Knowledge about Diabetes and Its Effect on Quality of Life among Diabetic Patients in King Abdulaziz University Hospital, Jeddah

**Hatoun Elazhary[1*], Abdulhaleem Noorwali[2], Nisar Zaidi[3], Reem Alshamrani[1],
Maram Aljohani[1], Duaa Khan[1] and Hadeel Saati[1]**

[1]*College of Medicine, King Abdulaziz University, Jeddah, Saudi Arabia.*
[2]*Department of Surgery, Oncology and Diabetic Foot, King Abdulaziz University, Jeddah,
Saudi Arabia.*
[3]*Department of Surgery, King Abdulaziz University, Jeddah, Saudi Arabia.*

Authors' contributions

This work was carried out in collaboration between all authors. Authors HE, AN and NZ designed the study, wrote the protocol. Authors RA and MA performed the statistical analysis and wrote the first draft of the manuscript. Author MA managed the analyses of the study. Author HS managed the literature searches. All authors participated in data collecting and were part of the team from the writing the proposal until editing the final draft. All authors read and approved the final manuscript.

Article Information

Original Research Article

ABSTRACT

Background: Quality of life (QOL) is an essential part in Diabetic patients since low QOL can decrease self-care which can lead to increased mortality and complications. The purpose of this study is to determine the effects of diabetes on QOL in Saudi Arabia, and to assess the knowledge about diabetes among these patients in order to know if there is a relation between diabetes knowledge and patient's QOL.
Methods: Cross sectional study done in king Abdul-Aziz university hospital in Jeddah. The sample was on type 2 diabetic patients (N=300), they were recruited from hospital wards and outpatient clinics during 2016. The questionnaire consisted of 3 sections: demographic and medical characteristic, knowledge of diabetes and QOL assessed by 4 dimensions.

_____

*Corresponding author: E-mail: hatoon_toona@hotmail.com, ha.al-azhary@hotmail.com;

Results: The mean age of the study population was 55.6±10.1 years and 189 (63%) were female. The median duration of having diabetes was 10 years. The mean score of diabetes knowledge was 8.57±1.8 out of 12 indicating good level of knowledge. The worst score was for alcohol's effect on blood glucose, only 21.7% answered correctly. The mean score QOL was 34.1±7.7 out of 50 which indicates average level of lifestyle. Regrading effect of the knowledge on QOL, there was positive correlation with no significant association.

Conclusion: Diabetes impairs QOL of patients, and the knowledge about diabetes affects QOL. We recommend the engagement of health professionals in educational settings in order to enhance health-related knowledge. Seminars, counseling sessions and workshop should be arranged periodically for diabetic patients to increase their awareness.

1. INTRODUCTION

Diabetes is a common chronic illness that have been increasing throughout the years, million people have diabetes in the world and more than 35.4 million people in the MENA Region (middle east, north African region), by 2040 this will rise to 72.1 million. There were 3.4 million cases of diabetes in Saudi Arabia in 2015 [1].

Diabetic patients are usually older, overweight, less likely to exercise, and more likely to have comorbidities and complications. The increasing number of diabetes has harmful effects on quality of life outcomes. Quality-of-life issues are of absolute importance, because they may strongly predict an individual's capability to manage his disease and maintain long-term health and well-being [2]. Diabetes mellitus imposes a heavy burden on individuals and health care systems [3]. Quality of life is an essential part in diabetic patients since low quality of life can decrease self-care which can prompt to increase mortality and complications (e.g. chronic renal failure, blindness, and lower limb amputations) which influence wellbeing and productivity [4]. Evidence shows that people affected by diabetes often have inadequate knowledge about the nature of the disease, its risk factors and the associated complications [5]. Poor motivation from the patient's side to maintain optimum glycemic control, their negligent attitude toward infection, injury, and other symptoms related to the feet leads to a delay in timely consultation to their physician [6]. Knowledge about diabetes is fundamental for the management, since it requires day-to-day knowledge about nutrition, exercise, monitoring, and medications [7].

The purpose of this study is to assess the knowledge about diabetes among diabetic patients in order to know if there is a relation between diabetes knowledge and patient's quality of life. Education about diabetes is important factor to change the behavior of the patients and for encouraging the patients in active management of their condition.

We chose patients in king Abdul-Aziz University Hospital; to assess their knowledge about DM* and to measure different dimensions of quality of life, including (general health, physical health, psychological health, social relationships, environment).

A lot of other studies came to the importance of health education because it is the theoretical and methodological basis for health promotion actions, as it can support both diseases prevention and rehabilitation and promote citizenship, personal and social responsibility related to health and contribute in the training of multipliers and caregivers [8].

2. METHODS

This is a cross sectional, interview- based study design conducted at King Abdul-Aziz University Hospital in Jeddah, the target population was diabetic patients who were admitted in the hospital wards or attending outpatient clinics. The data was collected from April 2016 to May 2016.Sample size was calculated using raosoft site, it was 300 diabetic patients measured by adding 10%. (based on total DM patients number per month 1200 patients, an error of 5%, the confidence interval of 95% and a prevalence of 50%). Out of the 300 patients enrolled in the study, 200 were from outpatient clinic and 100 from hospital ward. Patients were chosen randomly, and they were included in the study if they had diagnosis of type 2 DM, were at between 18-70 years old, Saudi or non-Saudi lived more than 3 years in Saudi Arabia, and excluded if they were currently pregnant and were non- Saudi living less than 3 years in Saudi

Arabia. Face to face structured interview questionnaire, was pre-tested on 10 diabetic patients a likely similar population to the study participants. The questionnaire was based on three major dimensions: demographic data (consisting of 18 items), knowledge (general knowledge consisting of 2 items, monitoring blood glucose consist of 2 items, factors affecting on blood glucose level consist of 2 items, complication of DM consist of 3 items) and QOL (physical health consist of 4 items, psychological health consist of 3 items, social relationship consist of 2 items, environment consist of 1 item). The questionnaire was based on thorough search of relevant literature and discussion with experienced faculty members.

2.1 The Scoring of Participants' Responses

Regarding knowledge questions (12), a score of (1) was given to the right answer. Summation of scores computed and the total score was 12, and the range was (0 -12). Then the score was transformed to a percentage. Which was categorized into high, who will get >80, the moderate, who will get between 50 to 80, and poor, who will get <50. (100)

2.2 Data Entry and Statistical Analysis

All collected data were coded and entered into a personal computer. Data entry and statistical analysis performed by using the Statistical Product and Service Solutions (SPSS, version 22.0) and appropriate statistical tests were applied.

Descriptive statistics (i.e., frequency, percentage, mean and standard deviation) calculated. Chi-square test, One way ANOVA, and independent t test were applied to compare participants' knowledge grades knowledge dimension and total score of lifestyle dimension and different demographic variables. Pearson test was used for the correlation between knowledge dimension & total score of lifestyle dimension P-value of <0.05 was considered as statistically significant.

2.3 Ethical Considerations

The protocol for the study was approved by the Ethics Committee for Health Researches at King Abdul-Aziz University Hospital.

Moreover, before the interview, the researchers explained the purpose of the study to all participants briefly and dealt with the collected data confidentially and used the data only for the purpose of research. Participants were informed that their participation in the study was completely optional and they had the full right to refuse to participate. Their consent to participate was obtained and the ethical considerations were observed through all research steps.

2.4 Pilot Study

Face to face structured interview questionnaire was pre-tested on 10 diabetic patients a likely similar population to the study participants.

2.5 Validity

The questionnaire developed by the researchers after reviewing the relevant literature to collect the necessary data which has been revised and validated by three expert consultants from medicine department.

2.6 Reliability

The researchers evaluated the reliability of variables included in the study questionnaire. It was assessed using the Cronbach's alpha coefficient. The questionnaire proved an acceptable reliability which was equal 0.719.

3. RESULTS

Three hundred diabetic patients who attend outpatient clinics in KAUH[***] were involved in this study, of which 189 (63%) were female and 111 (37%) were male, with mean age score 55.6±10.1, 144 (48%) were Saudi, and the majority (250-83.3%) were married. Only 56 (18.6%) had university degree and more than half (180- 60%) reported no job. Three quarter (265- 89%) reported no smoking (Table 1).

Table 2 showed the medical characteristic of the participants, the median score of duration of being a diabetic patient was 10 years, 255 (85%) reported taking medication on regular base, 122 (40%) stated checking blood sugar 1-2 times per day, the majority (249-83%) reported hyperglycemia experience, Where two third (200- 66.7%) reported hypoglycemia experience with main symptoms of sweating (34.3%) followed by shacking (33.7%) then (32.7%) confusion. More than half (177-59%) stated seeing dietitian. The main source of knowledge was doctors (64.7%) (Table 2).

Table 1. Demographic data

Variables	N (300)	%
Gender		
Female	189	63.0
Male	111	37.0
Nationality		
Saudi	144	48.0
Non-Saudi	156	52.0
Marital status		
Single	16	5.3
Married	250	83.3
Divorced	11	3.7
Widow	23	7.7
Employee		
Employed	68	22.7
Not employed	180	60.0
Retired	52	17.3
Education		
University and above	56	18.6
High school	60	20.0
Intermediate school	41	13.8
Elementary school	58	19.3
Illiterate	85	28.3
Smoking		
No	265	89.0
Yes	35	11.0
Smoking type		
Cigarettes	21	60%
Shisha	14	40%
Variables	Mean± SD	Rang (min-max)
Age	55.6±10.1	(27-70)

Table 3 showed the rate of choosing right information about DM, the higher rate was for (Exercise: Decrease random blood sugar) 92%, followed by (Carbohydrates & stress : Increase random blood sugar) 91.3% equally, (Home Monitoring: Blood testing) 89.3%, then (Hypoglycemia correction: Drink juice) 87.3%, then (Complication of diabetes: Eye symptoms) 79.3%, (Healthy Diabetic Diet: low fat, high fiber, and low added sugar diet) 70.3%, (Infection : increase random blood sugar) 66.7%, then (To Assessment tool of Controlling DM: Glycosylated HB (HbA1c) and Diabetic foot care: Check the feet and wash) 58.3%, followed by (Hyperglycemia signs: Numbness) 53.3%, and lastly (Alcohol: Increase random blood sugar) 21.7%. (Table 3)

Regarding participants' knowledge and relation with gender, martial statue and educational level, there was a significant association between gender and stress increasing random blood sugar item (94.2% female vs 86.5% male, p=0.01). There was significant association between martial statue & Controlling DM: Glycosylated HB (HbA1c) item (p=0.03), also there was significant association between educational level and two items (Hypoglycemia Correction: Drink juice) (p=0.03) & (Alcohol: Increase random blood sugar) (p=0.004), while all other items showed no significant difference.

Table 4 showed the mean scores of individual domains for knowledge dimension and lifestyle dimension and also the total score for each dimension, the mean score of total knowledge dimension was 8.57±1.8 which indicate good level of knowledge. While the mean score of total lifestyle dimension was 34.1±7.7 which indicate average level of lifestyle (Table 4).

Regarding knowledge and lifestyle dimensions and relation with gender, marital status and educational level, there was significant association between gender and physical activity domain where males are more interested in physical activity than female (12.33±3.69 for female vs 13.57±4.14 for male, p=0.008), also there was significant association between educational level and two domains environment domain (p=0.001) and monitoring blood glucose domain (p=0.002). Significant association between educational level and total mean score for knowledge dimension was found (p=0.008) in all the domain there is increasing in lifestyle domains with high level of education, while all other domains showed no significant difference.

Regarding the domain of quality of life, the mean score of individual items are shown in Table (5). One item (10.0%) (Item 4) its mean scores was (2.6) indicating poor quality of life, scores on 3 out of 10 (30.0%) (Items 1,2 & 5) were between (3.0-3.5), and 5 items (50.0%) (Items 3,6,7,9 &10) were between (3.6-4.0) which indicates average satisfaction, one item (10.0%) (Item 8) was (4.2) indicating good quality of life with positive trend. On the other hand, each item of the domains was divided to three categories (poor, moderate and good) and percentage was calculated for each category, half of the participants reported poor level of practicing exercises, more than third reported moderate impact on their sleep, emotions and moderate level of physical pains, more than half stated moderate level of family supports and safety

environments, more than half reported that diabetes condition didn't affect their social life, daily activities, working performance and that they don't have any worries about their blood sugar changes. Regarding the association between level of knowledge and the quality of life, the results showed significant association between good level of knowledge and all items of good physical health, physiological conditions, social relationship, and environment. (Table 5)

Table 2. Medical characteristic

Variables	N (300)	%
Medications regularly		
Yes	255	85.0
No	45	15.0
Checking blood sugar		
Never	76	26.0
1-2 times per day	122	40.0
3-5 times per day	30	10.0
3 times or less per week	72	24.0
Experienced hypoglycemia		
Yes	200	66.7
No	100	33.3
If yes, list symptoms (Multiple symptoms)		
Not applicable	95	31.7
Shaking	101	33.7
Rapid heart beat	88	29.3
Sweating	103	34.3
Blurred vision	84	28.0
Confusion	98	32.7
No symptoms, only low reading	12	4.0
Experienced hyperglycemia		
Yes	249	83.0
No	51	17.0
Complain of other illness		
Yes	208	69.4
No	92	30.6
Saw dietitian		
Yes	177	59.0
No	123	41.0
Source of knowledge (Multiple sources)		
Doctors	194	64.7
Social media	62	20.7
Friends	30	10.0
Other	31	10.3
Nothing	34	11.3
Variables	Median	Quartile (25-75)
Duration of diabetes by years	10	(5-15)

Table 3. Participants' knowledge of DM

Variables	N (300)	%
Exercise: Decrease random blood sugar	276	92.0
Carbohydrates: Increase random blood sugar	274	91.3
Stress: Increase random blood sugar	274	91.3
Home Monitoring of Blood Sugar: Blood testing	268	89.3
Hypoglycemia Correction: Drink juice	262	87.3
Complication of Diabetes: Eye symptoms	238	79.3
Healthy Diabetic Diet: low fat, high fiber, and low added sugar diet	211	70.3
Infection: Increase random blood sugar	200	66.7
Assessing Control of Diabetes: Glycosylated HB (HbA1c)	175	58.3
Diabetic Foot Care: Check the feet and wash	175	58.3
Hyperglycemia signs: Numbness	160	53.3
Alcohol: Increase random blood sugar	65	21.7

Table 4. Participants' knowledge of DM and life style scores

Variables	Mean ± SD	RANG (Min-max)
General knowledge	1.56±0.6	(0-2)
Monitoring Blood glucose	1.47±0.6	(0-2)
Factors affecting on blood glucose level	3.64±0.9	(0-5)
Complication of DM	1.91±0.9	(0-3)
Total score 1 (knowledge of DM)	8.57±1.8	(0-12)
Physical health	12.8±3.9	(4-20)
Psychological health	10.7±3.1	(3-15)
Social relationship	8.02±1.7	(2-10)
Environment	3.8 ±1.1	(1-5)
Total score 2 (quality of life)	34.1±7.7	(10-50)

Table 5. Dimensions of quality of life

Variables	Poor	Moderate	Good	P value	Mean± SD	Range
Physical Health						
1-Physical pain	98 (32.6%)	126 (42.1%)	76 (25.3%)	0.002*	3.3±1.2	(1-5)
2-Sleep	100 (33.3%)	101 (33.6%)	99 (33.0%)	0.0001**	3.3±1.5	(1-5)
3-Performance at work	80 (26.6%)	92 (30.7%)	128 (42.7%)	0.0001**	3.6±1.4	(1-5)
4-Exercise	150 (50.0%)	112 (37.3%)	38 (12.7%)	0.0001**	2.6±1.3	(1-5)
Psychological						
5-Emotions	101 (33.7%)	130 (43.3%)	69 (23.0%)	0.0001**	3.2±1.3	(1-5)
6-Diabetes effect on daily activities	74 (24.6%)	105 (35.1%)	121 (40.3%)	0.0001**	3.7±1.3	(1-5)
7-Blood sugar changes causing worries	65 (21.6%)	89 (29.6%)	146 (48.8%)	0.0001**	3.8±1.4	(1-5)
Social relationships						
8-Diabetes effect on social life	35 (11.7%)	64 (21.3%)	201 (67.0%)	0.0001**	4.2±1.2	(1-5)
9-Family support	50 (16.7%)	163 (54.3%)	87 (29.0%)	0.0001**	3.7±1.2	(1-5)
Environment						
10-Home safety environment	32 (10.6%)	184 (61.4%)	84 (28.0%)	0.0001**	3.8±1.1	(1-5)

Table 6. Relation between level of knowledge and of quality of life

Variables	Level of knowledge			P value
	Poor N=5 (1.6%)	Moderate N=143 (47.7%)	Good N= 152 (50.7%)	
Physical health	12.4±3.6	12.9±3.8	12.4±4.0	0.9
Psychological health	12.4±3.4	10.8±2.9	10.7±3.3	0.4
Social relationship	7.0± 2.5	7.9±1.7	8.0±1.7	0.4
Environment	1.2±0.4	2.5±1.4	2.7±1.3	0.02*
Total score	33.2±6.1	34.2±7.1	34.2±8.3	0.9

One way ANOVA test was used to detect the association

Chi square test was used to detect the association regarding the relation between level of knowledge and of quality of life, the results showed significant association between good level of knowledge and safety environment (p=0.02), while in all other quality of life domains no significant difference was found (Table 6).

Concerning the correlation between total score of knowledge dimension and total score of lifestyle dimension there was a positive correlation but with no significant difference (r= 0.014, p=0.82). While the correlation between total score of lifestyle dimension and age and duration of diabetes were negative correlation without significant difference (r= -0.103, p=0.07) and (r= -0.063, p=0.28) respectively.

4. DISCUSSION

The current study shows prevalence of T2DM in female (63%) is significantly higher than men (37%). similar result was found in studies made in brazil and Saudi Arabia [8,9]. On the contrary, studies show the opposite result with minimal differences [10,11,12], it is maybe due to larger number of females involved in the study compared to men.

Our result show significant increases of DM in married people compared to other patient with different marital status, maybe it is due to higher number of married patient (N= 250- 83.3%) compared to single patients (N=16 -5.3%), divorced (N=11- 3.7%), and widow (N=23 -7.7%). Studies from Brazil and Poland show the same result. [8,13]

Also, the study found increase prevalence of DM2** in not employed patients (60%). The same result in study made in Saudi Arabia [9].

The current study found illiterate diabetic patient have higher prevalence of diabetes than educated patients with minimal differences (28.3 %)This result agrees with other studies from Saudi Arabia [9] and Canada [14].

Study also show increase prevalence of DM 2 in non-smoker patients (89%). It may be due to a higher number of females compared to men in the study and smoking is less common in female in Saudi culture. The same result from study from Canada [14].

4.1 Medical Characteristic

Although the most of diabetic patients are taking their medication regularly (85%) and more than the half had saw dietitian (59%), it shows increase prevalence of experienced hypoglycemia (66.7%) and (83%) experienced hypoglycemia. May be due to poor sources of knowledge about this chronic disease as current study shows most of them have information from their doctors (64.7%),followed by Social media (20.7%), then (11.3%) had No source of knowledge [15] .As study from USA [16] and Thailand [17] found strong opposite relationship between patient education and glycemic control .The other reason that may contribute to having poor glycemic control is having other illness as the current study show highly prevalence (69.4%) of diabetic patient with other diseases.

The results of the current study found (40%) of DM2 patient are checking blood sugar at home and (26%) are never which may increase risk of diabetes complication [18].

4.2 Knowledge of DM

The mean score of total knowledge dimension was 8.57±1.8 which indicate good level of knowledge, similar to other researches done in Saudi Arabia Riyadh in 2016 [19]. Unlike 2 studies done in Vietnam with different regions [20,21] show insufficient knowledge of T2D in different geographical regions indicate the importance of education especially in rural areas.

Our study shows No differences in knowledge were observed between men and women, and between different martial statues (single, married, divorced and widow). The same result regarding relation between sex and knowledge found in study conducted in Greece [22].

Patients with higher education demonstrated greater diabetes knowledge comparing to Illiterate people as better education attainment is indicative of better understanding of the disease. The same result in studies conducted in Greece [22] and Ohio [23], and Pakistan [24].

The knowledge percentage of questions about treat hypoglycemia by different (drink juice) was 87.3% which a good percentage is comparing to incorrect answering in the studies [19,25,26].

Knowledge scores were high regarding questions about factors affecting the glucose level in blood which are (Exercise: Decrease DM), as study done at 2016 [19] and (Carbohydrates: Increase DM). This finding disagrees with those of other studies [25,26,27]. Also, high scores in answering the question (Home Monitoring: Blood testing) 89.3% with relatively same result in study done in Emirate [28].

Patients' awareness about complications was relatively average; 79.3% with same finding in a study [19]. Other study shows satisfaction result [28].

Knowledge scores were low regarding the both questions (Controlling DM: by (HbA1c) and diabetic foot: check the feet and wash) 58.3% as in the in Riyadh [27] show poor knowledge about Hba1c test but good knowledge about foot caring.

lastly, knowledge about (Alcohol: Increase DM) was significant low 21.7% maybe as Alcohol drinking is not allowed in Islam and is not socially accepted.

4.3 Quality of Life

Diabetes affects negatively all quality dimensions, the quality of life score 34.1±7.7 out of 50. Many studies found similar results [4,29]. In Saudi Arabia, the quality of life of diabetic patients was studied by multiple researchers using deferent questioners such as SF36 and EQ5d, they also reached the same result [9,19].

The main age of the sample was 55 years and most of the sample had diabetes for 10 years. The effect of age on quality of life showed negative correlation without significant difference (r= -0.103, p=0.07), while the correlation between duration of diabetes and quality of life also showed negative correlation without significant difference (r= -0.063, p=0.28). These results were similar a research done in Portuguese [12].

Women had worse quality of life than men regarding physical health dimension only and similar results as men in other dimensions. The physical health score for female 12.33±3.69 out of 20, and as for male 13.57±4.14 and the P-Value is 0.008. This is similar to a research done India and Saudi Arabia in 2014 [4,9] This might be due to higher HbA1c and anxiety level and increased cardiovascular risk in female [12].

The safety of home and neighborhood conditions such as availability of stairs at home and places for exercise affects quality of life, the score for environment is 3.8 ±1.1 out of 5. In Saudi Arabia, a research was done to assess environment effect in lifestyle of diabetic patients and it shows a close relation between the environment setting, life style and health statutes [30].

The association between quality of life and level of knowledge about diabetes was studied. There was significant association between good level of knowledge about diabetes and a safe environment, P-Value is 0.02. Regarding effect of the knowledge on other dimensions of quality of life, there was positive correlation with no significant association. In contrast to a pilot study done in Saudi by Hana R. Al-Ban nay, et al [31], which showed education program has increased all dimension of the quality of life not only environment dimension, this result is similar to another research done in Thai [17].

5. CONCLUSION

The knowledge of diabetic patient in KAUH is average, which indicate patient need for more education during their hospital stay or while following up diabetes especially about factors affecting blood glucose level. The quality of life for the sample was also average, which require further assessment of the patients' conditions to know the risk factors affecting their quality of life and how to improve it. Similar to other researches, the knowledge of diabetes didn't

significantly increase quality of life which might be due attitude and practice issues of already established knowledge. We recommend the engagement of health professionals in educational settings in order to enhance health-related knowledge. Seminars, counseling sessions and workshop should be arranged periodically for diabetic patients to increase their awareness.

6. LIMITATION OF THE STUDY

The study was done in one center only in Jeddah and the result can't be generalized to Kingdom of Saudi Arabia. The research consisted of two parts, knowledge about diabetes and quality of life, which compromised the number of questions that can be asked to patients. In kingdom of Saudi Arabia, the assessment of quality of life was done by different methods which made the comparison of the results between researches not accurate.

CONSENT

As per international standard or university standard, patient's written consent has been collected and preserved by the authors.

ETHICAL APPROVAL

As per international standard or university standard, written approval of Ethics committee has been collected and preserved by the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Anonymous. Saudi Arabia Diabetes Journal List; 2015.
   (Accessed 14 December 2017)
   Available:https://www.omicsonline.org/diabetes-journals-saudi-arabia/

2. Richard R. Rubin, PhD, CDE. Diabetes and quality of life. Diabetes Spectrum; 2000.
   (Accessed 14 December 2017)
   Available:http://journal.diabetes.org/diabetesspectrum/00v13n1/pg21.htm

3. Yang Chi-Hsuan Asphodel, Ting Hung-Wen. Health-related quality of life and its related factors in patients with diabetes. 2016;17:3.
   (Accessed 1 December 2017)
   Available:http://www.nursinglibrary.org/vhl/bitstream/10755/601677/1/Chi Hsuan_Yang_2015.pdf

4. Jain V, Shivkumar S, Gupta O. Health-related quality of life (Hr-Qol) in patients with type 2 diabetes mellitus. N Am J Med Sci. 2014;6(2):96-101.
   DOI: 10.4103/1947-2714.127752.

5. Alanazi AM, Abo El-Fetoh NM, Alotaibi HK, Alanazi KA, Alotaibi BK, Alshammari SM, et al. Survey of awareness of diabetes mellitus among the Arar population, Northern Border Region of Saudi Arabia. Electron Physician. 2017;25;9(9): 5369-5374.
   DOI: 10.19082/5369. eCollection 2017 Sep.

6. Taksande BA, Thote M, Jajoo UN. Knowledge, attitude, and practice of foot care in patients with diabetes at central rural India. J Family Med Prim Care. 2017;6(2):284-287.
   DOI: 10.4103/2249-4863.219994.

7. Anonymous. Diabetes education: Why it is so crucial to care.
   (Accessed 19 march 2018)
   Available:http://www.joslin.org/info/diabetes_education_why_its_so_crucial_to_care.html

8. Imazu MF, Faria BN, de Arruda GO, Sales CA, Marcon SS. Effectiveness of individual and group interventions for people with type 2 diabetes. Rev Lat Am Enfermagem. 2015;23(2):200-7.
   DOI: 10.1590/0104-1169.0247.2543.

9. Al Hayek AA, Robert AA, Al Saeed A, Alzaid AA, Al Sabaan FS. Factors associated with health-related quality of life among saudi patients with type 2 diabetes mellitus: A cross-sectional survey. Diabetes Metab J. 2014;38(3):220-9.
   DOI: 10.4093/dmj.2014.38.3.220. Epub 2014 Jun 17.

10. Singh A, Shenoy S, Sandhu JS. Prevalence of type 2 diabetes mellitus among urban sikh population of Amritsar. Indian J Community Med. 2016;41(4): 263-267.

11. Meo SA, Zia I, Bukhari IA, Arain SA. Type 2 diabetes mellitus in Pakistan:

Current prevalence and future forecast. J Pak Med Assoc. 2016;66(12):1637-1642.

12. Sepúlveda E, Poínhos R, Constante M, Pais-Ribeiro J, Freitas P, Carvalho D. Health-related quality of life in type 1 and type 2 diabetic patients in a Portuguese central public hospital. Diabetes Metab Syndr Obes. 2015;29(8):219-26.

    DOI: 10.2147/DMSO.S80472. eCollection 2015.

13. Golicki D, Dudzińska M, Zwolak A, Tarach JS. Quality of life in patients with type 2 diabetes in Poland – Comparison with the general population using the EQ-5D questionnaire. Adv Clin Exp Med. 2015;24(1):139-46.

    DOI: 10.17219/acem/38137.

14. Imayama I, Plotnikoff RC, Courneya KS, Johnson JA. Determinants of quality of life in adults with type1 and type 2 diabetes. Health Qual Life Outcomes.2011;19(9):115.

    DOI: 10.1186/1477-7525-9-115.

15. Jamal A, Khan SA, AlHumud A, Al-Duhyyim A, Alrashed M, Bin Shabr F, et al. Association of online health information–Seeking behavior and self-care activities among type 2 diabetic patients in Saudi Arabia. J Med Internet Res. 2015;17(8):e196.

    DOI: 10.2196/jmir.4312.

16. Chrvala CA, Sherr D, Lipman RD. Diabetes self-management education for adults with type 2 diabetes mellitus: A systematic review of the effect on glycemic control. Patient Educ Couns. 2016;99(6):926-43.

    DOI: 10.1016/j.pec.2015.11.003. Epub 2015 Nov 22.

17. Wichit N, Mnatzaganian G, Courtney M, Schulz P, Johnson M. Randomized controlled trial of a family-oriented self-management program to improve self-efficacy, glycemic control and quality of life among Thai individuals with type 2 diabetes. Diabetes Res Clin Pract. 2017;123:37-48.

    DOI: 10.1016/j.diabres.2016.11.013. Epub 2016 Nov 19.

18. Younis BB, Shahid A, Arshad R, Khurshid S, Masood J. Charcot osteoarthropathy in type 2 diabetes persons presenting to specialist diabetes clinic at a tertiary care hospital. BMC Endocr Disord. 2015;15:28. DOI: 10.1186/s 12902-015-0023-4.

19. 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(3):195-202. DOI: 10.4103/0975-7406.171683.

20. Binh T, Phuong P, Nhung. Knowledge and associated factors towards type 2 diabetes among a rural population in the Red River Delta region, Vietnam. Rural Remote Health. 2015;15(3):3275. Epub 2015 Sep 26.

21. Quang LN, Ha NT, Viet NQ. Study on knowledge, attitude and practices about control of diabetes in Thai Binh population, 2011. Vietnam Journal of Practical Medicine. 2012;7(834):127-132.

22. Poulimeneas D, Grammatikopoulou MG, Bougioukli V, Iosifidou P, Vasiloglou MF, Gerama MA, et al. Diabetes knowledge among Greek type 2 diabetes mellitus patients. Endocrinol Nutr. 2016;63(7):320-6. DOI: 10.1016/j.endonu.2016.04.008. Epub 2016 Jun 3.

23. Jeppesen KM, Hull BP, Raines M and Miser WF. A validation study of the spoken knowledge in low literacy in diabetes scale (SKILLD). J Gen Intern Med. 2012;27(2):207-12. DOI: 10.1007/s11606-011-1900-9. Epub 2011 Oct 18.

24. Masood I, Saleem A, Hassan A, Umm-E-Kalsoom, Zia A, Khan AT. Evaluation of diabetes awareness among general population of Bahawalpur, Pakistan. Prim Care Diabetes. 2016;10(1):3-9. DOI: 10.1016/j.pcd.2015.06.004. Epub 2015 Jun 29.

25. Al-Maskari F, El-Sadig M, Al-Kaabi JM, Afandi B, Nagelkerke N, Yeatts KB. Knowledge, attitude and practices of diabetic patients in the United Arab Emirates. PLoS One. 2013;8(1):e52857. DOI: 10.1371/journal.pone.0052857. Epub 2013 Jan 14.

26. Al-Adsani AM, Moussa MA, Al-Jasem LI, Abdella NA, Al-Hamad NM. The level and determinants of diabetes knowledge in Kuwaiti adults with type 2

diabetes. Diabetes Metab. 2009;35(2):121-8.
DOI:10.1016/j.diabet.2008.09.005. Epub 2009 Feb 27.

27. Murata GH, Shah JH, Adam KD, Wendel CS, Bokhari SU, Solvas PA, et al. Factors affecting diabetes knowledge in type 2 diabetic veterans. Diabetologia. 2003;46(8):1170-8. Epub 2003 Jul 11.

28. Hashim MJ, Mustafa H, Ali H. Knowledge of diabetes among patients in the United Arab Emirates and trends since 2001: A study using the Michigan diabetes knowledge test. East Mediterr Health J. 2017;22(10):742-748.

29. Manjunath K, Christopher P, Gopichandran V, Rakesh PS, George K, Prasad JH. Quality of life of a patient with type 2 diabetes: A cross-sectional study in rural South India. J Family Med Prim Care. 2014;3(4):396-9.
DOI: 10.4103/2249-4863.148124.

30. Sidawi B, Al-Hariri MT. The Impact of built environment on diabetic patients: The case of Eastern Province, Kingdom of Saudi Arabia. Glob J Health Sci. 2012;4(4): 126-38.
DOI: 10.5539/gjhs.v4n4p126

31. Al-Bannay HR, Jongbloed LE, Jarus T, Alabdulwahab SS, Khoja TA, Dean E. Outcomes of a type 2 diabetes education program adapted to the cultural contexts of Saudi women. A pilot study. Saudi Medical Journal. 2015;36(7):869-73.
DOI: 10.15537/smj.2015.7.11681.

Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sciencedomain.org/review-history/24271