

The level of knowledge and awareness about diabetes and diabetic foot among the Taif general population

Haifa Alotaibi (1)
 Areej M. Abdullah (2)
 Rawan I. Alqurashi (2)
 Kholood S. Althobaiti (2)
 Sarah A. Khan (2)
 Shumukh G. Althobaiti (2)

(1) Teaching Assistant in At General Surgery department , Taif University, Saudi Arabia
 (2) Medical Intern, Taif University, Saudi Arabia

Corresponding Author:

Dr. Shumukh G. Althobaiti
 Saudi Arabia
 Mobile: 0543081471
 Email: Shumookh-ghazy1471@outlook.com

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Abstract

Background: Diabetes mellitus and diabetic foot are increasing worldwide. There is a lack of information about diabetes and diabetic foot in the kingdom of Saudi Arabia.

Objectives: The current study aims to explore the level of knowledge about diabetes and diabetic foot among the general population in Taif city of Saudi Arabia.

Methods: A cross-sectional study was done on diabetic patients in Taif city. A questionnaire was distributed randomly to the general population and their demographic information was recorded after obtaining their consent.

Results: Diabetes Type 1 was the most common type with retinopathy as the most common single complication, where 12.5% had more than one complication. The mean knowledge score was 17.98 ± 4.25 . The participants had 46% for good knowledge, 41% and 13% of fair and poor knowledge about diabetes and diabetic foot respectively. No significant relationship was found between the level of the participant's knowledge about diabetes and diabetic foot and their characteristics (except for educational level).

Conclusion: Healthcare providers should devote more time to educating patients and their families about diabetes, particularly the complications.

Keywords: level, knowledge, diabetic, foot, Taif, population

Introduction

Saudi Arabia (SA) is ranked sixth among the top ten countries in terms of diabetes prevalence, and it is expected to maintain a prevalence rate of 20% in people aged 20 to 79 over the next two decades [1].

Diabetes Mellitus (abbreviated "DM") is a group of chronic metabolic diseases characterised by an increase in blood glucose levels. The most common types of diabetes are type 1 and type 2. Diabetes type 1 is defined as an autoimmune-response-based destruction of pancreatic cells responsible for insulin production, resulting in an absolute insulin deficiency. Type 2 diabetes is caused by a combination of genetic predisposing factors as well as long-standing lifestyle and dietary habits such as obesity from overindulgence and a sedentary daily routine, which is more common than type 1 [2,3].

The most common problem in diabetic patients is foot infection, which can range from superficial (e.g., cellulitis) to severe (e.g., gangrene) (eg. Chronic Osteomyelitis). This susceptibility to infection is caused by associated complications in diabetic patients, namely microvascular disease and localised neuropathy, both of which cause a loss of regenerative capability and a lack of sensory awareness of injury or trauma. As a result, patients may be unaware that they have an open wound that requires treatment, or they may lack the natural ability to fight infection and heal the wound before infection sets in [2,3].

A cross-sectional study in Riyadh conducted in 2019 showed that about 282 (76.6 percent) patients were strongly aware about diabetic foot and foot ulcers. Their knowledge came from a diabetic foot care class by 41 (11.1) patients, and 81 (22.0 percent) received diabetic foot care instructions from a doctor and 38 (10.3 percent) from a nurse. Being married, obtaining a secondary and university education, and working for the government all resulted in significantly improved knowledge when compared to others. There were no significant differences in attitudes toward diabetic foot care and diabetic foot care across age groups. Patients who had diabetes for a longer period of time (> 5 years) had a significant increase in diabetic foot care practice [4].

A systematic review was done in Saudi Arabia in 2018 and showed that most studies found a defect in awareness about the risk factors and complications of DM in the population. That review focused on the need for improving awareness and knowledge of DM among the population in SA. The review concluded that the existing healthcare systems and processes unified can help to improve awareness and knowledge of patients, families, and communities about this chronic disease are the ways to improve awareness and knowledge of DM [5]. In the same year, a study in Makkah city, Kingdom of Saudi Arabia showed that about two-thirds of participants assessed the knowledge and awareness of diabetes mellitus in Saudi Arabia as good, a quarter of them assessed it as poor (26.4%), and only (7.3%)

thought it was excellent. Participants were asked if they had ever heard about long-term complications of diabetes mellitus if blood sugar was uncontrolled. Nearly (80%) had heard about it. The most recognized complications of diabetes mellitus were as follows: 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%) [6]. The year before, a cross-sectional study showed that the prevalence of diabetic ulcers ranges from 2%-10%. The rate of lower limb amputation in diabetic foot disease is over 15% and the survival rate for patients undergoing amputation is short. Monthly amputation performed in Riyadh, also found that over 43% didn't do any exercises. However, if we consider resistance to diabetic medication as a risk factor for diabetic complications, we have 30% of diabetic patients who were at risk since they were not compliant [7].

Since diabetes is a very common problem and lack of knowledge and awareness will lead to adverse consequences including amputation to improve the health care systems, we need to measure the knowledge and awareness of the patients and the general population to initiate any interventions. Our study aims to estimate the level of knowledge and awareness about diabetes, diabetic foot, and the relationship between them and the demographic factors through the general population in Taif, Saudi Arabia.

Subjects and Methods

This study was approved by Taif University. A descriptive cross-sectional study was conducted in Taif city, Saudi Arabia. Data collection was from the first November to 30th of March 2021. Both genders, aged 16 years or above were invited to join our study. All responses that provided sufficient information were included in the study. The sample size was 704 participants selected randomly and calculated by the Raosoft calculator [8]. Data were collected via an online questionnaire that was used in previous studies [9,10,11,12], and was translated into the Arabic language. The questionnaire was distributed through social media applications. After we assured confidentiality, the participants were asked to fill in the questionnaire after giving their consent.

The questionnaire consisted of 3 sections:

1. Demographic data which included: Gender (Male, Female), Age, Educational, the living region in Taif city.
- 2- The second part involved 26 questions.

The first 16 questions were about knowledge of foot care; each answer with yes, we gave one point, and the responses no, and I don't know, were give zero points. The knowledge score was calculated for each participant by summation of all the points. The knowledge score was classified as good if the score was more than 12, acceptable if the score was between 8 and 12, and poor if the score was less than 8.

The other ten questions were from DKT2; for the correct answer we gave one score and zero for an incorrect selection with a total score out of ten.

3- What are the reasons for refusing the amputation by many patients and their relatives when it is offered by the treating physician.

Ethical approval: ethical approval was obtained from the research ethics committee of Taif university.

Data analysis: Data were analyzed using (SPSS) version 24. Qualitative data were expressed as numbers and percentages, and a Chi-squared test (χ^2) was applied to test the relationship between variables. Quantitative data were expressed as mean and standard deviation (Mean \pm SD) and a p-value of <0.05 was considered as statistically significant.

Results

Table 1 shows that 82.9% of the participants were females, 47.8% had an age ranging from 40-49 years, 67.2% had a university education, and 90.8% had a diabetic relative and 56.2% were primary degree relatives. Diabetes Type 1 was the most common type (57.2%), 55.6% had oral treatment, 45.6% had diabetic complications with retinopathy as the most common single complication (14.1%), 12.5% had more than one complication.

Table 2 shows that according to the response with the right answers on knowledge items about DM, only 18.3% of the participants reported correctly that if the diabetic has the flu he should test blood glucose more often; 48.1% reported that if a diabetic takes rapid-acting insulin, the required time until its secondary effect begins is less than 2 hours; 70% reported that if the participant is starting to have a low blood glucose reaction, he should drink some juice, and 35.9% reported that low blood glucose reaction may be due to too much insulin. Most of the participants (71.7%) reported that if a diabetic does not eat breakfast after taking a dose of insulin, the level of sugar in the blood will be decreased, 49.3% reported that high blood glucose may be due to not enough insulin, 31.6% reported that low blood glucose reaction may be due to heavy exercise, and 39.4% reported that if a diabetic right before lunch remembers that he forgot to take an insulin dose for breakfast, he should check his blood glucose level to decide how much insulin to take. Only 16.1% of the participants reported correctly that a sign of diabetic ketoacidosis (DKA) is vomiting; 62.9% reported that lung problems are not associated with diabetes, and 80.7% agreed that a diabetic should change his socks daily. Most of the participants (83.2% and 85.5%) agreed that a diabetic should dry their feet from between their toes after washing and that diabetics should trim their toenails carefully and straight respectively. Most of the respondents (84.9%) agreed that a diabetic should be seen at the clinic regularly, 42.1% reported that they have read brochures about proper shoes, 54.9% read pedicures about foot care, and 53.7% reported correctly that in cold

weather, diabetics should put their feet on a stove or use hot compresses. Of them, 73.9% correctly thought that diabetics should wash their feet daily, 92% agreed that a diabetic should see a doctor if their foot had redness, blisters, or wounds, 77.9% agreed that diabetics should not walk barefoot and 84.4% agreed that a diabetic should check the inside of the shoe before wearing it. Most of the participants (92%) agreed that diabetics should wear comfortable shoes, 76.9% agreed that diabetics should put lotions or moisturizing creams on feet to prevent dry skin, 64.2% agreed that a diabetic should use lukewarm water to wash their feet and 64.4% agreed that a diabetic should check the sole daily and put a moisturizing cream between their toes (Table 2).

More than half of the participants (53.7%) reported that if they are a diabetic patient or one of their relatives is and his or her condition requires amputation, they will agree to it. For those who refused, the most common reason was a desire to try other treatments, such as a complementary medicine (17.1%), while 15% had more than one reason (Table 2).

Mean knowledge score was 17.98 ± 4.25 . Figure 1 illustrates that 46%, 41%, and 13% of the participants had good, fair, and poor knowledge about diabetes and diabetic foot respectively. Figure 2 shows that participants with a master's degree of education had a significantly higher percentage of those who had good knowledge about diabetes and diabetic foot ($\chi^2=14.58$, p-value=0.006). And participants who had diabetic complications had a significantly higher percentage than those who had good knowledge about diabetes and diabetic foot ($\chi^2=6.42$, p-value=0.04) (Figure 3).

Table 3 shows that a non-significant relationship was found between the level of the participant's knowledge about diabetes and diabetic foot and their characteristics (except for educational level), being diabetic or having a diabetic relative, DM type, and diabetic treatment ($p>0.05$).

Table 1: Distribution of studied participants according to their characteristics, being diabetic or having a diabetic relative, DM type, treatment and complications (No.: 601)

Variable	No. (%)
Gender	
Male	103 (17.1)
Female	498 (82.9)
Age in years	
18-28	192 (31.9)
29-39	95 (15.8)
40-59	287 (47.8)
60-79	26 (4.3)
≥ 80	1 (0.2)
Educational level	
Up to secondary	176 (29.3)
University	404 (67.2)
Master	21 (3.5)
Are you diabetic or have a diabetic relative?	
I am a diabetic patient	55 (9.2)
I have a diabetic relative	546 (90.8)
Diabetic relative degree (No. 546)	
Primary	307 (56.2)
Secondary	123 (22.5)
Tertiary	73 (13.4)
Quad	43 (7.9)
Type of diabetes	
Type 1	344 (57.2)
Type 2	257 (42.8)
Type of treatment	
Oral	334 (55.6)
Insulin	267 (44.4)
Presence of diabetic complications	
Yes	274 (45.6)
No	327 (54.4)
If yes, complication type (No.: 274):	
DF	38 (6.3)
Retinopathy	85 (14.1)
Nephropathy	20 (3.3)
Neuropathy	30 (5)
DKA	26 (4.3)
More than one complication	75 (12.5)

Table 2. Distribution of studied participants according to their response to knowledge items about DM (No.: 601)

Variable	No. (%)
Q1 If the diabetic has the flu, should they:	
a. Take less insulin	23 (3.8)
b. Drink fewer liquids	20 (3.3)
c. Eat more proteins	18 (3)
d. Test blood glucose more often*	110 (18.3)
e. I don't know	430 (71.5)
Q2: If a diabetic takes rapid-acting insulin, the required time until its second effect begins:	
a. Less than 2 hours*	289 (48.1)
b. 3-5 hours	49 (8.2)
c. 6-12 hours	4 (0.7)
d. More than 13 hours	6 (1)
e. I don't know	253 (42.1)
Q3 If you are starting to have a low blood glucose reaction, you should:	
a. exercise	28 (4.7)
b. lie down and rest	16 (2.7)
c. drink some juice*	421 (70)
d. take rapid-acting insulin	44 (7.3)
e. I don't know	92 (15.3)
Q4 Low blood glucose reaction may be due to:	
a. too much insulin*	216 (35.9)
b. too little insulin	129 (21.5)
c. too much food	55 (9.2)
d. too little exercise	28 (4.7)
e. I don't know	173 (28.8)
Q5- If a diabetic does not eat breakfast after taking a dose of insulin, the level of sugar in the blood will:	
Decrease*	431 (71.7)
Increase	64 (10.6)
No change	15 (2.5)
I don't know	91 (15.1)
Q6 High blood glucose may be due to:	
a. not enough insulin*	296 (49.3)
b. skipping meals	66 (11)
c. delaying your snack	59 (9.8)
d. skipping your exercise	37 (6.2)
e. I don't know	143 (23.8)
Q7 Low blood glucose reaction may be due to:	
a. heavy exercise*	190 (31.6)
b. infection	12 (2)
c. overeating	58 (9.7)
d. not taking your insulin	136 (22.6)
e. I don't know	205 (34.1)
Q8 If a diabetic right before lunch remembers that he forgot to take an insulin dose for breakfast, what should they do now?	
a. Skip lunch to lower their blood glucose	23 (3.8)
b. Take the insulin that they usually take at breakfast	142 (23.6)
c. Take twice as much insulin as they usually take at breakfast	17 (2.8)
d. Check their blood glucose level to decide how much insulin to take*	237 (39.4)
e. I don't know	182 (30.3)

Table 2. Distribution of studied participants according to their response to knowledge items about DM (No.: 601)
continued

Q9 A sign of diabetic ketoacidosis (DKA) is: a. shakiness b. sweating c. vomiting* d. low blood glucose e. I don't know	38 (6.3) 120 (20) 97 (16.1) 65 (10.8) 281 (46.8)
Q10 One of the following is not associated with diabetes: a. vision problems b. kidney problems c. nerve problems d. lung problems* e. I don't know	38 (6.3) 23 (3.8) 40 (6.7) 378 (62.9) 122 (20.3)
Q11 Do you think that a diabetic should change his socks daily? Yes* No I don't know	485 (80.7) 41 (6.8) 75 (12.5)
Q12 Do you think that a diabetic should dry their feet from between their toes after washing? Yes* No I don't know	500 (83.2) 41 (6.8) 60 (10)
Q13- Do you think diabetics should trim their toenails carefully and straight? Yes* No I don't know	514 (85.5) 31 (5.2) 56 (9.3)
Q14 Do you think that a diabetic should be seen at the clinic regularly? Yes* No I don't know	510 (84.9) 29 (4.8) 62 (10.3)
Q15 Have you ever read any brochures about proper shoes? Yes* No I don't know	253 (42.1) 301 (50.1) 47 (7.8)
Q16- Have you ever read any pedicure information about foot care? Yes* No I don't know	330 (54.9) 234 (38.9) 37 (6.2)
Q17 In cold weather, do you think diabetics should put their feet on a stove or use hot compresses? Yes* No I don't know	323 (53.7) 85 (14.1) 193 (32.1)
Q18 Do you think diabetics should wash their feet daily? Yes* No I don't know	444 (73.9) 44 (7.3) 113 (18.8)
Q19 Do you think a diabetic should see a doctor if his foot has redness, blisters or wounds? Yes* No I don't know	553 (92) 3 (0.5) 45 (7.5)

Table 2. Distribution of studied participants according to their response to knowledge items about DM (No.: 601)
continued

Q20 Do you think a diabetic should not walk barefoot? Yes* No I don't know	468 (77.9) 64 (10.6) 69 (11.5)
Q21 Do you think a diabetic should check the inside of the shoe before wearing it? Yes* No I don't know	507 (84.4) 27 (4.5) 67 (11.1)
Q22 Do you think diabetics should wear comfortable shoes? Yes* No I don't know	553 (92) 7 (1.2) 41 (6.8)
Q23 Do you think diabetics should put lotions or moisturizing creams on feet to prevent dry skin? Yes* No I don't know	462 (76.9) 28 (4.7) 111 (18.5)
Q24 Do you think that a diabetic should use lukewarm water to wash his feet? Yes* No I don't know	386 (64.2) 58 (9.7) 157 (26.1)
Q25 Do you think that a diabetic should check the sole of the foot daily? Yes* No I don't know	411 (68.4) 69 (11.5) 121 (20.1)
Q26 Do you think a diabetic should put a moisturizing cream between their toes? Yes* No I don't know	387 (64.4) 71 (11.8) 143 (23.8)
Q27 If you are a diabetic patient or one of his relatives and his or your condition requires amputation, will you agree? Yes No If the answer is no, what is the reason for rejection? Psychological reasons Religion and society A desire to try other treatments, such as a complementary medicine Physical disability Cosmetic reasons More than one answer	323 (53.7) 278 (46.3) 54 (9) 4 (0.7) 103 (17.1) 21 (3.5) 6 (1) 90 (15)

N.B.: * = correct answer

Figure 1. Percentage distribution of the participants according to their level of knowledge about diabetes and diabetic foot

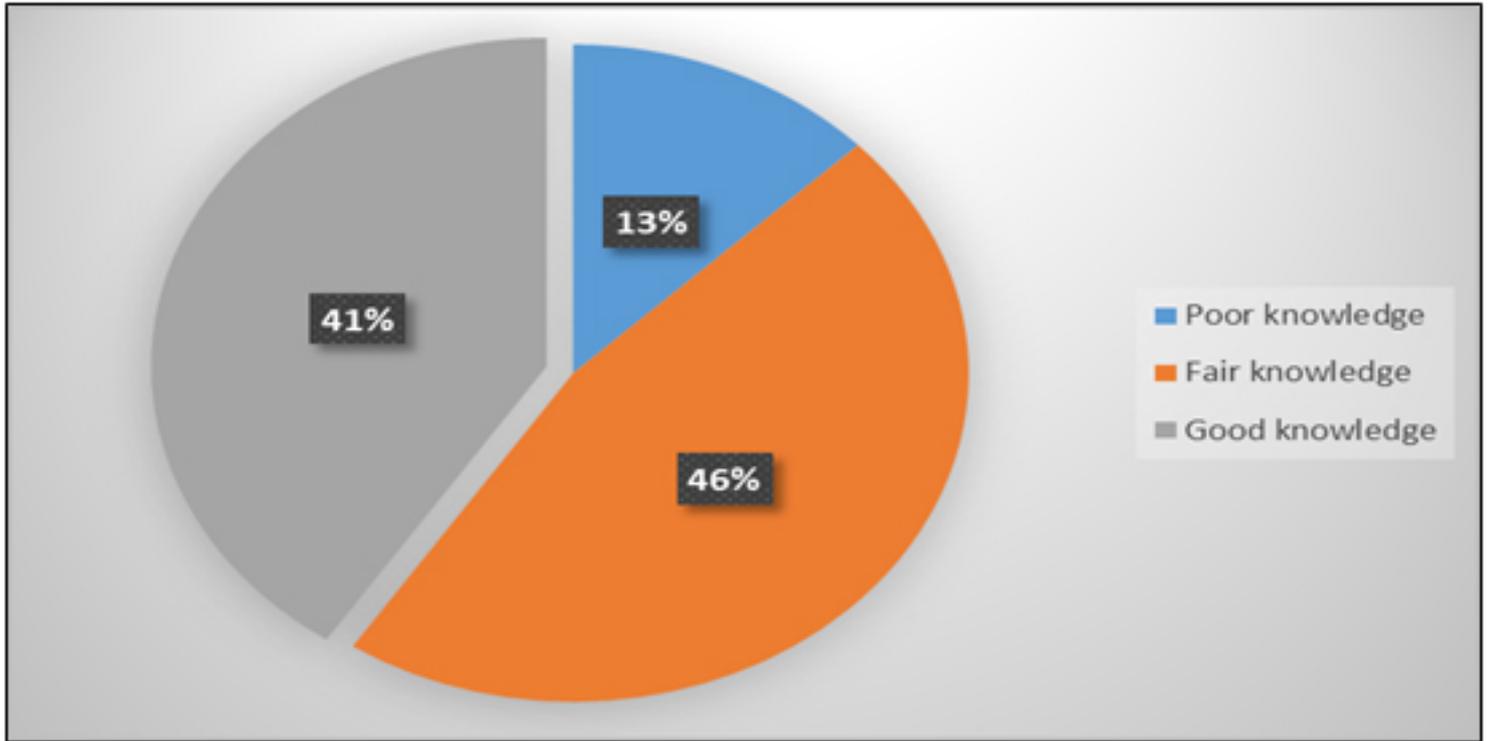
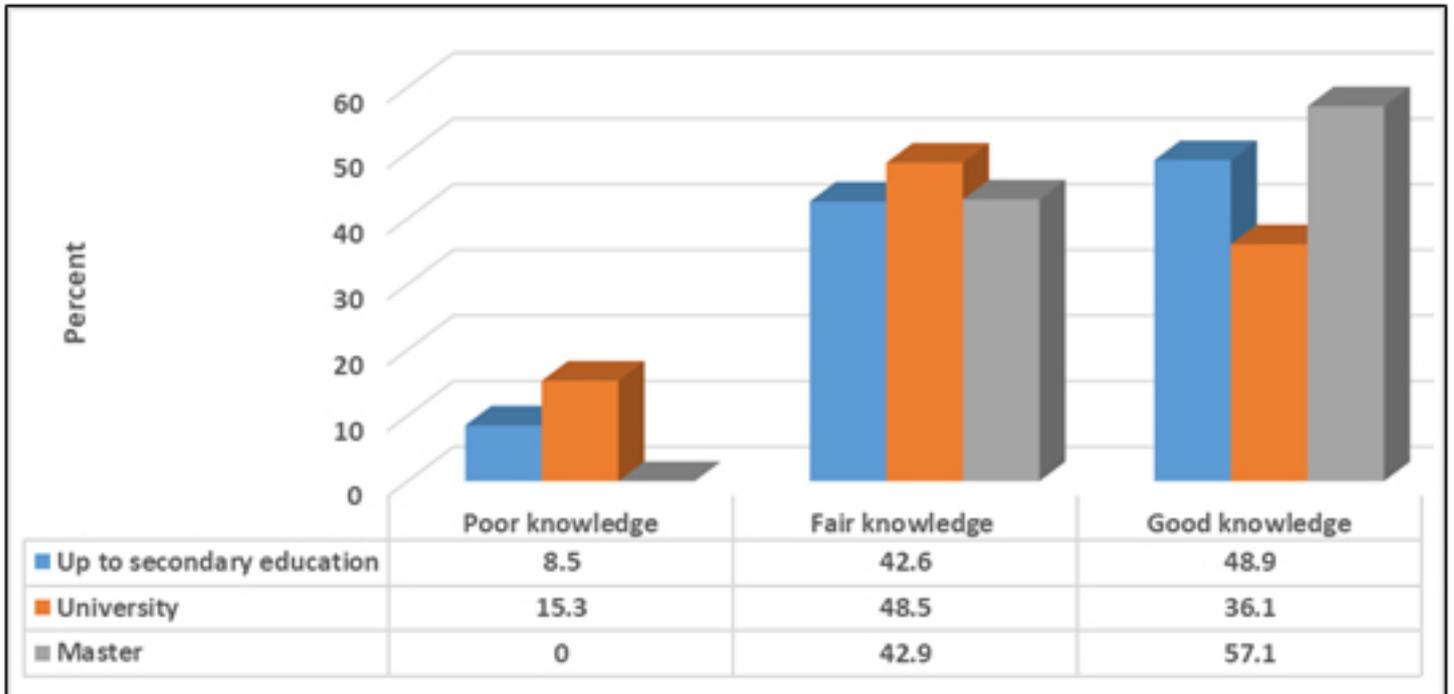
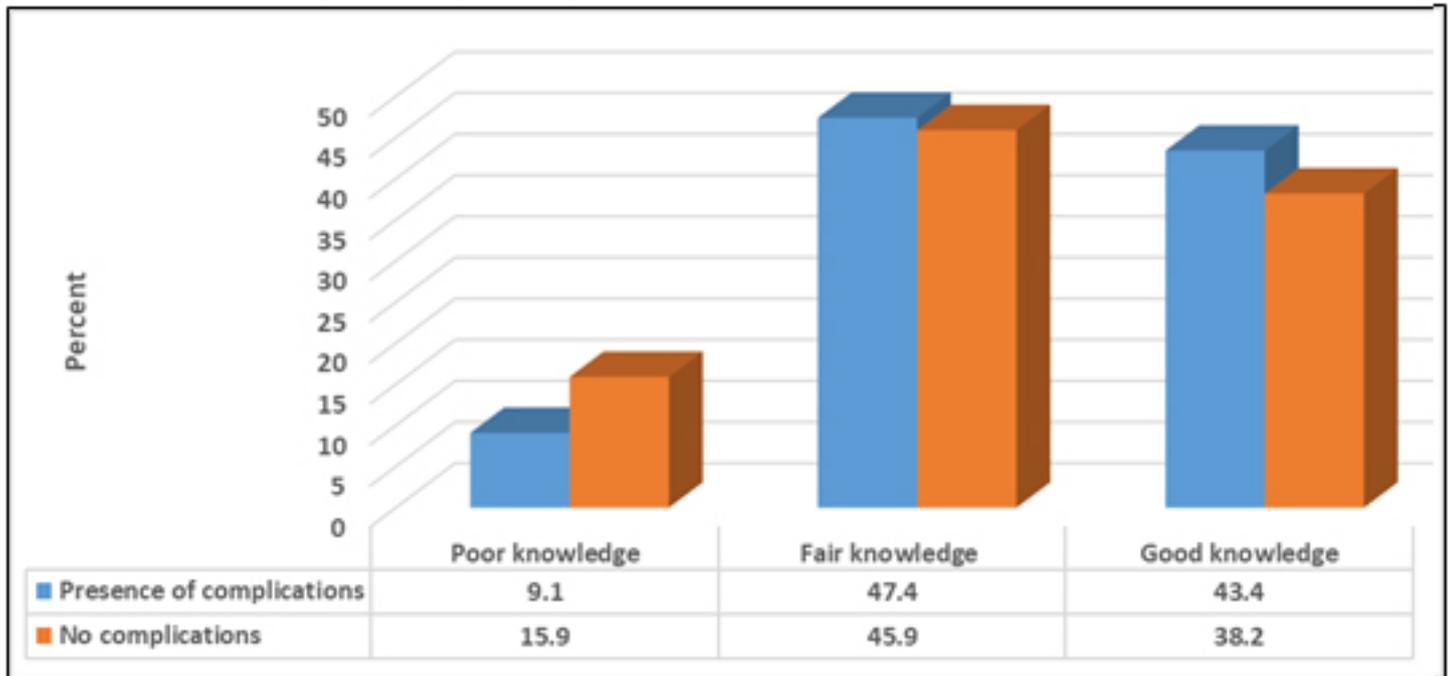


Figure 2. Relationship between level of the participant’s knowledge about diabetes and diabetic foot and their educational level (No.: 601)



N.B.: ($\chi^2=14.58$, p-value= 0.006)

Figure 3. Relationship between level of the participant's knowledge about diabetes and diabetic foot and presence of diabetic complications (No.: 601)



N.B.: ($\chi^2=6.42$, p-value= 0.04)

Table 3. Relationship between level of the participants knowledge about diabetes and diabetic foot and their characteristics, being diabetic or having a diabetic relative, DM type, treatment and complications (No.: 601)

Variable	Knowledge level			χ^2	p-value
	Poor No. (%)	Fair No. (%)	Good No. (%)		
Gender					
Male	13 (12.6)	44 (42.7)	46 (44.7)	0.9	0.635
Female	64 (12.9)	236 (47.5)	198 (39.8)		
Age in years				5.12	0.744
18-28	26 (13.5)	88 (45.8)	78 (40.6)		
29-39	15 (15.8)	45 (47.4)	35 (36.8)		
40-59	31 (10.8)	137 (47.7)	119 (41.5)		
60-79	5 (19.2)	9 (34.6)	12 (46.2)		
≥ 80	0 (0.0)	1 (100)	0 (0.0)		
Are you Diabetic or have a diabetic relative?				3.39	0.183
I am a diabetic patient	9 (16.4)	30 (54.5)	16 (29.1)		
I have a diabetic relative	68 (12.5)	259 (45.8)	228 (41.8)		
Diabetic relative degree (No. 546)				5.5	0.481
Primary	36 (11.7)	139 (45.3)	132 (43)		
Secondary	22 (17.9)	54 (43.9)	47 (38.2)		
Tertiary	6 (8.2)	35 (47.9)	32 (43.8)		
Quad	4 (9.3)	22 (51.2)	17 (39.5)		
Type of diabetes				1.19	0.552
Type 1	48 (14)	161 (46.8)	135 (39.2)		
Type 2	29 (11.3)	119 (46.3)	109 (42.4)		
Type of treatment				2.55	0.278
Oral	46 (13.8)	146 (43.7)	142 (42.5)		
Insulin	31 (11.6)	134 (50.2)	102 (38.2)		

Discussion

Patients with Diabetes are at a huge risk of developing neuropathic foot that often causes skin problems, deformity, and other limb-threatening complications. Most of these factors are modifiable and are entirely preventable or treatable. Current trends show that the incidence and prevalence of Diabetes Mellitus (DM) are increasing in Saudi Arabia at a huge pace, and Type 1 DM has become a soaring epidemic in the Kingdom [13,14]. Self-management education among diabetic patients is crucial in preventing complications related to Diabetes, as it would help them perform self-care and make necessary lifestyle modifications [15,16].

The level of awareness and education regarding diabetic foot and its risk factors are of utmost importance in seeking timely advice and treatment. This study's findings showed that the knowledge regarding Diabetes and diabetic foot was moderate in these patients. During the assessment of knowledge related to Diabetes, we found that only 35.9% knew the reasons for hypoglycemia. The hypoglycemic symptoms vary between patients and may be nonspecific, and their intensity may decrease with age. When a patient experiences hypoglycemia, the common symptoms may not always be the first to appear. To avoid severe complications, it is essential to recognize and identify these symptoms at their early stages to take appropriate, timely medical care [17].

A study done by Shiram et al. among type 2 diabetic Mellitus patients reported that 66.1% of the participants had good knowledge regarding the most common symptoms of hypoglycemia [18]. In our study, most patients (70%) knew about the immediate management of hypoglycemia. Patients who have hypoglycemia could manage the condition by immediately taking oral or intravenous glucose or drinks rich in glucose sugars and/or immediately taken to hospital for taking intramuscular glucagon injection in case the patient is unable to take oral agents [19,20].

The knowledge about the mechanism of action of rapid-acting insulin among these patients was not that satisfactory. Understanding the mechanism of action of insulin analogues requires knowledge of normal human insulin action. Our study findings showed that 44.4% were on analogue insulin and remain on oral hypoglycemic drugs. Insulin therapy is commonly given to the majority of patients with Type 1 DM and some with Type 2DM [21,22].

Type 1 DM results from lack of endogenous insulin secretion and autoimmune destruction of β -cells in the pancreas [23]. To minimize the burden for the health care providers, hospitals, and patients, it is essential that these diabetic patients need to know about insulin self-administration. The likelihood of making errors during self-injection of insulin is high among patients, and it demands sound knowledge and a good attitude toward self-administration [24].

Studies conducted in different countries like India [25], Turkey [26], Egypt [27], and United Arab Emirates [28] have reported good knowledge regarding insulin self-administration among diabetes patients. It is crucial to have the proper knowledge and attitude regarding self-management of Diabetes to reduce the morbidity and mortality associated with it, thereby improving the quality of life.

Diabetic ketoacidosis (DKA) is a life-threatening condition resulting from an uncontrolled increase in blood glucose levels, increased ketone concentration in the body, and metabolic acidosis, which is seen more in Type 1 DM patients compared to Type 2 DM [29].

Patients experiencing DKA may present with a myriad of symptoms, including nausea, vomiting, anorexia, abdominal pain, increased thirst, polyuria, and weight loss, and on physical examination, signs of tachycardia and tachypnea are seen [30]. The current study findings showed that knowledge regarding signs of DKA was poor among the participants. Self-monitoring of blood glucose and ketone bodies by diabetes patients could provide essential and complementary information on the metabolic state. Patients could utilize home-based self-monitoring devices for blood glucose and ketone estimation, which is paramount in preventing DKA development [31].

The knowledge regarding self-care of diabetic foot was excellent among the study population. Another study conducted by Desalu et al. in Ghana reported poor knowledge and practices on foot care among diabetic patients [32]. Diabetic foot lesion is one of the major complications resulting from peripheral vascular disease and neuropathy [33]. This lesion is highly preventable in most diabetic patients, and poor knowledge regarding foot care might lead to foot ulcers and other lower extremity complications, and amputation [34]. Patients should be educated about foot care practices such as daily foot washing and drying, appropriate nail care, compatible footwear, and daily foot examination. The control of diet is crucial in the management of DM, and self-dietary management is a key step to control the blood glucose level among diabetes patients. A study done in Saudi Arabia has reported that poor dietary knowledge increases the risk of getting Type 2 DM [35], and similar findings have been reported by many authors worldwide [36,37,38,39].

Limitations

The cross-sectional nature of the study design could reveal the associations between studied variables without concluding the causal relationships.

Conclusion

This study found that participants who had diabetic complications had a significantly higher percentage of those who had good knowledge about diabetes and diabetic foot. No significant relationship between the level of the participant's knowledge about diabetes and diabetic foot and their characteristics (except for educational level)

was found. Fortunately, most of the respondents (84.9%) agreed that a diabetic should be seen at the clinic regularly. Based on the results of this study, healthcare providers should give more time to educate the patients and their relatives about DM especially the complications before they happen. Also, more Public awareness campaigns should be started and clinics must involve patients in making decisions about the management.

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