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ORIGINAL RESEARCH

Knowledge of Diabetes Mellitus and Practices Regarding Lifestyle Factors and Diabetes Management in a General Adult Population of Aseer Region, Saudi Arabia

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Introduction: Many studies report a lack of public awareness of the risk factors and complications of Diabetes Mellitus. Adequate glycemic control is crucial in preventing or delaying the onset of type 2 diabetes complications, and medication adherence is one of the key factors in achieving this goal. This study aimed to measure the knowledge about diabetes mellitus and practices regarding lifestyle factors and diabetes management in the study population in the Aseer region, of Saudi Arabia.

Material and Methods: A descriptive cross-sectional survey was conducted in Abha, a city in the Aseer region of Saudi Arabia. The general population of 18 years of age and above, who were residing in the study area during the period of study, ie, January 2023 to June 2023, were included. The questionnaire was distributed through social media and e-mail for data collection. The descriptive variables were presented using frequency, percentage, and graphs. Pearson's chi-square test was used at a 5% level of significance. Multivariate tests were applied to further explore the findings of univariate analysis. The data were analyzed using SPSS version 20.0.

Results: Out of the total 348 participants, a higher proportion was males (56.3%). About 78.7% of the participants were ever diagnosed with diabetes mellitus and 21.3% were never diagnosed with diabetes mellitus. Nearly 31.6% knew that the major cause of diabetes mellitus was obesity and 31.3% knew that it was a hereditary disease. About 42.2% of respondents exercised regularly and 27.6% were smokers. Adherence to prescribed anti-diabetic medications was seen in 63.2% of the respondents. Self-alterations in the timing and dose of prescribed anti-diabetic drugs were seen in 36.5% and 34.8%, respectively. About 60.1% had a moderate level of self-rated knowledge about Diabetes Mellitus, and 27.6% and 12.4% had good and poor self-rated knowledge levels of Diabetes mellitus, respectively. On multivariate analysis, the age group 60–69 years had significant variations as compared to the other age groups on DM, bachelor's degree holders had significant variations as compared to other education variables, being married had significant differences as compared to those unmarried, those employed had significant variations as compared to the other occupation categories, and smokers had a significant impact on DM as compared to non-smokers.

Conclusion: Findings indicated less number of respondents exercised regularly, low adherence to prescribed anti-diabetic medications and low levels of self-rated knowledge of diabetes mellitus. Enhancing the patients' knowledge of diabetes mellitus and improving their self-management and adherence to its medications is necessary through public health education.

Keywords: adherence, diabetes mellitus, management, aseer region

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Introduction

Diabetes Mellitus (DM) is a complicated disorder that shows the need for therapeutic medicine, self-care management, and therapeutic lifestyle modification to attain good control.[1]

According to the International Diabetes Federation's (IDF) global estimations, there were 463 million adults worldwide with DM in 2019, and if no preventative measures are done, this number will rise to 578 million in 2030 and potentially 700 million in 2045 with a 51% increase.[2] The annual direct healthcare costs of diabetes worldwide, for people in the 20–79 age groups, are estimated to be as much as 286 billion. High economic and social costs of type 2 Diabetes and its ris*in*g prevalence make a compell*in*g case for its prevention.[3] The prevalence of DM in Saudi Arabia has risen tenfold in recent decades, leading to high mortality, poor health and lower quality of life, becoming a significant public health issue.[4] In KSA, the healthcare burden attributable to Diabetes is anticipated to surpass $0.87 billion.[5]

There is a lack of public awareness of the risk factors and complications of Diabetes Mellitus reported in Saudi Arabia. Given that DM is prevalent in Saudi Arabia, it is important to ensure that the community has sufficient knowledge and awareness of this disease to enable further promotion of public health interventions to control its prevalence.[6]

Clinical inertia and medication non-adherence are thought to contribute largely to the suboptimal glycemic control in many patients with type 2 diabetes.[7] Adequate glycemic control is crucial in preventing or delaying the onset of complications connected to type 2 diabetes, and medication adherence is one of the key factors in achieving this goal.[8]

Poor adherence can lead to diabetes complications and high treatment costs, especially if there are long-term complications.[8]

A recent Kathmandu study showed that the major contributing factors for non-adherence to diabetic treatment were due to ignorance of lifestyle modification and unawareness about missed drugs, and very few of them due to lack of information about prescribed medication.[9]

Several factors will influence this poor adherence, similar to age, period of the disease, lack of communicative relationship between the patient and health care providers, health beliefs and perceptions that are incompatible with the recommendations, and socioeconomic factors.[1]

Non-adherence to therapeutic methods could be a serious concern that poses an excellent challenge to the productive delivery of healthcare. Patient non-adherence is not solely restricted to the failure to require medication; however, additionally the failure to create lifestyle changes, endure tests, or keep appointments with physicians. Non-adherent patients, particularly those with chronic illnesses, are additionally at risk of encountering serious difficulties.[10]

Lifestyle and medicine treatments for type 2 diabetes have to be compelled to be reassessed over time to stay the HbA_1C. At identical times, the success of long-maintenance medical care and sensible metabolic management depends for the most part upon the patient's adherence and behavior in terms of keeping appointments, taking medication, and creating lifestyle changes.[6] However, few Saudi Arabian studies have investigated the knowledge about factors that contribute to non-adherence to medication and lifestyle modification among patients with type 2 diabetes. As a result, this study aimed to measure the knowledge about factors that contribute to non-adherence to medication and lifestyle modification among patients with type 2 diabetes among the adult population in the Asir region of Saudi Arabia.

Materials and Methods

A descriptive cross-sectional online questionnaire survey was conducted in Abha, a city in the Aseer region of Saudi Arabia. The general population of 18 years of age and above, who were residing in the study area during the period of study, ie, January 2023 to June 2023, were included. All participants electronic consent was obtained before the commencement of the study, and they were informed about the purpose of the study. The people who refused to participate were excluded from this study. Those aged below 18 years of age and non-residents of the study area were also excluded.

Sample Size

The study sample size was estimated using the Raosoft sample size calculator. The estimated sample size of the study population was calculated using a 50% response distribution, a 5.2% margin of error, and a 95% confidence interval. The estimated sample size was calculated as 348 participants.

Based on the literature review, the researchers constructed a questionnaire for the study to avoid errors in data collection. The questionnaire was further reviewed by subject experts and was disseminated online after developing thorough Google forms for the participants. The questionnaire consisted of close-ended questions constructed both in English and Arabic language. The questionnaire was translated from the English language to the Arabic language (which is the local language) by a bilingual person. This enabled an easy understanding of the study question by local participants of the study and avoided bias.

The questionnaire was distributed through social media and e-mail for the convenience of data collection and to avoid face-to-face interviews, which were more time-consuming than the online survey questionnaire.

A pilot study of 25 individuals was conducted to assess the questionnaire's validity, reliability, applicability, and average filling time before the administration of the final version of the questionnaire. The overall reliability coefficient (α-Cronbach's) was 0.76. The questionnaire contained 30 items. It was divided broadly into 3 sections: 1—demographic information, 2— Knowledge and profile about diabetes, and 3— Patient adherence to drug therapy.

Sampling Technique

The participants were selected by convenience through a call for answers to a wide audience, with subjects answering based on their thoughts.

Informed Consent

The questionnaire started with a brief explanation of the objectives of the study and intended to remind the participants that their participation in the study was entirely their own choice. The names of the participants were not collected, and their identities were kept confidential and anonymous. An electronic version of an informed consent form was obtained from all study subjects.

Ethical Considerations

Ethical approval (ECM#2022-2602) was obtained from the Research Ethics Committee of King Khalid University. Participants were assured that their data would be kept anonymous, confidential, and utilized only for research purposes. The data were kept in a password-protected cloud system for safety purposes. The use of anonymous data in this research project was reviewed and approved by the research ethics committee.

Statistical Analysis

The collected data were coded and then entered into an Excel sheet (Microsoft Office Excel 2010) database. The data were analyzed using SPSS (Statistical Package for Social Sciences), version 20.0 (SPSS, Inc., Chicago, IL, USA). The descriptive variables were presented using frequency, percentage, and graphs as appropriate. Pearson's chi-square test was used at a 5% level of significance. A *p*-value of less than 0.05 was regarded as statistically significant. Multivariate tests were applied to further explore the findings of univariate analysis. We have applied multivariate tests, to further explore the findings of univariate analysis.

Results

As per Table 1, out of 348 respondents, 44.8% were aged between 51 and 59 years, followed by 40.8% belonging to the age group less than or equal to 50 years, 13.5% between 60 and 69 years, and 0.9% were and above 69 years, respectively. Nearly 56.3% had a bachelor's degree, 50.6% were employed, 40.5% were unemployed, 4.0% were retired, 3.7% were students and 1.1% were housewives. A higher proportion (56.3%) was males while 43.7% were females. The majority (78.8%) were married, while the rest were singles.

About 78.7% of the participants were ever diagnosed with diabetes mellitus and 21.3% were never diagnosed with diabetes mellitus (Figure 1).

Table 2 depicts, 49.7% knew symptoms of diabetes mellitus. About 31.6% knew that the major cause of diabetes mellitus was obesity and 31.3% knew that it was hereditary. About 53.4% had adequate knowledge regarding DM

Table 1 Demographic Characteristics of Study Participants

Demographic Characteristics	Frequency	Percent
Age (in years)		
≤50	142	40.8
51–59	156	44.8
60–69	47	13.5
≥ 70	3	0.9
Gender		
Male	196	56.3
Female	152	43.7
Marital Status		
Married	76	21.8
Un Married	272	78.2
Educational Status		
Up to Intermediate	71	20.4
Bachelor	196	56.3
Masters	64	18.4
Doctorate	17	4.9
Employment Status		
Employed	176	50.6
Un Employed	141	40.5
Retired	14	4.0
Student	13	3.7
Housewife	4	1.1
Type of diabetes		
Type 1	42	12.1
Type 2	199	57.2
Gestational DM	26	7.5
Type of diabetes not Known	7	2.0
Never Diagnosed with DM	74	21.3

Abbreviation: DM, Diabetes Mellitus.

medications and 46.6% knew dietary advice regarding control of diabetes mellitus. About 91.4% believed that DM affects the heart, while almost 95% and 93%, respectively, believed that DM affects the eyes and kidneys.

About 42.2% exercised regularly and 27.6% were smokers. Adherence to prescribed anti-diabetic medications was seen in 63.2% of respondents. Self-alterations in the timing and dose of prescribed anti-diabetic drugs were seen in 36.5% and 34.8%, respectively (Table 3).

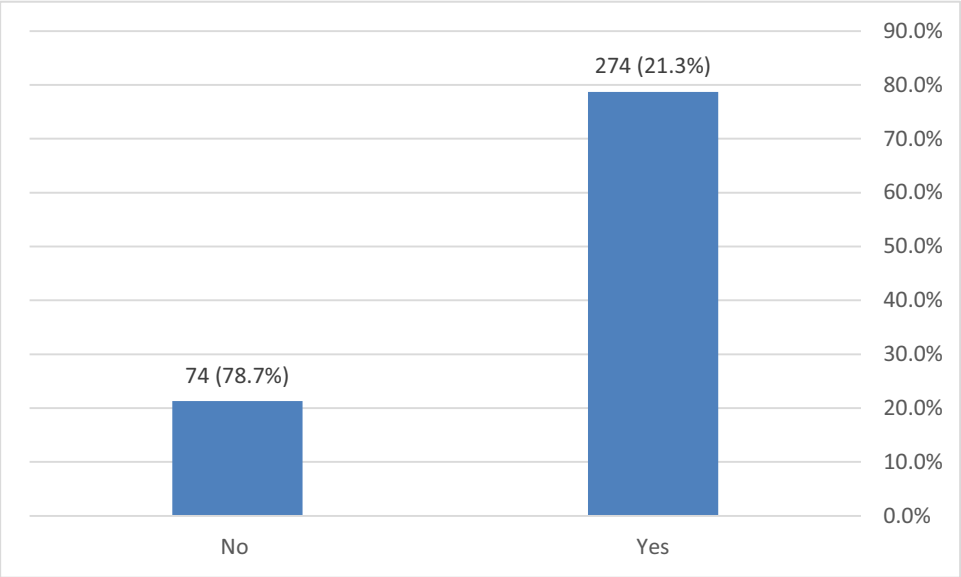

Figure 1 Ever diagnosed with diabetes mellitus.

As per Figure 2, 33% had multiple symptoms, 20% had frequent urination, 15% had increased thirst and 12% had increased hunger.

As per Figure 3, 60.1% had a moderate level of knowledge.

Univariate analysis suggested that all demographical variables, ie age, marital status, education, and employment status (except gender), had a significant relationship with DM prevalence (Table 4).

On multivariate analysis, we observed that the age group 60–69 years had significant variations as compared to the other age groups on DM, bachelor's degree holders had significant variations as compared to other education variables, being married had significant differences as compared to those unmarried, those employed had significant variations as compared to the other occupation categories and smokers had a significant impact on DM as compared to non-smokers (Table 5).

Table 2 Knowledge Regarding Diabetes Mellitus Among Study Participants

Knowledge Regarding Diabetes Mellitus		**Frequency**	**Percent**
Knowledge about Symptoms of Diabetes Mellitus	Yes	173	49.7
	No	101	29.0
	Never diagnosed with DM	74	21.3
Knowledge about the Major Causes of Diabetes Mellitus	Hereditary	109	31.3
	Obesity	110	31.6
	Smoking	105	30.2
	Eating more sugar	24	6.9
Knowledge about Anti-Diabetic Drugs	Yes	186	53.4
	No	88	25.3
	Never diagnosed with DM	74	21.3

(*Continued*)

Table 2 (Continued).

Knowledge Regarding Diabetes Mellitus		Frequency	Percent
Knowledge about Dietary Advice Regarding the Control of Diabetes Mellitus	Yes	162	46.6
	No	112	32.2
	Never diagnosed with DM	74	21.3
Knowledge Regarding Complications of Diabetes Mellitus			
Diabetes Affects the Heart	Yes	318	91.4
	No	30	8.6
Diabetes Affects the Eyes	Yes	330	94.8
	No	18	5.2
Diabetes Affects the Kidneys	Yes	324	93.1
	No	24	6.9

Table 3 Practices Regarding Diabetes Mellitus Among Study Participants

Practices Regarding Lifestyle Factors and Management of Diabetes Mellitus		Frequency	Percent
Doing Regular Exercise (At Least 30 Minutes of Physical Activity)	Yes	147	42.2
	No	127	36.5
	Never diagnosed with DM	74	21.3
Smoking Status	Yes	96	27.6
	No	252	72.4
Patient Involvement in the Management Decisions of Diabetes Mellitus along with Physician	Yes	164	47.1
	No	110	31.6
	Never diagnosed with DM	74	21.3
Adherence to Prescribed Anti-Diabetic Medications as Advised by Doctor	Yes	220	63.2
	No	54	15.5
	Never diagnosed with DM	74	21.3
Self-Alterations in the Timings of Prescribed Anti-Diabetic Drugs	Yes	127	36.5
	No	147	42.2
	Never diagnosed with DM	74	21.3
Self-Alterations in the Dose of Prescribed Anti-Diabetic Drugs	Yes	121	34.8
	No	153	44.0
	Never diagnosed with DM	74	21.3

Abbreviation: DM, Diabetes Mellitus.

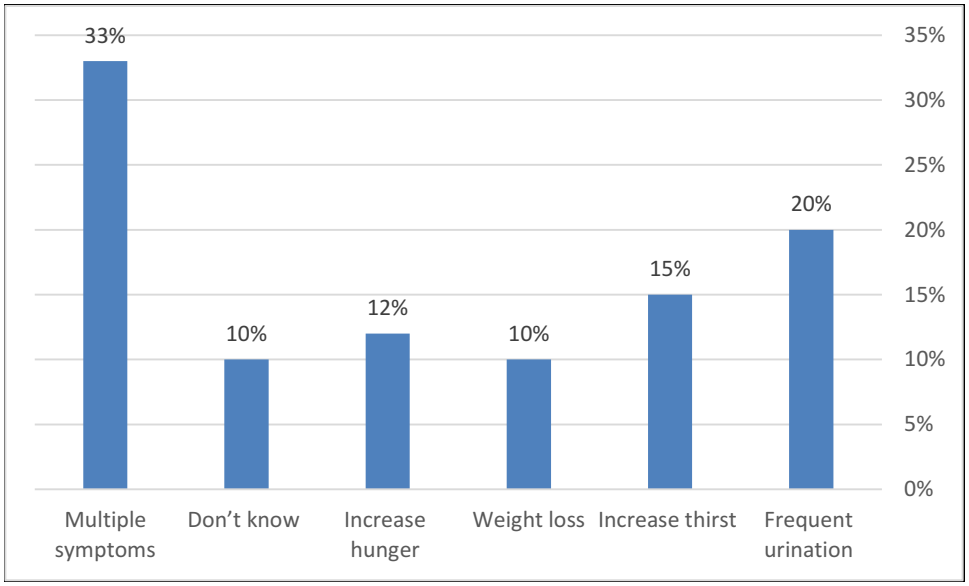

Figure 2 Knowledge about symptoms of diabetes mellitus among participants.

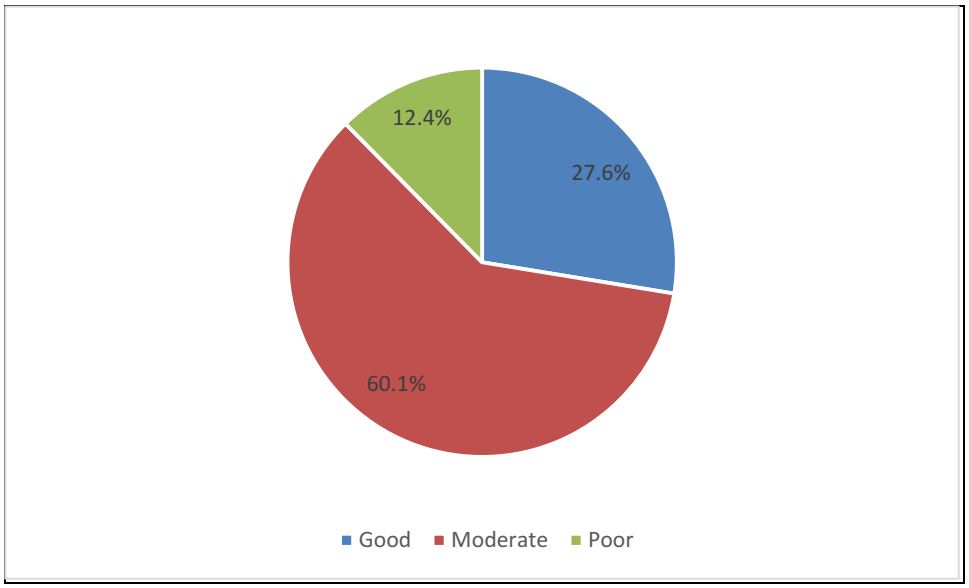

Figure 3 Self-rated knowledge grades regarding diabetes mellitus.

Discussion

Since diabetes is one of the most common chronic diseases encountered in Saudi Arabia, tremendous efforts have been made to find the causes and factors regarding the occurrence and management of diabetes among patients. Still, Saudi Arabia is battling not only with the high prevalence of diabetes mellitus but also with the problems in the management of diabetes as well. Therefore, in this study, we tried to find out the factors related to adherence to diabetes mellitus management. Adherence is defined as how far the patients stick to their prescribed management plan suggested by the doctor.[11] No adherence included not initiating the following advice regarding management, alteration in the medications, alteration in doses and timings, or discontinuing treatment because of lack of education regarding their disease. Although

Table 4 Univariate Analysis of Factors Related to Diabetes Mellitus

Variables			Ever Diagnosed with Diabetes Mellitus		p-value
			Yes	No	
Age (years)	≤ 50	Freq.	79	63	0.0001
		%	55.6%	44.4%	
	51–59	Freq.	147	9	
		%	94.2%	5.8%	
	60–69	Freq.	46	1	
		%	97.9%	2.1%	
	≥ 70	Freq.	2	1	
		%	66.7%	33.3%	
Education	Up to Intermediate	Freq.	59	12	0.0001
		%	83.1%	16.9%	
	Bachelors	Freq.	135	61	
		%	68.9%	31.1%	
	Masters	Freq.	64	0	
		%	100.0%	0.0%	
	Doctorate	Freq.	16	1	
		%	94.1%	5.9%	
Employment Status	Employed	Freq.	136	40	0.00001
		%	77.3%	22.7%	
	Un Employed	Freq.	123	18	
		%	87.2%	12.8%	
	Retired	Freq.	12	2	
		%	85.7%	14.3%	
	Student	Freq.	1	12	
		%	7.7%	92.3%	
	Housewife	Freq.	2	2	
		%	50.0%	50.0%	
Marital Status	Married	Freq.	45	31	0.0001
		%	59.2%	40.8%	
	Unmarried	Freq.	229	43	
		%	84.2%	15.8%	

(*Continued*)

Table 4 (Continued).

Variables			Ever Diagnosed with Diabetes Mellitus		p-value
			Yes	No	
Smoking Status	Yes	Freq.	90	6	0.0001
		%	93.8%	6.3%	
	No	Freq.	184	68	
		%	73.0%	27.0%	
Gender	Male	Freq.	157	39	0.282
		%	80.10%	19.90%	
	Female	Freq.	117	35	
		%	77.00%	23.00%	

Table 5 Multivariate Analysis of Factors Related to Diabetes Mellitus

Ever Diagnosed with Diabetes Mellitus		B	Std. Error	Wald	Df	Sig.	Exp(B)	95% Confidence Interval for Exp(B)	
								Lower Bound	Upper Bound
Age (years)	≤ 50	0.000	1.367	0.000	1	1.000	1.000	0.069	14.585
	51–59	2.382	1.385	2.955	1	0.086	10.821	0.716	163.508
	60–69	3.224	1.647	3.833	1	**0.040***	25.122	0.996	633.346
	≥70	0[b]			0				
Education Status	Bachelor	−2.805	1.082	6.715	1	**0.010***	0.061	0.007	0.505
	Secondary or Less	−1.957	1.210	2.615	1	0.106	0.141	0.013	1.514
	Masters	3.500	0.000		1		0.458	0.258	0.658
	Doctor	0[b]			0				
Employment status	Employed	−0.051	1.231	0.002	1	0.967	0.950	0.085	10.606
	Un Employed	0.393	1.240	0.101	1	0.751	1.482	0.130	16.836
	Retired	−0.438	1.484	0.087	1	0.768	0.646	0.035	11.841
	Student	−1.764	1.585	1.239	1	**0.044***	0.171	0.008	3.829
	Housewife	0[b]			0				
Marital Status	Married	1.562	0.513	9.266	1	**0.002***	4.768	1.744	13.034
	Unmarried	0[b]			0				
Smoking Status	Smoker	−0.789	0.463	2.904	1	**0.048***	0.455	0.184	1.126
	Nonsmoker	0[b]			0				

Note: *P- values in bold indicate significant.

chronic disease patients may become nonadherent to their treatment at any point in their life and any stage of their disease management.[12]

We found 40.8% of diabetics up to 50 years of age, 44.8% of diabetics between 51 and 59 years of age 13.5% between 60 and 69 years, and only 0.9% above 70 years in our studied population. Whereas Shu Hui Ng et al reported in Malaysia that the greatest number of participants were in the age group of 60–69 years 32.0% followed by 50–59 years 24.0% and 70–79 years 21.3%.[13] This can be attributed to the difference in the role of genetic, socio-demographic, and environmental factors in both the study populations.

In this study, diabetic females were 36.7% and overall 21.8% of respondents were married. Whereas a study conducted in Gaza showed 55.8% female diabetic patients and 95.4% were married which is higher than our study participants.[14] A study conducted in Bangladesh reported 58% of female respondents as well, 36% of their respondents had primary level education, and only 19% had bachelor degrees, which is reverse in our study group we 20% up to intermediate and 56% bachelor education.[15]

We found out that the prevalence of diabetes was higher among the age group 60–69 years, those married, employed, and smokers. Similar findings were found in a study conducted in Brazil.[16] We also find out that prevalence is higher among people with a higher educational status, which is also supported by a Kenya study.[17] A study conducted in Jeddah also suggested marital status and smoking as risk factors for the occurrence of diabetes mellitus.[18]

Our participants knew the major causes of diabetes such as hereditary causes of diabetes, obesity, smoking, and eating more 31.3%, 31.6%, 30.2% and 6.9%, respectively, and 46.6% were aware of dietary advice regarding diabetes control. About 42.2% of our study participants were exercising regularly. Shu Hui Ng et reported in Malaysia also reported that more than half of their population was also not aware of the major causes of diabetes mellitus and 3/4th of them were not aware of nutrition regarding diabetes control, whereas 45% admitted to exercise regularly which is similar to our participants.[13] About knowledge of symptoms of diabetes around 12% of participants know about increased hunger and 20% about increased urination. A previous study conducted in the Aseer region of Saudi Arabia showed 33% knowledge about increased hunger and 72% about increased urination, which is quite higher than the current study population.[19]

Diabetes can play a vital role in affecting the heart, kidneys, and eyes and has the greatest morbidities in terms of coronary heart disease, renal failure, and blindness, so it is very important for diabetic patients to be aware of these morbidities.[20]

A vast majority 94.8% of our participants were aware that diabetes can affect the eyes, which is higher than a study conducted in AlJouf and Hail provinces that showed 75.62% of participants' awareness regarding the effect of diabetes on the eyes.[21] A study from India[22] reports 50% awareness, the United States[23] reports 52% awareness, and Oman[24] reports 72% awareness, these variations may be due to the different literacy rates in these countries and possible health care infrastructure and health education provided to the people there.

A vast majority 91.4% of our study participants also showed good knowledge regarding cardiac complications of diabetes mellitus. It is also determined that diabetes has an impact on the heart as well, a study also showed that participants had good knowledge about diabetes complications but did not show satisfactory levels of health-promoting behavior to control diabetes through lifestyle modifications.[25] Diabetes mellitus is one of the major causes of nephropathy because hyperglycemia is the key factor for the development of kidney disease.[26] Around 93.1% of our population was aware of the fact that diabetes can affect the kidneys.

The primary objective of diabetes management is to delay these complications by achieving optimal diabetes control, which is only possible by following lifestyle modifications such as doing regular exercise, quitting smoking, weight reduction, dietary modifications, and adherence to medications as prescribed by physicians. Hence, health education plays a pivotal role in the management of diabetes, those people with good knowledge and proper adherence to health care advice seek proper treatment and care from physicians to control their diabetes.[27–29]

Almost half 53.4% of our participants were aware of anti-diabetic drugs, this less knowledge might be one of the factors in non-adherence to anti-diabetic drugs, which leads to serious health problems among diabetic patients. However, educational interventions have been shown to increase adherence and produce better clinical outcomes.[30,31]

In the present study, we found 63.2% adherence to anti-diabetic drugs among the Saudi population of the Aseer region, which is quite lower than studies conducted in Uganda, Ethiopia, and the United Arab Emirates showed the prevalence of adherence with hypoglycemic medications as 83.3%, 85.1% and 84%, respectively.[32–34] Whereas studies conducted in Botswana, Switzerland, Cameroon, Nigeria, and Palestine showed 52%, 40%, 54.4%, 27.5%, and 42% adherence, respectively, to hypoglycemic medications among diabetic patients, which is lower than our studied population.[14,35–38] This variable difference in prevalence in different countries could be due to the variable health care services provided in the countries and the socioeconomic status of the region as well. Literature also evident that there is a gap between the patient's knowledge about their disease and the management modalities provided by health care modalities therefore they might be confused about the adherence to lifestyle modifications and medications use. Unfortunately, ignoring prescribed health care advice by the patients cannot be neglected as well. Hence, considering both the above factors patients tend to start self-medications without considering doctors' advice.[36] Self-medication is a behavior where patients tend to initiate their medications or alter the doses of prescribed medications as well.[39,40] Around 36.5% of our participants altered the timings of their medications by themselves and 34.8% altered the dose of their prescribed medications on their own. By doing self-medication, patients might harm themselves and end up with the complications of drugs or the complications of diabetes as well.[41,42] Another probable reason for non-adherence might be that patients may not be properly exposed to good-quality health education provided by healthcare providers that's why they do not follow their physician's advice.[43]

Around one-fourth of our population was a smoker, whereas a study conducted by Gautam et al in Nepal reported only 9% smoker population.[44]

Nearly half 47.1% of our study participants were involved in the decisions of the management of diabetes along with physicians, which is one of the key points in good compliance with management advice. It has been determined that a patient-centered strategy is the best way to address low health literacy and medication non-adherence. Numerous allegations about healthcare organizations' ability to properly disseminate health information among individuals with low health literacy were noted in a study on contextualizing health literacy in healthcare organizations.[45] It is very important to engage patients in their treatment plan as clients to get the maximum idea about their insight and view and perceptions about their disease and acceptability about the management of problem with their agreement.[46,47] Naqvi et al evaluated the medication adherence in Saudi patients with chronic illnesses by translating and validating the Arabic version of the General Medication Adherence Scale (GMAS).[48] However, we did not use this scale in our study. Future research needs to preferably use this scale or any other standardized measurement tool to assess the adherence of medication accurately. In light of the present study findings, it is suggested that health authorities should take intensive initiatives to form health policies and implement action plans that contribute towards aggressive health education and health promotion among the general population and targeted population as well to reduce the burden of disease and the debilitated consequences of diabetes mellitus. Health education policies should focus on self-management and self-monitoring of diabetes as well to achieve the goals of reducing diabetes mellitus. Stewardship authorities should also include motivational efforts, enhancing good health beliefs and perceptions towards treatment benefits, and addressing the factors encountered with non-adherence to diabetes as well.

Our study has a few limitations. The cross-sectional nature of this study and the sampling used cannot confirm the causality association between the compared variables. The self-reported responses could over or underestimate the results. Also, the subjects for the study were chosen from a particular region, and thus they may not have been the representatives of the entire Kingdom. A larger nationwide study should be conducted involving different regions in the future.

Conclusion

Findings indicated less number of respondents exercised regularly, low adherence to prescribed anti-diabetic medications and low levels of self-rated knowledge of diabetes mellitus. Enhancing patients' knowledge and recognition of diabetes, through diabetes education, is necessary to improve self-management of DM and increase the rate of adherence. Increasing interactions and having a partner relationship with patients are keys to improving patients' adherence to medications.

Institutional Review Board Statement

The study was conducted in accordance with the Declaration of Helsinki and approved by the Institutional Research Ethical Committee of the College of Medicine, King Khalid University for studies involving humans.

Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

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Disclosure

The authors declare no conflicts of interest in this work.

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