

Perception of Attendees of Primary Healthcare Centers in Al-Majmaah City, Saudi Arabia About Skin Manifestations of Diabetes Mellitus

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ABSTRACT

Background: Diabetes mellitus is one of the prevalent diseases in the Saudi community and exploring perception of skin manifestation in diabetes mellitus among the patients is important to improve the prognosis and quality of life for the patients. However, this part of knowledge among diabetics is under-researched.

Objectives: This study aims to evaluate the perception on skin manifestation in diabetes mellitus among attendees of a primary care center in Al-Majmaah City, Riyadh region, Kingdom of Saudi Arabia.

Methods: A descriptive cross-sectional study was conducted using a pre-tested and pre-coded self-administered questionnaire. The study targeted all attendees of the Primary Care Centers in Al-Majmaah city, using multi-stage systemic sampling. Data were analyzed by SPSS version 21, using descriptive statistics and Chi-square test.

Results:

346 participants participated in the study, 235 (67.9%) females and 111 (32.1%) males, who were mostly young and middle-aged and of no or low formal education. Most of the participants were not diabetic 300 (86.7%) but have diabetic close relative 238 (68.80%). The main sources of information for the most known skin manifestations of DM were health care providers, internet & social media, and relatives and friends, the average of each was 88 (25.57%), 84 (24.37%) and 81 (23.30%), respectively. The most known skin manifestations of DM were delayed healing 324 (93.6%), xerosis (dry skin) 274 (79.2%) and Diabetic foot 264 (76.3%).

Conclusion: Overall, there was a lack of knowledge about these manifestations. The authorities need to take the necessary actions to address these gaps in knowledge through more efficient utilization of the sources commonly used by the attendees of the PHCs.

Key words: Diabetes, Health education, Public health, Primary care, Saudi Arabia, Skin manifestations

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INTRODUCTION

Diabetes is a chronic, metabolic disease characterized by elevated levels of blood glucose, which leads over time to serious damage to various organs. Diabetes mellitus (DM) has been

found to be related to high mortality, morbidity, and vascular complications, accompanied by poor general health and lower quality of life [1]. In the past three decades the prevalence of type 2 diabetes has risen dramatically in countries of all income levels [2]. Diabetes is responsible for 318,036 regional deaths in adults aged 20-79 years in 2017 (13% of all mortality) and more than half of all deaths from diabetes in the Middle East and North Africa (MENA) occurred in people under 60 [3].

The World Health Organization (WHO) has reported that Saudi Arabia ranks the second highest in the Middle East and is seventh in the world in the rate of diabetes. It is estimated that around 7 million of the population are diabetic and almost around 3 million have pre-diabetes, and an estimate of approximately a ten-fold increase in the past three decades in Saudi Arabia [1,3], particularly among females, older children/adolescent and in urban areas [4], of whom an estimate of 35,000 diabetic patients under the age of 20 years [3]. Further insidious increase in the prevalence and incidence of DM is expected in Saudi Arabia [1].

Skin disorders, usually neglected and frequently underdiagnosed among diabetic patients, are common complications and encounter a broad spectrum of disorders in both type 1 and type 2 diabetes mellitus (DM), e.g. cutaneous infection, dry skin, pruritus. They can be the first sign of diabetes, while uncontrolled diabetic patients will be at high risk of skin tags, xerosis, delay wound healing and diabetic foot ulcer [5].

Although diabetic's skin disorders are reported in the literature, there is limited data regarding early-stage skin disorders in DM patients. A study by Zimmo, et al. on 558 diabetic patients, attending the dermatology and diabetic clinic found that the common skin disorders were: xerosis (74.7%), pruritus (38.2%), diabetic dermopathy (30.1%), finger pebbles (25.6%), and thickened skin (22.2%) [6]. Another study found that Saudi diabetic patients had a greater prevalence of skin manifestations in type 2 than type 1, and as the duration of diabetes increased, the likelihood of developing skin manifestations also increased in those patients having diabetes of less than 5 years' duration (80.6%), compared to more than 5 years (98%). Shahzad, et al. found that the skin manifestations included gangrene, diabetic dermopathy, paresthesia, diabetic feet, diabetic bullae and fungal infections [7].

The current literature suggests that patient education improves the outcome and reduces the complications [8–10]. A summary of studies about public knowledge about DM among the Saudi population has shown a lack of public awareness of the risk factors and complications of DM, including medical students and healthcare workers [8,9]. Other studies have shown a significant statistical association between foot

care education, practices, and diabetic foot [11] and suggested that periodic counseling should also be integrated into the treatment program [12]. Overall, there is a general agreement that diabetic patients should receive health education about clinical manifestations and prevention of diabetic complications.

Despite the high prevalence of skin manifestations of DM [6,13,14] and lack of knowledge about them [8,15,16], especially among those with lower levels of formal education [10,16,17] and the significance of health education about DM in improving the outcomes and managing its complications [8,18,19]; the specific knowledge about skin complications among Saudi diabetic patients remains an under-researched area. The aim of this study is to evaluate the perception of the attendees of a primary care center in Al-Majmaah City, Kingdom of Saudi Arabia about the skin manifestations in diabetes mellitus and to determine the sources of their knowledge about these manifestations.

METHODS AND MATERIALS

Study design

This study used a cross-sectional questionnaire-based study, where a pre-tested, pre-coded, questionnaires were used to collect data through a structured Arabic self-administered questionnaire. The questionnaire was categorized into demographic data; presence (or absence) of diabetes in the respondents or their families; their source of information about DM; and their awareness of skin complications associated with diabetes.

Study design and population

A descriptive questionnaire-based study was conducted among the attendees of the PHC centers in Al-Majmaah City who fulfilled the inclusion criteria (whether diabetic or not) Al-Majmaah city, Riyadh province, which has an area of 30,000 square kilometers and a population of 45,000 people. The sample size was calculated at 346 participants.

Sampling and inclusion criteria

The study used multi-stage systemic sampling. The sampling frame included all the PHCCs in Al-Majmaah City. Six PHCCs (Al-Faihaa, Al-Faisaliah, Al-Yarmouk, Harmah, Al-Majmaah, Al-Matar) were selected at random and subjects were selected using systemic random sampling

from each PHCC attendance list who fulfilled the following inclusion criteria:

Age: 15 - 60 years old, regardless their diagnosis (diabetic or not).

Ability to understand and complete Arabic self-administered questionnaire.

If the participant cannot complete the questionnaire by himself/herself, one of the researchers will read the questions and record the responses

Ability to provide informed consent.

Attendees who did not meet the inclusion criteria were excluded from the study.

Data collection and data analysis

A pre-tested and pre-coded self-administered questionnaire was developed and used. It was revised by three consultants in endocrinology, dermatology, and research methods for consistency, validity, and suitability of use to collect the intended information. It consisted of two main parts. First, there was a section on demographic information and health condition of the participants, e.g. their gender, age, education level, diabetic or non-diabetic, and family history of diabetes. The second section asked about the participants' awareness of the skin manifestation of diabetes mellitus and the sources of this information. All the questions were in Arabic. Data collected by using the online link sent to the official list of registered phones in those PHCs. The data were entered into Microsoft Excel (version 2016), then transferred to the Statistical Package for the Social Sciences Program (SPSS) 21st Edition for statistical analysis. Chi square test of independence was performed to examine the relations between the main variables based on a degree of freedom (df) of 1 and p-value of 0.05 or less is considered statistically significant.

Ethical considerations

The study was approved by the ethics committee in the Ministry of Health (Central IRB log No: 2019-0069E). The attendees of the PHC centers were approached for a written informed consent. The questionnaires were filled by the participants at their place and time of convenience. To maintain confidentiality, the questionnaires did not include any identifiable information and the filled questionnaires are kept safe in compliance with the Ministry of Health policies.

RESULTS

Participants' educational and diabetic profiles

346 participants participated in the study, 235 (67.9%) were females and 111 (32.1%) were males. Table 1 summarizes the main demographic and diabetic features of the participants. Overall, most of the participants were young and middle-aged and were not diabetic 300 (86.7%) but have diabetic close relative 238 (68.80%). The diagnosis of diabetes was almost equal in both males and females, 22 (6.4%), and 24 (6.9%) respectively).

Main sources of information about skin manifestations of DM

Overall, the main sources of information about diabetes were equally distributed among the participants, namely health care providers, internet & social media and relatives & friends, 102 (29.5%) for each. 40 participants (11.6%) stated that their main source of information about diabetes was the educational materials. Moreover, for each source, there was no apparent variation by the participants' gender, except for the Educational Material, where there were less men than women who considered them as their main source of information, 29 (12.3%) and 11 (9.9%), respectively (Table 2). There was no significant association between sex of the participants and their main source of knowledge about DM, $X^2(3, N=364)=1.006, p=0.800$.

The sources of information for the most known skin manifestations of DM were health care providers, internet & social media, and relatives and friends, the average of each was 88 (25.57%), 84 (24.37%) and 81 (23.30%), respectively. The main sources among both female and male participants were internet and social media, relatives and friends, and health care providers, with an average of 30% for each in both categories. The least used source of information was the educational material which was used by 29 (12.3%) female participants and 11 (9.9%) male participants.

Participants' knowledge about skin manifestations of DM

The participants' knowledge about various skin manifestations of DM varied widely (Figure 1: source vs manifestation). The most known skin manifestations of DM were delayed healing 324 (93.6%), xerosis (dry skin) 274 (79.2%)

Table 1: Demographic and diabetic profile of participants.

Variable	Female		Male		Total	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Age						
>60	5	1.40%	10	2.90%	15	4.30%
15-30	110	31.80%	39	11.30%	149	43.10%
31-45	86	24.90%	35	10.10%	121	35.00%
46-60	34	9.80%	27	7.80%	61	17.60%
Total	235	67.90%	111	32.10%	346	100.00%
Education						
Illiterate	2	0.60%	1	0.30%	3	0.90%
Primary	5	1.40%	0	0.00%	5	1.40%
Intermediate	7	2.00%	17	4.90%	24	6.90%
Secondary	45	13.00%	36	10.40%	81	23.40%
University	167	48.30%	51	14.70%	218	63.00%
Postgraduate	9	2.60%	6	1.70%	15	4.30%
Total	235	67.90%	111	32.10%	346	100.00%
Diabetic status						
Not diabetic	211	61.00%	89	25.70%	300	86.70%
Diabetic	24	6.90%	22	6.40%	46	13.30%
Total	235	67.90%	111	32.10%	346	100.00%
Family history of DM						
No	69	19.90%	39	11.30%	108	31.20%
Yes	166	48.00%	72	20.80%	238	68.80%
Total	235	67.90%	111	32.10%	346	100.00%

Table 2: Main source of participants' information about diabetes.

Sex	Source of information							
	Educational material		Health sources		Internet & Social media		Relatives and Friends	
	No.	%	No.	%	No.	%	No.	%
Female	29	12.30%	66	28.10%	71	30.20%	69	29.40%
Male	11	9.90%	36	32.40%	31	27.90%	33	29.70%
Total %	40	11.56%	102	29.48%	102	29.48%	102	29.48%

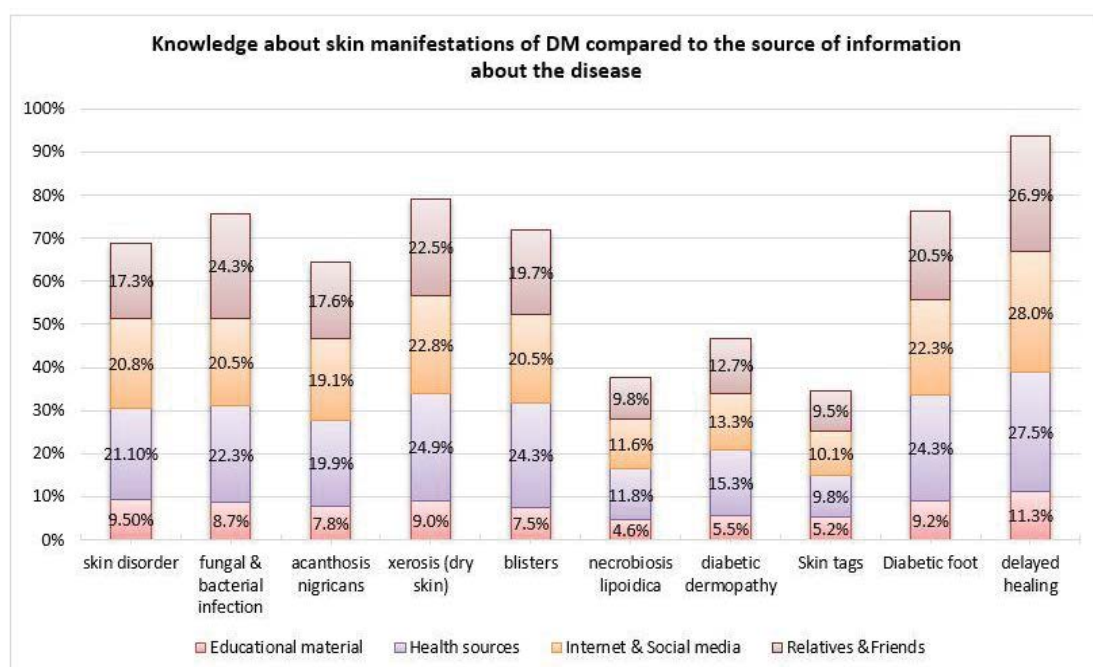


Figure 1: Knowledge about skin manifestations of DM compared to the source of information about the disease.

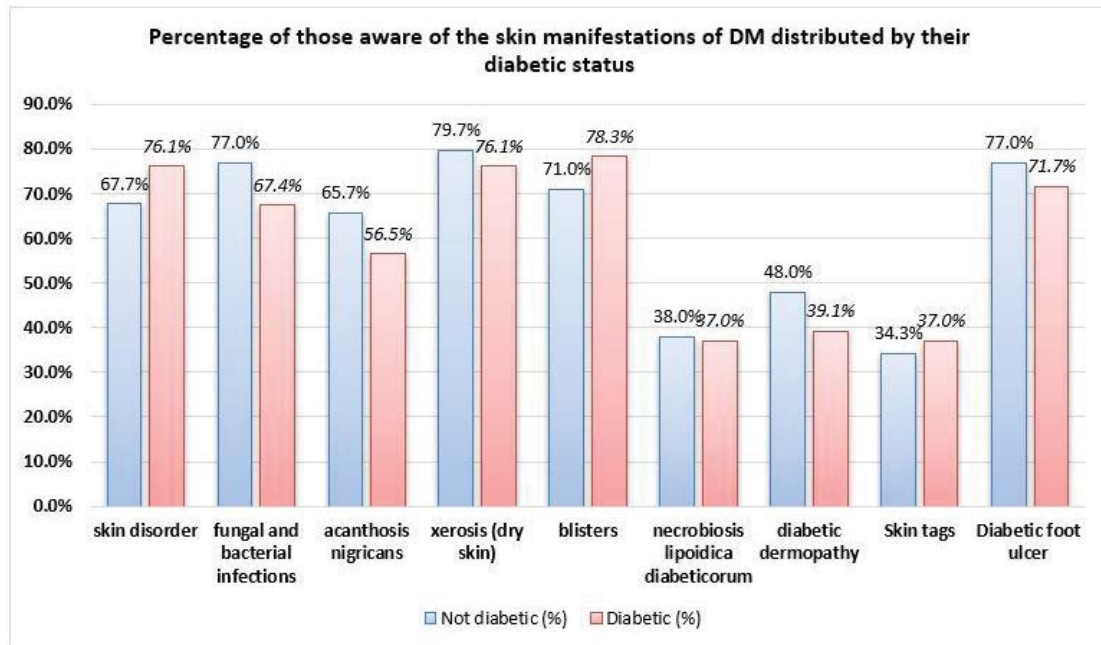


Figure 2: Percentage of those aware of the skin manifestations of DM distributed by their diabetic status.

and diabetic foot 264 (76.3%). In contrast, the least known manifestations were Skin tags 120 (34.7%), necrobiosis lipoidica 131 (37.9%), and diabetic dermopathy 162 (46.8%).

The manifestations were better known among those who used health care providers sources, Internet & Social media, and Relatives & Friends as their main sources of information, with average of 88 (25.57%), 84 (24.37%) and 81 (23.30%), respectively, compared to an average of only 34 (9.83%) among those who used educational material across all the manifestations. There was no statistical association between the source of the information about DM except for skin disorders (p=0.033) and blisters (p=0.044).

The average of awareness of skin manifestations of DM among the participants was 206 (59.6%). However, the average percentage of knowledge about these manifestations among female participants was 144.8 (44.4%), which was more than double the average of knowledge among the male participants 61.4 (19.0%).

The level of knowledge about skin manifestations of DM had the same pattern among both diabetic and non-diabetic patients (Figure 2). There was no statistical association between the diagnosis of DM and the level of awareness about its skin manifestations. Nevertheless, the diabetic patients were more aware of the association of DM and blisters 36 (78.3%), skin disorders 35 (76.1%) and skin tags 17 (37%) compared to

the non-diabetics about these manifestations. However, the non-diabetics were more aware of the association of the rest of the skin manifestations they were asked about.

DISCUSSION

This study was conducted to assess the knowledge of the attendees of the PHC centers in Al-Majmaah city about skin manifestations of DM. The main findings are discussed under two subheadings: The demographic and diabetic profile and the sources and levels of knowledge about these manifestations.

The participants' demographic and diabetic profile

Most of the participants were female attendees, persons who have low level of education, and young persons. This is quite comparable to the overall demographic profile of the Saudi population. The persons between 15 and 34-year-old represent about 25%, and those between 35 and 40-year-old represent about 31%, while those who are 60-year-old or more represent 5.5% of the population [20]. However, the level of persons who are either illiterate or with primary education is unexpectedly higher than the national and international figures, which is estimating the literacy rate in the kingdom at around 90% in both sexes [21], as well as other similar studies [22]. This could be an incidental finding given that most of the attendees of those PHCs were from the remote rural villages

around Al-Majmaah city. This assumption can be supported by the findings of a similar study on the same population by Alzahrani, et al. who found that 18% of the participants were either illiterate or with primary education [23].

Moreover, this could be explained by the fact that despite the high number of PHC visits estimated at 50.2 million visits in 2018; this figure represents less than half (43.2%) of the total number of visits to health care facilities in the same year, estimated at 144 million visits [20]. It is reasonable to expect that the more educated persons would have better jobs that facilitate their access to other sources of healthcare, hence missed in this PHC-based study. Nevertheless, Salem et al. found is no relation between the level of health literacy with age and education level of the participants [16].

Most of the participants were not diabetic 300 (86.7%) yet had diabetic, close relative 238 (68.8%), which is concomitant with their mostly young age. The significance of assessing their knowledge about skin manifestations of DM is that they are at relatively higher risk to be diabetic [22]. Thus, their knowledge needs to be assessed so that the needed interventions are taken early in case their knowledge was deficit or incorrect. Also, as discussed later, it should be known whether their diabetic, close relatives represent the main source of information about the disease.

Knowledge about the skin manifestations of DM

Main sources of knowledge

There were three main sources of information about the skin manifestations of DM: Healthcare providers, the use of the internet and social media. The reliance on health providers' source is relevant given the high percentage of participants with low or no formal education. Moreover, the role of the healthcare providers in effective diabetes education and prevention of complications was concluded in other studies. For example, Goweda, et al. found that almost half of the participants (49.1%) in their study received educational information from their providers [11], while Alwan, et al. found that the most frequent sources were mass media (57.4%) and health sector (29.9%) [24].

The use of the internet and social media as a main source of information is relevant to the official published figures that among those whose ages

range between (12 and 65 years), 83.83% use the internet, and 91% use cell phones [25]. Also, this result is comparable to other studies conducted in the kingdom. Mohieldein, et al. have conducted a study that involved 2007 Saudi citizens about their knowledge about diabetes found that relatives and friends, in addition to media, were the major sources of information (73.8% and 47.1%, respectively) [26]. Similarly, Salem, et al. found that media and family members are common sources of information about diabetes [16].

In contrast, the least used source of information was the educational material in both male and female participants (12.3% and 9.9%, respectively). This is expected given the high level of illiterate and low-educated participants. Moreover, the use of this material has diminished by the ministry of health. For example, in 2018 there were only 31 health education lectures held was lectures, no educational seminars, and 53,000 visits to health education clinics out of 50.2 million visits to the PHCs in the same year [27]. Moreover, educational material was not found helpful in other studies on knowledge about DM in the Saudi population [9,22,28].

The most known skin manifestations of DM were delayed healing 324 (93.6%), xerosis 274 (79.2%) and Diabetic foot 264 (76.3%), which are the commonly seen manifestations of DM in Saudi population [7,29,30]. The level of knowledge about delayed healing is higher than other studies [31–33]. Expectedly, the least level of knowledge was among those who used educational material at an average of 9.9%, which matches the levels of their usage as sources of information about DM.

Interestingly, the levels of knowledge among female participants were more than double that of male participants. Given that both sexes receive the same services, used the same sources of information almost equally, and lack of sex-segregated statistics about the PHCs visits in the annual Ministry of Health (MOH) statistics; it would be hard to find a straightforward explanation from this study. Nevertheless, this finding is like the findings of Al-Mutairi (2015) who found that female students were more aware of the benefits of preventative lifestyle behaviors than males [34]. However, our findings contradict previous findings which found that there is a lack of knowledge within the age group less than 40-year-old, females, and illiterates [35].

Another interesting finding is that the levels of knowledge about skin manifestations of DM were similar among both diabetic and non-diabetic participants. Moreover, the non-diabetics had better levels of knowledge about skin disorders and blisters as skin manifestations of DM, compared to diabetic patients. Lack of knowledge among Saudi diabetic patients has been described by Mohieldein, et al. who concluded that there is serious unawareness of diabetes [26].

The main limitation of this study is related to its geographical and conditional scope, where it included a mostly suburban region of Riyadh that may not be representative of the metropolitan capital city. The questions were focused on the skin manifestations of DM without further expansion of other complications or risk factors. However, this was meant to remedy the gap in knowledge about this under-researched area of DM without repeating the known information from other studies done in Saudi Arabia.

CONCLUSION

Our study has revealed characteristics and gaps in the current knowledge about skin manifestations of DM. Overall, there was a lack of knowledge about these manifestations. The authorities need to take the necessary actions to address these gaps in knowledge through more efficient utilization of the sources commonly used by the attendees of the PHCs. Any means of communication of information need to consider the educational level of the target audience. Peer knowledge is an area that needs to be explored and enhanced through training diabetic patients to educate their relatives and other patients who are at higher risk of getting diabetes.

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REFERENCES

1. Abdulaziz Al Dawish M, Alwin Robert A, Braham R, et al. Diabetes mellitus in Saudi Arabia: A review of the recent literature. *Curr Diabetes Rev* 2016; 12:359-368.
2. https://www.who.int/health-topics/diabetes#tab=tab_1

3. [https://www.thelancet.com/journals/lancet/article/PIIS0140-6736\(16\)31679-8/fulltext](https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(16)31679-8/fulltext)
4. Alotaibi A, Perry L, Gholizadeh L, et al. Incidence and prevalence rates of diabetes mellitus in Saudi Arabia: An overview. *J Epidemiol Glob Health*. 2017; 7:211-218.
5. Duff M, Demidova O, Blackburn S, et al. Cutaneous manifestations of diabetes mellitus. *Clin Diabetes* 2015; 33:40-48.
6. Zimmo SK. Prevalence of skin manifestations in diabetes mellitus at King Abdulaziz University Hospital. *Saudi J Intern Med* 2012; 2:19-22.
7. Shahzad M, Al Robaee A, Al Shobaili HA, et al. Skin manifestations in diabetic patients attending a diabetic clinic in the Qassim region, Saudi Arabia. *Med Princ Pract* 2011; 20:137-141.
8. Alanazi AM, Abo El-Fetoh NM, Alotaibi HK, et al. Survey of awareness of diabetes mellitus among the Arar population, Northern border region of Saudi Arabia. *Electron Phys* 2017; 9:5369-5374.
9. Alanazi FK, Alotaibi JS, Paliadelis P, et al. Knowledge and awareness of diabetes mellitus and its risk factors in Saudi Arabia. *Saudi Med J* 2018; 39:981.
10. Al Zahrani HA, Qadi MA. Foot care knowledge and practice among diabetic patients attending primary health care centers in Jeddah City. *J King Abdulaziz Univ Med Sci* 2011; 98:1-34.
11. Goweda R, Shatla M, Alzaidi A, et al. Assessment of knowledge and practices of diabetic patients regarding diabetic foot care, in Makkah, Saudi Arabia. *J Fam Med Heal Care* 2017; 3:17-22.
12. Inzucchi SE, Bergenstal RM, Buse JB, et al. Management of hyperglycemia in type 2 diabetes: A patient-centered approach: Position statement of the American diabetes association (ADA) and the European association for the study of diabetes (EASD). *Diabetes Spectr* 2012; 25:154-171.
13. de Macedo GMC, Nunes S, Barreto T. Skin disorders in diabetes mellitus: an epidemiology and physiopathology review. *Diabetol Metab Syndr* 2016; 8:63.
14. Lima AL, Illing T, Schliemann S, et al. Cutaneous manifestations of diabetes mellitus: A review. *Am J Clin Dermatol* 2017; 18:541-553.
15. Aida H, Heather G, Maria V, et al. Diabetes awareness and behavioural risk factors among University students in Saudi Arabia. *Middle East J Fam Med* 2013; 99:1-6..
16. Salem A, Majed A, Mahfooz Mustafa MA, et al. Knowledge, attitude, and practice regarding diabetes mellitus among general public and diabetic patients in Riyadh, Saudi Arabia. *Asian J Pharm*. 2018; 12.
17. Al-Aboudi IS, Hassali MA, Shafie AA. Knowledge, attitudes, and quality of life of type 2 diabetes patients in Riyadh, Saudi Arabia. *J Pharm Bioallied Sci* 2016; 8:195.
18. Sanjay S, Chin YC, Sun Y, et al. Awareness of HbA1c and Its relationship With Diabetic Retinopathy Among Adult Diabetic Patients Attending a Tertiary Ophthalmic Center. *Diabetes Care* 2013; 36:e1LP-e1.

19. Megeid FYA, El-Sayed MMA. Health education intervention improves knowledge, attitude and practices of mothers of insulin dependent diabetes mellitus. *World Appl Sci J* 2012; 17:1398-1404.
20. <https://www.moh.gov.sa/en/Ministry/Statistics/book/Pages/default.aspx>
21. <http://uis.unesco.org/en/country/sa>
22. Bani IA. Prevalence, knowledge, attitude and practices of diabetes mellitus among Jazan population, Kingdom of Saudi Arabia (KSA). *J Diabetes Mellit* 2015; 30:115.
23. Alzahrani M. Severe lack of diabetic foot education among Saudi patients with diabetes in Majmaah, Saudi Arabia. *Int J Adv Life Sci* 2016; 9:472-478.
24. Alwan YMS, Alayed IS, Albarakati MH. Assessing awareness about diabetes mellitus among attendees of primary health care centers, Makkah, Saudi Arabia. *Egypt J Hosp Med* 2017; 66:57-65.
25. <https://www.stats.gov.sa/en/news/254>
26. Mohieldein AH, Alzohairy MA, Hasan M. Awareness of diabetes mellitus among Saudi non- diabetic population in Al-Qassim region, Saudi Arabia. *J Diabetes Endocrinol* 2011; 2:14-19.
27. <https://www.stats.gov.sa/en/929-0>
28. Al Rasheed R, Al Adel F. Diabetic retinopathy: Knowledge, awareness and practices of physicians in primary-care centers in Riyadh, Saudi Arabia. *Saudi J Ophthalmol* 2017; 31:2-6.
29. Furqan S, Kamani L, Jabbar A. Skin manifestations in diabetes mellitus. *J Ayub Med Coll Abbottabad* 2014; 26:46-48.
30. Sameer KZ. Prevalence of skin manifestations in diabetes mellitus at King Abdulaziz University Hospital. *Saudi J Intern Med*. 2012; 30:19-22.
31. Foma MA, Saidu Y, Omoleke SA, et al. Awareness of diabetes mellitus among diabetic patients in the Gambia: A strong case for health education and promotion. *BMC Public Health* 2013; 13:1124.
32. Omer AR, Alghamdi AA, Alyamani RA, et al. Awareness on diabetes complications and protective measures in Makkah region among known diabetic patients: A cross-sectional survey. *Int J Sci Res* 2017; 6:2450-2458.
33. Obirikorang Y, Obirikorang C, Anto EO, et al. Knowledge of complications of diabetes mellitus among patients visiting the diabetes clinic at Sampa Government Hospital, Ghana: A descriptive study. *BMC Public Health*. 2016; 16:637.
34. Al-Mutairi RL, Bawazir AA, Ahmed AE, et al. Health beliefs related to diabetes mellitus prevention among adolescents in Saudi Arabia. *Sultan Qaboos Univ Med J* 2015; 15:e398.
35. AL-Asmary Alis, Mostafa Ossa, AL-Khaldi YM. Diabetic patients' knowledge and practice regarding prevention of diabetic foot. *Med J Cairo Univ*. 2013; 81.