professionals if they have questions.<sup>17</sup>

Our study showed that monthly income did not significantly correlate with good knowledge and positive attitude; these results are incompatible with a few other studies showing that better knowledge was associated with higher income.<sup>20,28,37</sup> For this result, we do not have an appropriate explanation.

Our results did not find an association between age and DM knowledge similar to a Qatari study.<sup>38</sup> In contrast to our findings, Austrian, Gambian and Saudi studies found that older people have better DM knowledge than younger people.<sup>39-41</sup> Our results found that good knowledge, positive attitudes, and good practice scores were not associated with each other. These results are similar to another Saudi study.<sup>42</sup> They explained this non-association between variables knowledge, attitudes, and practices by stating that because all participants in the survey were non-diabetic individuals, their knowledge and attitudes toward the disease may not have been influenced by personal considerations or worries associated with having DM or deeming they are prone to DM.

The present study results showed that there is still a need to work more to enhance common peoples' DM knowledge. More public awareness about any disease could help to reduce its prevalence. Diabetes education focusing on amendable risk factors is more valuable than pharmacological therapies for the disease.<sup>38</sup> Adequate knowledge, optimism, and proactive commitment to healthy behavior are the foundations of preventive and early intervention to combat the diabetes epidemic.<sup>38</sup>

There is a need to start a campaign on social media regarding DM prevention strategies. Booklets, pamphlets, and flyers should be distributed among the masses to increase their awareness regarding this silent but dangerous disease. Universities and medical schools should hold small camps and awareness seminars in big shopping malls, along the corniche, and in schools and colleges to educate students and the general public about the importance of maintaining healthy body weight, quitting smoking, getting regular exercise, having their blood sugar and blood pressure checked regularly, and avoiding fast food.<sup>43</sup> There is a need to initiate community awareness campaigns by involving the community and local religious leaders because they have direct contact and influence on the general public, and they can convince them easily to adopt a healthy lifestyle necessary to avoid DM and its consequences.

The present study has a few limitations. Firstly, one issue with questionnaire research is that people tend to choose the "right" answer rather than the one that reflects their real-life knowledge, perspectives, and behavior. Secondly, the online nature of the study was one of the drawbacks and we were unable to reach the participants who did not use social media apps. Thirdly, regarding the KAP of the people residing Makkah region, it's possible that in the other areas, people have different KAP. Therefore, the results cannot be generalized.

## Conclusion

Diabetes prevention is built on knowledge, optimism, and an active commitment to healthy behavior. The present KAP study results are promising because more than half of the participants showed positive attitudes, enough knowledge, and effective behavior toward DM prevention. Diabetes education that addresses risk factors will be more effective. Public awareness of any disease could lower its prevalence. The current study's findings are useful for policymakers in targeting at-risk populations by filling in gaps in information, attitudes, and practices related to DM, an important health issue in KSA. Effective mass campaigns utilizing digital and social media channels should be the emphasis of future efforts to enhance common people's knowledge and educate them.

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## Disclosure

The authors report no conflicts of interest in this work.

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