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Original Research Article

Awareness and Perception of Diabetic Patients Towards Diabetes Mellitus, its Complications and Management Modalities in Primary Healthcare Centers

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Abstract

Type 2 diabetes mellitus is a common health problem in Saudi Arabia. Awareness of patients about the disease, its complications, preventive measures, and management modalities will play a vital role in its better control and avoidance of hazardous complications. The objective was to assess type 2 diabetic patients` awareness of DM, its complications, preventive measures, and treatment modalities. A cross-sectional study was conducted among a sample of adult type 2 diabetic patients attending the chronic diseases clinic at Alwazarat primary healthcare center in Riyadh City, Saudi Arabia. Data were collected by interviewing patients using a valid questionnaire consisting of four main sections: socio-demographic characteristics of patients, diabetes-related characteristics, awareness about diabetic complications, and knowledge about different aspects of diabetes. The study included 252 type 2 diabetic patients. The age of 29.4% of them ranged between 50 and 59 years and males represented 58.7% of the patients. The majority of patients (92.5%) were aware of the development of diabetic complications in case of uncontrolled blood sugar levels. Among those patients, the most reported source of information was diabetologists (54.1%). The overall level of diabetic patients` knowledge about diabetes mellitus, its complications, and prevention and management modalities was good among 21% of patients whereas, it was poor among 31% of them. Patients aged between 30 and 49 years, females, housewives, university graduated patients (p<0.001) and married patients (p=0.001) were more knowledgeable about diabetes compared to their peers. Additionally, patients with a longer duration of diabetes (>5 years) (p=0.001), patients who reported non-adherence to anti-diabetic medications (p<0.001), those with a family history of diabetes (p<0.001), those having their information from diabetologists (p<0.001), and reported previous clinical examination for diabetic complications (p<0.001) were more knowledgeable about diabetes than their counterparts. The majority of type 2 diabetic patients were aware of the development of diabetic complications in case of uncontrolled blood sugar levels. However, the overall level of diabetic patients` knowledge about diabetes mellitus, its complications, prevention and management modalities was good among almost fifth of patients.

Keywords: Complications, Knowledge, Management, Type 2 diabetes

INTRODUCTION

Globally, Diabetes mellitus (DM) is one of the foremost non-communicable diseases that currently affects 463 million adults (20-79 years); a total that is set to reach 700 million by 2045 (International Diabetes Federation,

2023). Type 2 diabetes constitutes about 85 to 95% of all diabetic patients in high-income countries and accounts for an even higher percentage in low-and middle-income countries, which has evolved in association with rapid cultural and social changes, aging populations, increasing urbanization, dietary changes, reduced physical activity and other unhealthy lifestyle and behavioral patterns (Harrison et al., 2003).

Awareness of DM will play a vital role in its prevention and control. Also, lack of awareness and adherence towards the management modalities leads to poor glycemic control, thus, increasing hazardous complications.

The study, research question was; Are diabetic patients attending chronic illness clinics (CIC) aware of DM, complications, and its treatment modalities?

Research Hypothesis

Null hypothesis: Diabetic patients attending CIC aren't aware of DM, its complications and treatment modalities

Alternative hypothesis: diabetic patients attending CIC have a good awareness of DM, its complications and treatment modalities.

Diabetes is a chronic disease that has increased substantially during the past 20 years (9.3%of the world population in 2019). At present, diabetes is the leading cause of blindness (5^{th} cause of blindness), renal failure (20%-40% of diabetics with renal failure) and non-traumatic lower limb amputations (amputation every 30 seconds) and is a major risk factor for cardiovascular disease (increased 2-3 folds). Owing to its chronic nature, the severity of its complications and the means required to control it, diabetes is a costly disease. The healthcare costs associated with this condition are substantial and can account for up to15% of national healthcare budgets. High awareness and proper knowledge of this highly prevalent disease is crucial to enhance early detection and proper intervention.

Aim of the study

To assess diabetic patients' awareness of DM, its complications, and treatment modalities

Specific objectives

1) - To evaluate the knowledge of DM, complications, and its treatment modalities
2) - To assess the knowledge required to help them obtain maximum benefit from their treatment for diabetes

LITERATURE REVIEW

In India, S DB et al, 2017, conducted a cross-sectional survey study to assess knowledge of diabetes, its complications, and treatment adherence among 120 diabetic patients, and they found that 55.8% of the respondents had more than 80% knowledge regarding diabetes mellitus and its complications, 37.5% had 60-79% knowledge and only 6.7% had less than 60% knowledge. Almost two-thirds of the patients (64.2%) scored greater than 80% in the treatment adherence, 22.5% scored between 60-79%, and 13.3%scored below 60%. This study also highlighted the positive association between good knowledge and better adherence to diabetes treatments (Deepali et al., 2017).

A study published by Gulabani et al. in 2008 among Indian diabetic patients aimed to assess the knowledge of diabetes, its treatment and complications, showed serious deficiencies in patients' knowledge regarding diabetes treatment and complications. This study was cross-sectional and its population was 101 diabetic patients (type 1(11), and type 2 (90)) attending an integrated diabetes clinic in a tertiary care hospital. The results showed that 50.5% of the participants thought that diabetes to be incurable, only 46% thought that diabetes could be prevented, and 71.3% did not know diabetes risk factors. More than half of the respondents did not know that kidney function tests should be performed in diabetes, and the vast majority (94.1%) did not know about glycosylated hemoglobin (HbA1c). The poor knowledge level was more so among women, even though most had been diabetic for years (Deepali et al., 2017).

In Ghana, Obirikorang et al. (2016) estimated diabetic patients knowledge regarding diabetes complications. Their study was descriptive, questionnaire-based, and they recruited a total of 630 patients from the diabetes clinic at the Sampa government hospital. Their assessment of the level of complications knowledge showed that the majority 60.0% of type 2 diabetes mellitus (T2DM) patients did not have knowledge on diabetes complications, 26.9 % had inadequate knowledge while only 13.1 % had adequate knowledge. Gender, marital status, and educational level were significantly correlated with the knowledge level. The authors concluded that diabetic patients who participated in the current study lack in-depth knowledge on the complications and recommended expansion of diabetic educative programs which may reduce the morbidity and mortality of diabetic patients (Obirikorang et al., 2016).

Nabina Paneru and Raj Devi Adhikari in their recently (2019) published study from Nepal assessed the diabetic complications knowledge among 100 diabetic patients attending outpatient department in a tertiary hospital. The study design was descriptive, cross-sectional, and the

results showed that 90% had knowledge of major symptoms of hyperglycemia, and 82% knew about its immediate management, 66% knew major symptoms of hypoglycemia whereas 92% knew its immediate management. The vast majority (95%) knew that diabetes increase the risk of loss of vision whereas only 13% knew about the increased risk of nerve damage. The knowledge level was significantly associated with educational status, economic status, and participation in diabetes counseling (Paneru and Adhikari, 2019).

In Ethiopia, Belsti et al. conducted a study aimed to assess awareness of diabetes complications and associated factors among type 2 DM. the study was cross-sectional and conducted among type 2 DM attending a hospital in 2019. It was found that 48.5% of the diabetic patients had awareness of DM complications, 92.5% knew dietary modification to prevent diabetes complications, 91.3% knew about complication related risk factor of alcohol and cigarette smoking (Belsti et al., 2019).

In Saudi Arabia, a recent systematic review published in 2018 by Alanazi FK et al, aimed to summarize the available peer-reviewed publications regarding public knowledge and awareness of DM among the population of Saudi Arabia. This systematic review main finding was that most studies found a lack of public awareness of the risk factors and complications of DM, which highlights the need for increased knowledge and awareness of DM among the Saudi population (Alanazi et al., 2018). Agrawaal KK in his study published in 2015 aimed to evaluate diabetic Patients' Awareness about the DM complications and their co-relation with the glycemic status. The study was a prospective observational study and included 123 DM patients. Overall, there was a lack of awareness about the major complications related to DM. Since the findings were that 58% had awareness regarding kidney damage, 51% had awareness that diabetes causes delay wound healing, only 3% did regular foot care and 9% knew what the target glycemic status is. Only 36% know that their diabetes causes cardiac complications, 27% regarding eyes, 36% regarding neuropathy and 18% were aware about cardiovascular accidents (CVA) (Agrawaal, 2015).

Fatani et al. (2018) in their cross-sectional study among the diabetic population of Makkah city, kingdom Saudi Arabia assessed the awareness of diabetic complications, perceived knowledge, compliance to medications, and control of diabetes. Their results revealed 80% heard about diabetes complications. The most recognized complications of diabetes mellitus were: eye disease (72.9%), diabetic foot 71.2%), renal disease (56.2%),peripheral neuropathy (53.8%), sexual impairment (42.5%), heart disease (40.1%), high blood pressure (33.1%), sudden death (20.4%), and cerebrovascular disease (18.7%). This study concluded that there is a need for more attention in primary prevention programs that focus on awareness of diabetic complications and the symptoms of these complications should be emphasized. Compliance with diabetes medications and control of blood sugar are essential to prevent the development of diabetic complications, and early identification of diabetic complications is essential.

Rahman UZ et al (2014) from Pakistan assessed 561 diabetic patients` awareness regarding diabetes and its management in a cross-sectional survey study. Overall, there was a low level of awareness in both male and female diabetics; and comparatively female patients have poorer awareness. The main outcomes were as that 63% of males and 32.4% of females were aware that diabetes could produce some complications (Rahman et al., 2014).

A recently published local study by Ahmed, I. B (2019) assessed the level of diabetic patients' knowledge of diabetes mellitus, its complications, and management in a cross-sectional design study of 906 Saudi Arabian diabetic patients from endocrinology outpatient clinics in 47 hospitals in 8 cities. The results of this study showed that only 19.2% of the patients were aware of the two types of diabetes, 40.3% were aware that DM can lead to visual problems and blindness; 37.3% were aware that DM can cause changes to the health of your retina; 40.4% were aware that DM can cause clouding of vision or cataracts. Besides, 40.4% have sufficient knowledge about their DM management;59.2% follow a dietary modification to control DM. this study concluded that Saudi diabetic patients do not have significant knowledge regarding diabetes mellitus, but are knowledgeable regarding the implications of diabetes mellitus and precautions against diabetes mellitus (Bin Ahmed et al., 2019).

MATERIALS AND METHODS

Study design

Cross-sectional study was performed.

Study area

The study was conducted at the chronic diseases clinic at Alwazarat primary healthcare center in Riyadh city, Kingdom of Saudi Arabia.

Target population/eligibility criteria

Diabetic patients attending chronic diseases clinic at Alwazarat primary healthcare center in Riyadh city, Saudi Arabia.

-Inclusion/exclusion criteria:
- -Adult diabetic patients (≥18 years of age)
- Type 2 diabetes mellitus

-Exclusion criteria:
- Type 2 diabetes aged<18 years old
- Type 1 diabetic patients

Sample size

The sample size was calculated by using the following formula:

$$N=\frac{Z_{\alpha/2}^2 x\ p\ (1-p)}{D^2}$$

Where:
N=Minimum sample size
$Z_{\alpha/2:}$ the critical value of the Normal distribution at α/2 (e.g. for a confidence level of 95%, α is 0.05 and the critical value is 1.96)
P: Prevalence of the outcome of interest (awareness about two types of diabetes 19.2%, based on a recent Saudi study (Bin Ahmed et al., 2019).
D: Degree of precision
So, the calculated minimum sample size was:

$$n = \frac{(1.96)^2 X\ 0.19 X\ 0.81}{(0.05)^2} = 236$$

The sample was increased by approximately 10% to compensate for possible none or incomplete response, thus it was 259 patients.

Sampling method

The simple random technique was used to select patients. Sample was obtained through using a list of random numbers generated by www.random.org website after getting list of patients attending at CIC from department of Family Medicine.

Data collection tool and method

Data for the current study were collected through interviewing patients using a valid questionnaire adopted from a previous study carried out in Makkah, Saudi Arabia (Fatani et al., 2018). The questionnaire consists of four main sections:
-Socio-demographic characteristics of patients (age, gender, occupation, educational level and marital status)
-Diabetes-related characteristics (duration of diabetes, adherence to medications, family history of diabetes and level of glycosylated hemoglobin "HbA1c")
-Awareness about diabetic complications
-Knowledge about different aspects of diabetes (existence of specific organizations in Saudi Arabia, self-evaluation of knowledge about diabetes in Saudi Arabia, diabetic complications, preventive and therapeutic measures). The participants` responses were scored by a giving a score of "1" for correct answer and "0" for incorrect answer. Total score ranged between 0 and 16. Total score and its percentage were computed and participants were categorized accordingly as follows: those scored below 50% were considered having " poor knowledge", those scored between 50% and 75% were considered having "moderate knowledge" whereas those scored above 75% were considered having "good knowledge (Gazzaz, 2020).

Data entry and analysis

Data entry and analysis were done utilizing the Statistical Package for Social Studies software (SPSS 28; IBM Corp., New York, NY, USA). Since all variables were categorized, they were expressed as frequency and percentages. The chi-square test was used to explore the association between categorical variables and a p-value <0.05 was considered for statistical significance.

Ethical consideration

-The proposal of this study was approved by the research ethical committee of Prince Sultan Military Medical City, Riyadh
-An informed consent was obtained from every participant before collection of data
-Collected data were treated confidentially and used only for research propos

RESULTS

-Socio-demographic characteristics

The study included 252 type 2 diabetic patients. The age of 29.4% of them ranged between 50 and 59 years, whereas that of 12.7% was 60 and over. Males represented 58.7% of the patients. Almost half of them (48.4%) were employed and university graduated. Majority of patients (79%) were married. Table 1

-Diabetes-related characteristics

The duration of diabetes exceeded five years among almost two-thirds of patients (68.3%). More than half of them (57.5%) reported compliance with anti-diabetic medications. The majority of patients (82.1%) had a

Table 1. Socio-demographic characteristics of the participants (n=252)

Socio-demographic variables	Frequency	Percentage
Age (years)		
≤19	11	4.4
20-29	20	7.9
30-39	63	25.0
40-49	52	20.6
50-59	74	29.4
≥60	32	12.7
Gender		
Male	148	58.7
Female	104	41.3
Occupation		
Employed	122	48.4
Retired	37	14.7
Housewife	93	36.9
Educational level		
No formal education	23	9.1
Primary school	31	12.3
Secondary school	76	30.2
University	122	48.4
Marital status		
Single	53	21.0
Married	199	79.0

Table 2. Diabetes-related characteristics of the participants (n=252)

	Frequency	Percentage
Duration of diabetes in years		
≤5	80	31.7
>5	172	68.3
Adherence to anti-diabetic medications		
No	34	13.5
Sometimes	73	29.0
Yes	145	57.5
Family history of diabetes		
No	45	17.9
Yes	207	82.1
Glycosylated hemoglobin (HbA1c) level		
≤7	116	46.0
>7	136	54.0

family history of diabetes. Glycemic un-control (HbA1c>7) was observed among 54% of patients. Table 2

-Awareness about diabetic complications

Majority of patients (92.5%) were aware of development of diabetic complications in case of uncontrolled blood sugar level (Figure 1). Among those patients, the commonest reported source of information was diabetologists (54.1%), followed by other physicians (17.6%) and family members (13.7%). Figure 2

-Knowledge about diabetes mellitus

From Table 3, it is shown that more than half (54%) of the participants could recognize the existence of specific organizations for diabetes mellitus in Saudi Arabia. Most of the patients (62.3%) self perceived their awareness and knowledge about DM in Saudi Arabia as good whereas 15.1% perceived it as poor. Almost two-thirds of patients (63.1%) knew diabetic complications. More than one-third of them could recognize eye/retinal diseases (39.7%) and renal insufficiency (34.1%) as complications of uncontrolled diabetes. About two-thirds of the

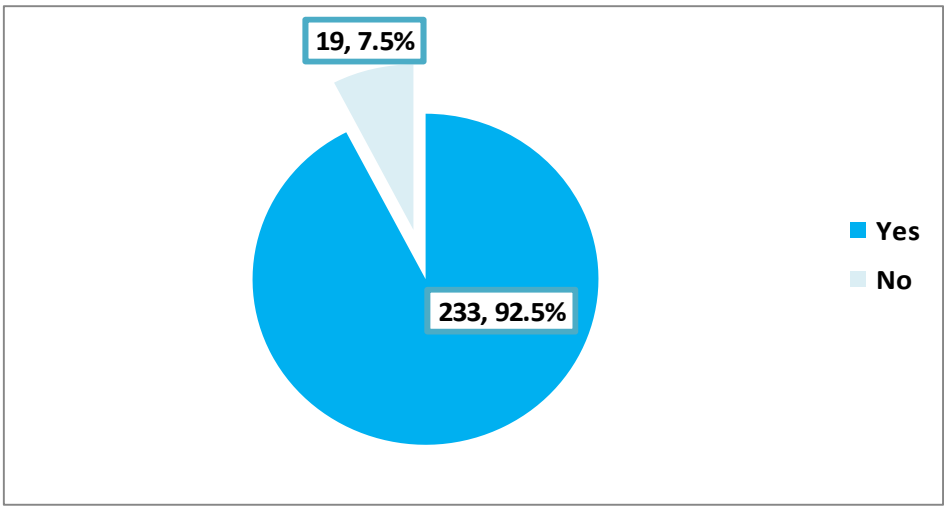

Figure 1. Awareness of the patients about diabetic complications in case of uncontrolled diabetes

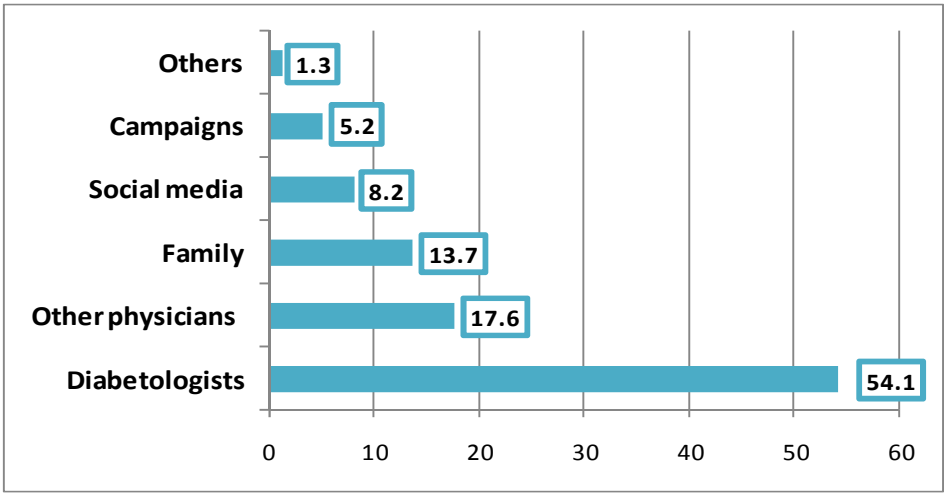

Figure 2. Source f information about diabetic complications among the participated type 2 diabetic patients.

Table 3. Assessment of the diabetic patients` knowledge about diabetes mellitus, its complications, preventive and management modalities

	Responses	
	No.	**%**
There is organizations specific for diabetes mellitus in Saudi Arabia		
Don`t know	53	21.0
Knows a little	63	25.0
Knows well	136	54.0
Self-evaluation of awareness and knowledge about diabetes in Saudi Arabia		
Poor	38	15.1
Good	157	62.3
excellent	57	22.6

Table 3. Continue

Diabetic complications	159	63.1
Peripheral neuropathy	65	25.8
Cardiac attach	55	21.8
Renal insufficiency	86	34.1
Eye and retinal disease	100	39.7
Therapeutic measures		
Diet regimen	9	3.6
Diet regimen and medications	45	17.9
Diet regimen, medications and physical activity	173	68.7
Medications		
Medications and physical activity	20	7.9
	5	2.0
Preventive measures		
Don`t know	7	2.8
Healthy diet	211	83.7
Intake of low amounts of sugar	128	50.8
Physical activity	131	52.0
Decrease body weight	86	34.1

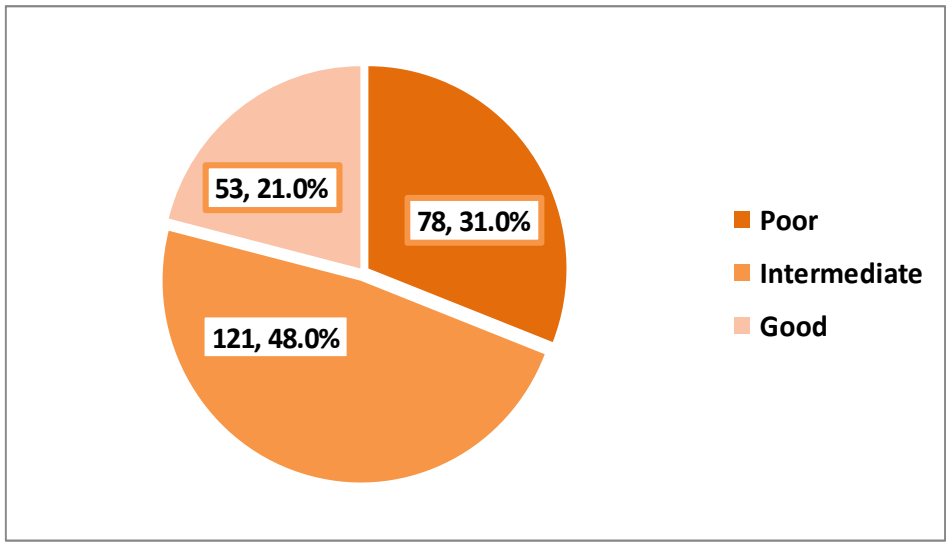

Figure 3. Overall level of diabetic patients` knowledge about diabetes mellitus, its complications, preventive and management modalities

participants (68.7%) knew that the treatment modalities of diabetes are diet regimen, medications and physical activity. As regards preventive measures, healthy diet, physical activity and intake low amounts of sugar were recognized by 83.7%, 52% and 50.8% of patients, respectively.

Overall level of diabetic patients` knowledge about diabetes mellitus, its complications, prevention and management modalities were good among 21% of patients whereas, it was poor among 31% of them. Figure 3

Factors associated with level of knowledge

-Socio-demographic factors

The highest rate of good levels of knowledge about diabetes was observed among patients aged between 30 and 49 years (30.2-30.8%) compared to none of those aged 60 years and over or 19 years and below, $p<0.001$. Good level of knowledge was more significantly reported by female patients compared to males (32.7% vs. 12.8%), $p<0.001$. House wives were more knowledgeable

Table 4. Association between participants` socio-demographic characteristics and their level of knowledge about diabetes

	Level of knowledge about diabetes			p-value*
	Poor N=78 N (%)	Intermediate N=121 N (%)	Good N=53 N (%)	
Age (years)				
≤19 (n=11)	11 (100)	0 (0.0)	0 (0.0)	
20-29 (n=20)	12 (60.0)	6 (30.0)	2 (10.0)	
30-39 (n=63)	9 (14.3)	35 (55.5)	19 (30.2)	
40-49 (n=52)	10 (19.2)	26 (50.0)	16 (30.8)	
50-59 (n=74)	18 (24.3)	40 (54.1)	16 (21.6)	
≥60 (n=32)	18 (56.2)	14 (43.8)	0 (0.0)	<0.001
Gender				
Male (n=148)	41 (27.7)	88 (59.5)	19 (12.8)	
Female (n=104)	37 (35.6)	33 (31.7)	34 (32.7)	<0.001
Occupation				
Employed (n=122)	26 (21.3)	81 (66.4)	15 (12.3)	
Retired (n=37)	11 (29.7)	16 (43.3)	10 (27.0)	
Housewife (n=93)	41 (44.1)	24 (25.8)	28 (30.1)	<0.001
Educational level				
No formal education (n=23)	20 (87.0)	3 (13.0)	0 (0.0)	
Primary school (n=31)	17 (54.8)	8 (25.8)	6 (19.4)	
Secondary school (n=76)	22 (28.9)	45 (59.3)	9 (11.8)	
University (n=122)	19 (15.6)	65 (53.3)	38 (31.1)	<0.001
Marital status				
Single (n=53)	28 (52.8)	18 (34.0)	7 (13.2)	
Married (n=199)	50 (25.1)	103 (51.8)	46 (23.1)	0.001

*Chi-square test

Table 5. Association between participants` diabetes-related characteristics and their level of knowledge about diabetes

	Level of knowledge about diabetes			p-value*
	Poor N=78 N (%)	Intermediate N=121 N (%)	Good N=53 N (%)	
Duration of diabetes in years				
≤5 (n=80)	34 (42.4)	39 (48.8)	7 (8.8)	
>5 (n=172)	44 (25.6)	82 (47.7)	46 (26.7)	0.001
Adherence to anti-diabetic medications				
No (n=34)	10 (29.4)	3 (8.8)	21 (61.8)	
Sometimes (n=73)	21 (28.8)	44 (60.2)	8 (11.0)	
Yes (n=145)	47 (32.4)	74 (51.0)	24 (16.6)	<0.001
Family history of diabetes				
No (n=45)	10 (22.2)	33 (73.4)	2 (4.4)	
Yes (n=207)	68 (32.9)	88 (42.5)	51 (24.6)	<0.001
Glycosylated hemoglobin level				
≤7 (n=116)	34 (29.3)	53 (45.7)	29 (25.0)	
>7 (n=136)	44 (32.4)	68 (50.0)	24 (17.6)	0.361

*Chi-square test

about diabetes compared to employed patients (good level was reported in 30.1% and 12.3%, respectively), p<0.001. Almost a third of university graduated patients (31.1%) compared to none of those without formal education had a good level of knowledge about diabetes, p<0.001. Married patients were more knowledgeable about diabetes compared to singles (good level was reported in 23.1% and 13.2%, respectively), p=0.001. Table 4

Table 6. Association between participants` source of information about diabetic complications and their level of knowledge about diabetes

	Level of knowledge about diabetes			p-value*
	Poor N=78 N (%)	Intermediate N=121 N (%)	Good N=53 N (%)	
No (n=19)	19 (100)	0 (0.0)	0 (0.0)	
Diabetologists (n=126)	23 (18.3)	60 (47.6)	43 (34.1)	
Other physicians (n=41)	4 (9.8)	33 (80.5)	4 (9.8)	
Family members (n=32)	16 (50.0)	11 (34.4)	5 (15.6)	
Social media (n=19)	9 (47.4)	9 (47.4)	1 (5.3)	
Campaigns (n=12)	6 (50.0)	6 (50.0)	0 (0.0)	
Others (n=3)	1 (33.3)	2 (66.7)	0 (0.0)	<0.001

*Chi-square test

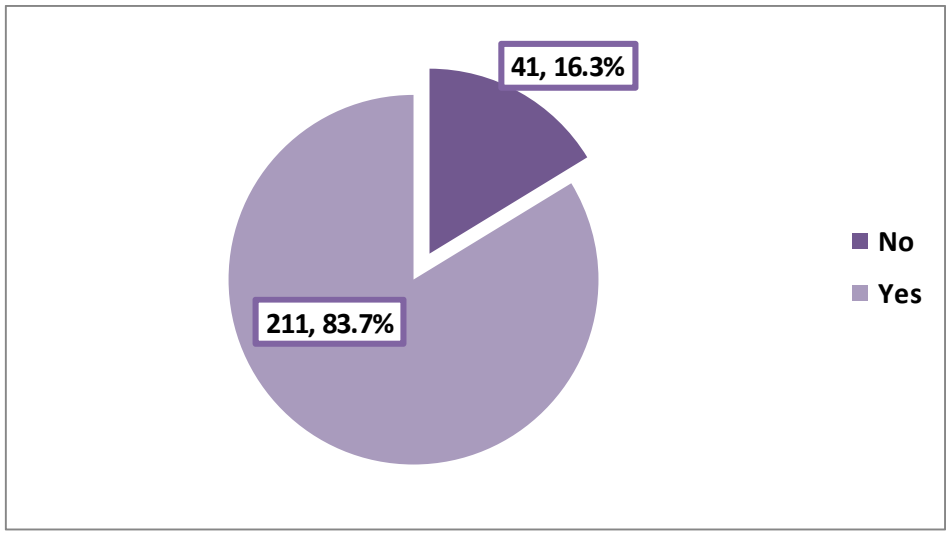

Figure 4. History of clinical examination for diabetic complications among the participants

Table 7. Association between participants` previous clinical examination for diabetic complications and their level of knowledge about diabetes

	Level of knowledge about diabetes			p-value*
	Poor N=78 N (%)	Intermediate N=121 N (%)	Good N=53 N (%)	
No (n=41)	31 (75.6)	10 (24.4)	0 (0.0)	
Yes (n=211)	47 (22.3)	111 (52.6)	53 (25.1)	<0.001

*Chi-square test

-Diabetes-related factors

Patients with longer duration of diabetes (>5 years) were more knowledgeable about the disease than those with shorter duration (good level was reported in 26.7% and 8.8%, respectively), p=0.001. Patients who reported non-adherence to anti-diabetic medications were more knowledgeable about the disease than those who

reported adherence to these medications (good level was reported in 61.8% and 16.6%, respectively), p<0.001. Patients with a family history of diabetes were more likely than their peers to have good level of knowledge about the disease (24.6% vs. 4.4%), p<0.001. Table 5

-Source of information

The highest rate of good levels of knowledge about diabetes was observed among patients who got their information about the disease from diabetologists (34.1%) compared to none among those who got their information from campaigns or other sources, p<0.001. Table 6

-**Clinical examination for diabetic complications**

Patients who reported previous clinical examination for diabetic complications were more knowledgeable about the diseases compared to their counterparts (good level was reported in 25.1% and none, respectively), p<0.001. Table 7

DISCUSSION

Kingdom of Saudi Arabia (KSA) is the second highest country in the Arabic world as regards the prevalence of DM and ranking 7th highest one on global level with about 7 million patients had diabetes mellitus, mostly of the type two (Al Dawish et al., 2016). Assessment of awareness and knowledge of diabetic patients as well as the general population concerning the disease is of vital importance on both prevention and management levels (Gazzaz, 2020). It has been documented that having good awareness and knowledge of patients and the whole community about any health problem can help in achieving better planning for managing the problem (Bin Ahmed et al., 2019). Therefore; this study was conducted primarily to assess type 2 diabetic patients` awareness and knowledge about DM, its complications, preventive measures and treatment modalities.

It has been documented that chronic status of hyperglycemia in patients with uncontrolled blood glucose leads to long-term dysfunction, and failure of vital organs, such as kidneys, retina, heart, blood vessels and nerves (American Diabetes Association, 2014). Fortunately, in the present study, majority of patients (92.5%) were aware of development of diabetic complications in case of uncontrolled blood sugar level. In another recent Saudi Study carried out in Makkah city, also about 80% of diabetic patients were aware about complications of diabetes mellitus. However, another Saudi study showed that 60% of patients were not aware of diabetes complications (Fatani et al., 2018). On international level, studies carried out in Ethiopia (Belsti et al., 2019), Ghana (Obirikorang et al., 2016), Pakistan (Ullah et al., 2015) and Bangladesh (Rahaman et al., 2017) revealed that less than half of diabetic patients were aware of diabetic complications. Variation in personal and socio-demographic characteristics of patients as well as variation in cultural habits could explain this difference between studies (Foma et al., 2013).

In the current study, the most frequently recognized diabetic complications were eye/retinal diseases, renal insufficiency and peripheral neuropathy. Quite similar results have been reported in other studies carried out in Makkah (Saudi Arabia) (Fatani et al., 2018) and India (Gupta et al., 2016).

In the present study, patients aged between 30 and 49 years, female patients, house wives, higher educated patients and married patients were more knowledgeable about diabetes, its complications, preventive and therapeutic strategies compared to their counterparts. In addition, patients with longer duration of diabetes (>5 years) and those with family history of diabetes were more likely than their peers to have good level of knowledge about the disease, its complications, preventive and therapeutic strategies. In a study conducted recently in Ethiopia (Belsti et al., 2019). Patients` age, male gender, educational level, job status, and family history of DM were predictors of awareness of DM complications. In India, male gender, educational level, occupation and family history of diabetes were associated with good awareness about diabetes and its complications (Murugesan et al., 2007). In Pakistan (Ullah et al., 2015), male diabetic patients were more aware about diabetes and its complications compared to females; contrary to what has been observed in the present study. This difference could be explained by cultural variation as in Saudi culture nowadays, females have better chances than males to attend educational meetings and acquire more information while in Pakistan, India and Ethiopia, females spend most of their time in house with little chances to attend educational meetings. In Bangladesh (Rahaman et al., 2017), patients aged between 31–45 years old were more likely to be aware about diabetes and its complications compared those aged 15–30 years old. This is quite expected as with advancing in age, patients got more counseling and health education during their follow-up.

In accordance with our findings, other studies observed that higher educated patients were more knowledgeable about diabetes and its complications (Belsti et al., 2019; Ullah et al., 2015; Murugesan et al., 2007), as higher educated patients had more chances to gain information about DM and its complications from many sources compared to less educated patients.

Interestingly in this study to find that housewives were more knowledgeable about diabetes and its complicat-

ions compared to employed patients. Again, this could be due to the fact that they might have more time to be engaged in educational meetings and discuss issues with diabetologists and other physicians compared to employed patients.

The present study revealed that patients with family history of diabetes were more knowledgeable about the disease, its complications as well as its preventive and therapeutic measures. The same had been observed in studies carried out in 8 main cities in Saudi Arabia (Bin Ahmed et al., 2019), Ethiopia (Belsti et al., 2019) and India (Murugesan et al., 2007). This could be attributed to their learning from family experience.

Patients with longer duration of diabetes were more knowledgeable about diabetes, its complications, preventive and therapeutic measures. However, this was not confirmed in other studies carried out in Nigeria (Nathaniel and Adio, 2015) and Ethiopia (Belsti et al., 2019).

In the current study, the main source of information among patients aware of diabetes complications was diabetologists followed by other physicians. The same has been observed in another Saudi study carried out in Makkah (Fatani et al., 2018). This finding enforces the role that could be played by diabetologists and other physicians in alerting diabetic patients about the importance of glycemic control to avoid the development of serious complications of the disease.

Interestingly, the present study revealed that patients who reported non-adherence to anti-diabetic medications were more knowledgeable about the disease than those who reported adherence to these medications. This finding could be explained by the fact that patients with poor knowledge about the disease claimed that they were adherent to anti-diabetic medications as in this study, we depended in assessing of adherence on a simple direct single question instead of using a valid tool for assessing adherence such as The Medication Compliance Questionnaire (Nathaniel and Adio, 2015) and Morisky Medication Adherence Scale (Morisky et al., 1986).

The present study showed that majority of patients could recognize healthy diet as a preventive measure of diabetes, whereas almost half of them could recognize the preventive role of physical activity. Lower rates have been reported in a similar previous Saudi study where 18.9% mentioned eating healthy foods while 20.4% focused on engaging in regular exercise as preventive measures for diabetic complications (Bin Ahmed et al., 2019).

Almost two-thirds of the type 2 DM patients in the present study knew correctly that the treatment modalities of diabetes are diet regimen, medications and physical activity together. In another recent Saudi study, 40.3% of diabetic patients expressed sufficient knowledge regarding the management of diabetes mellitus, 59.2% reported modifications of diet and 62.3% reported practicing of regular physical exercise (Bin Ahmed et al., 2019).

The study limitations include the facts that it is a single center study, which could impact the generalizability of findings, cross-sectional one, so causality cannot be confirmed, depending on a single, simple direct questions in assessing patients` adherence to anti-diabetic medications instead of using a valid toll for this purpose and finally, data were collected through interviewing patients who may have replied socially acceptable answers which may lead to an overestimation of responses.

CONCLUSION

Majority of type 2 diabetic patients were aware of development of diabetic complications in case of uncontrolled blood sugar level. Among those patients, the commonest reported source of information was diabetologists. However, overall level of diabetic patients` knowledge about diabetes mellitus, its complications, preventive and management modalities was good among almost fifth of patients. Patients aged between 30 and 49 years, females, house wives, higher educated patients, married patients, patients with longer duration of diabetes (>5 years), those with family history of diabetes and patients had their information from diabetologists were more knowledgeable compared to their counterparts.

RECOMMENDATIONS

-Organizing regular educational activities for type 2 diabetic patients in waiting areas regarding diabetic complications, preventive and management modalities of the disease and their role in decreasing the complications of diabetes.
-Healthcare professionals, particularly diabetologists should have a role in these educational activities in addition to health educators.
-Early recognition of diabetic complications is important for avoiding their dangerous final effects; both physicians and patients themselves should have a role in this regards.
-Further longitudinal multi-centric study is recommended to include patients from various healthcare facilities.

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