Diabetes mellitus knowledge of type 2 diabetic patients, Almajmaah, Saudi Arabia

Waqas Sami*[&]***, Tahir Ansari***, Nadeem Shafique Butt****and Mohd Rashid Bin Ab Hamid**
*Department of Public Health & Community Medicine, College of Medicine, Majmaah University, 11952, Kingdom of Saudi Arabia, **Faculty of Industrial Management, Universiti Malaysia Pahang, 26300 Gambang, Kuantan, Pahang, Malaysia, *** Department of Clinical Sciences, College of Medicine, Majmaah University, 11952, Kingdom of Saudi Arabia, **** Department of Family & Community Medicine, College of Medicine in Rabigh, King Abdulaziz University, Jeddah, Kingdom of Saudi Arabia
E-mail : w.mahmood@mu.edu.sa

Corresponding Author
Waqas Sami
Department of Public Health & Community Medicine, College of Medicine, Majmaah University, Kingdom of Saudi Arabia
E-mail: w.mahmood@mu.edu.sa

Abstract

The aim of our study was to assess the level of knowledge of type 2 Saudi diabetics regarding diabetes and its domains (symptoms and causes, complications, food and exercise, medication, prevention of diabetes, investigations and understanding of diabetes). This cross-sectional study was conducted on type 2 diabetic Saudi patients visiting the Primary Health Care Centers in Almajmaah city. The data comprising 350 patients was collected from 5th February –24th April, 2017 through a systematic sampling technique using the direct investigation method. Data was collected through self – developed validated questionnaire. Type 2 diabetics had overall poor diabetes mellitus knowledge (42.41%, $P<0.001$) when compared with the threshold value of 50%. Moreover, diabetics had poor knowledge in all domains i.e. symptoms and causes (33.33%), complications (47.75%), food and exercise (43.40%), medication (29.75%), prevention of diabetes (30%), investigations (35%) and understanding of diabetes (38%). Based on our findings, interventions are required and patients should be empowered for better self-management of diabetes through educational programmes.

Introduction

Diabetes Mellitus (DM) is the most common non-communicable disease in the world. The growing global epidemic of type 2 Diabetes Mellitus is expected to increase from 171 million cases in 2000 to 366 million by 2030 (IDF, 2014). Moreover, the increasing trend in prevalence of diabetes has been observed in the developing countries rather than in the developed countries (Alsunni *et al.,* 2014). Six Arab speaking countries, namely; Kingdom of Saudi Arabia (KSA), Kuwait, Qatar, Lebanon, Bahrain and United Arab Emirates are among the world's top countries with the highest prevalence of type 2 diabetes affecting 32.8 million people in 2011, which is expected to increase to 60 million by 2030 (IDF, 2014). As DM is a chronic threatening disease, appropriate self-management can improve glycemic control which is a major contributor for developing diabetes complications (Adibe *et al.,* 2009).

Knowledge of diabetes provides the information about eating, attitude, workout, weight monitoring, blood glucose levels, use of medication, eye care, foot care and control of diabetes complications (Weinstein *et al.,* 2003). Published literature have shown that

reasonable knowledge regarding disease could have a significant impact on the patient's compliance to treatment and can also help in decreasing the risk of complications associated with that disease (Heisler *et al.,* 2005). Some studies have suggested that the occurrence of diabetes is different in various ethnic groups (Jakicic and Otto, 2005). Moreover, knowledge related to diabetes is a requirement to achieve better compliance with medical therapy (Kriska *et al.,* 2003). According to Redmond *et al.* (2014), diabetes mellitus knowledge (DMK) can be considered as a keystone in decision-making for self-management factors (diet, glucose monitoring, weight, medications etc.). Adequate knowledge of diabetes can help diabetics in assessing their risk of developing complications; therefore, can seek proper treatment to have good quality of life (Angeles-Llerenas *et al.,* 2005). Thus, adequate knowledge related to diabetes is considered as a greatest weapon in the fight against this disease in diabetic community (Berhe *et al.,* 2014).

Among the patients, diabetes awareness and management are still the major challenges faced by stakeholders all over the world. Poor knowledge related to diabetes is reported in many studies from the developing countries (Bassuk and Manson, 2005). According to a study conducted by Mohammadi *et al.* (2015a), patient's knowledge and self-care management regarding DM was not sufficient. Parimalakrishnan (2015) concluded that level of diabetes awareness among patients and general population in India was low. Shah *et al.* (2009) reported that 63% of T2DM patients did not know what DM is and majority were also unaware about its complications. In KSA, Bani (2015) reported that majority of the patients (97.3% males and 93.1% females) were unaware about the importance of monitoring diabetes, with no significant gender difference. DMK was also studied in Qatari type 2 diabetics. Patients' knowledge regarding diabetes was very poor, and their knowledge regarding the effect of diabetes on foot was also not appreciable (Kheir *et al.,* 2011). Results from a study conducted in Najran, KSA by Khan and Khan (2000) reported that almost half of the patients did not have adequate knowledge regarding diabetes disease. Males in this study had more knowledge regarding diabetes than female patients. DMK among self-reported diabetic female teachers was studied in Al-Khobar, KSA by Abahussain and El-Zubier (2005) revealed that DMK among diabetic female teachers was very poor. It was further suggested that awareness and education about diabetes should be urgently given to sample patients.

Therefore, we planned this study to assess the level of knowledge of type 2 Saudi diabetics regarding diabetes and its domains i.e., symptoms and causes, complications, food and exercise, medication, prevention of diabetes, investigations and understanding of diabetes.

Materials and methods

This cross-sectional study was conducted on type 2 diabetic Saudi patients visiting the Primary Health Care Centres (PHC's) in Almajmaah city. The data comprising 350 patients was collected from 5th February - 24th April, 2017 through a systematic random sampling technique using the direct investigation method. The sample size of 350 was calculated using a level of precision formula, keeping in view the prevalence of diabetes in KSA (23.7%) (Alsulaiman *et al.,* 2016). The data was collected from self-developed questionnaire and the reliability of the questionnaire was tested trough Cronbach Alpha. The questionnaire was divided into three parts. First part relates to socio-demographic characteristics of diabetics, section 2 relates to risk profile and section 3 was related to knowledge part whose responses were coded as 1 = yes and 0 = no and I don't know. The knowledge score ranges from 0 – 29, higher level of DMK was indicated by a higher score. Furthermore, the quantitative DMK

score was categorized in percentages. A score of < 50% was considered as having poor knowledge, whereas, a score between 50% - 75% was considered as having a good knowledge and a score > 75% was considered as having adequate knowledge (Mohieldein *et al.,* 2011b; Mohammadi *et al.,* 2015a; Al-Aboudi *et al.,* 2016; Obirikorang *et al.,* 2016; Saleh *et al.,* 2016). Inclusion criteria was (1) known type 2 diabetics since 5 years, (2) aged between 35 – 55 years, (3) both gender i.e. males and females and (4) having no other co-morbidities. Exclusion criteria was (1) patients with type 1 diabetes and other chronic diseases, (2) patients with age less than 35 years and more than 55 years and (3) other co-morbidities. Informed consent was taken from the patients prior to data collection and anonymity was maintained.

Statistical Analysis

Preceding to data analysis, the data was screened for typographically wrong entries and missing values using IBM SPSS 23.0 (IBM Corp., Armonk, N.Y., USA). Standardized Z scores were used to identify the outliers. Normality of quantitative data was checked through one sample Kolmogorov Smirnov Test (K – S test). Median (25 – 75 quartiles) was reported for non – normally distributed quantitative variables. Frequencies and percentages were reported for qualitative variables. Wilcoxon signed rank test was used to test the adequacy of knowledge of type 2 diabetics. Mann – Whitnety U test was applied to compare the DMK score between males and females. A p-value of <0.05 was considered as statistically significant.

Results

The data was collected from 350 patients using a systematic random sampling technique. One sample K – S showed that the data was not normally distributed. The median age of the patients was 45 (40 - 51) years. The majority of the patients were males as compared to females (n = 202; 57.7% vs n = 148; 42.3%). Major

chunk of the patients were married (n = 322; 92%). Again majority of the patients (n = 115; 32.9%) received education at primary level. Most of the patients were doing their own business (n = 163; 46.6%). Bulk of patients (n = 65; 18.6%) had monthly income between 3000 – 5000 SAR. Almost two quarter of the patients were performing low physical activity (n = 222; 63.4%), moderate physical activity was observed in one quarter of patients (n = 117; 33.4%) and only (n = 11; 3.1%) patients were performing an intense physical activity (Table - 1).

Results presented in Table 2 below showed that, most of the patients' (n = 91; 70%) duration of diabetes was between 5 – 10 years. The mode of diagnosis for majority of the patients was during a routine checkup (n = 242; 69.1%). Three fourth of the patients (n = 262; 74.9%) were consulting general practitioners for treat-ment of diabetes. Family history of diabetes was positive in some patients (n = 142; 40%). The highest number of patients were non-smokers (n = 197; 53.4%) and many patients were overweight (n = 157; 47.7%).

The first step before analyzing the DMK score was to detect the presence or absence of outliers. The minimum z - score value was -1.933 and the maximum was 2.433. Therefore, no outlier problem was detected in DMK score variable as all z – score values were less than 4. The median DMK score out of 29 items was 12.0 (8 – 16). Minimum DMK score was 3 and the maximum was 24. In terms of percentage, type 2 diabetics had poor DMK (42.41%, p<0.001) when compared with the threshold value of 50%. The average correct answers by male diabetics were 13.0 (8 – 16) and by female diabetics were 12.0 (8 – 15.75), however, this difference was not statistically significant (p= 0.328). The percentage of correct answers for each item are presented in Table 3.

Items assessing DMK were further categorized into groups to assess the degree of knowledge of

Table - 1. Socio-demographic characteristics of patients (n = 350)

	n (%)		n (%)
Gender		**Occupation**	
Male	202 (57.7)	Unemployed	11 (3.10)
Female	148 (42.3)	Government Employee	74 (21.1)
		Own business	163 (46.6)
		House Wife	102 (29.1)
Marital Status		**Monthly Income (SAR)**	
Married	322 (92.0)	< 3000	56 (16.0)
Single	11 (3.10)	3000 – 5000	65 (18.6)
Widow	06 (1.70)	5001 – 10,000	61 (17.4)
Divorced / Separate	11 (3.10)	10,001 – 15,000	40 (11.4)
		> 15000	15 (4.30)
Education Status		**Physical Activity**	
Illiterate	69 (19.7)	Low physical activity	222 (63.4)
Primary	115 (32.9)	Moderate physical activity	117 (33.4)
Secondary / Middle	85 (24.3)	Intense physical activity	11 (3.10)
Graduate	51 (14.6)		
Postgraduate	30 (8.60)		

Table – 2. Risk factors profile of patients (n=350)

	n (%)		n (%)
Duration of diabetes		**Family history**	
< 5 years	39 (29.6)	Yes	142 (40.6)
5 – 10 years	91 (68.9)	No	208 (59.4)
11 – 15 years	15 (4.30)		
> 15 years	18 (5.10)		
Mode of diagnosis		**Smoking**	
Routine checkup	242 (69.1)	Yes	141 (40.3)
At screening	44 (12.60)	No	187 (53.4)
Symptomatic	38 (10.90)	Ex-smoker	22 (6.30)
Emergency	26 (7.40)		
Treating doctor		**BMI**	
General practitioner	262 (74.9)	Underweight	12 (3.40)
Physician	74 (21.1)	Normal weight	56 (16.0)
Endocrinologist	14 (4.0)	Over weight	167 (47.7)
		Obese	115 (32.9)

patients in specific areas. The groups were symptoms and causes (6 items), complications (4 items), food and exercise (5 items), medication (4 items), prevention (5 items), investigations (2 items) and understanding of diabetes (3 items). The median knowledge score of symptoms and causes group was 2.0 (0 – 2). In percentage, it showed that type 2 diabetics poor knowledge (33.33%) regarding symptoms and causes of diabetes. The median knowledge score of complications group was 2.0 (1 – 3), converting the score to percentage showed that type 2 diabetics had poor knowledge (47.75%) regarding complications of diabetes. The median knowledge score of food and exercise group was 2.0 (1 - 3), it again showed that

Table – 3. Diabetes Mellitus Knowledge Score (n = 350)

Items		n (%) Correct Answers
1	Sweet food is a cause of diabetes.	166 (47.4)
2	The usual cause of diabetes is lack of effective insulin in the body.	105 (30.0)
3	Role of insulin in diabetes is clear to you?	114 (32.6)
4	Diabetes can be cured.	181 (51.7)
5	Diabetes is caused by failure of the kidneys to keep sugar out of the urine.	134 (38.3)
6	Raised sugar level can be lowered by medication.	127 (36.3)
7	If I am diabetic, my children have a higher chance of being diabetic.	109 (31.1)
8	There are two types of diabetes: Type 1 and Type 2	105 (30.0)
9	A fasting blood sugar level of 200 is very high.	135 (38.6)
10	The best way to diagnose my diabetes is by testing my urine.	112 (32.0)
11	Exercise increase the need for insulin or other diabetic medication.	99 (28.3)
12	Exercise and diet modification both are important in controlling diabetes.	167 (47.7)
13	Obese or slim, both should exercise.	147 (42.0)
14	Insulin secretion is caused by too much food only.	84 (24.0)
15	Medication is more important than diet and exercise to control my diabetes.	121 (34.6)
16	Once blood sugar level is controlled medication should be stopped.	55 (15.7)
17	Diabetes often causes problem in circulation.	123 (35.1)
18	Cuts and abrasions on diabetics heal more slowly.	64 (18.3)
19	Diabetics should take extra care when cutting their toenails.	123 (35.1)
20	A person with diabetes should cleanse a cut with iodine and alcohol.	107 (30.6)
21	Diabetes can cause numbness in my hands, fingers and feet.	158 (45.1)
22	Shaking and sweating are signs of high blood sugar.	79 (22.6)
23	Frequent urination and thirst are signs of low blood sugar.	193 (55.1)
24	Tight elastic shoes or socks are bad for diabetics.	109 (31.1)
25	A diabetic diet consists mostly of special foods.	182 (52.0)
26	If untreated, diabetes can damage my kidneys.	72 (20.6)
27	If untreated, diabetes can damage my eyes.	120 (34.3)
28	If untreated, diabetes can cause stroke and heart disease	69 (19.7)
29	Do you think that change in life style (including diet, physical activity and medication) can cure you or prevent you from diabetes complications?	109 (31.1)

type 2 diabetics had poor knowledge (43.40%) regarding food and exercise. The median knowledge score of medication group was 1.0 (1 – 2) converting the score to percentage showed that type 2 diabetics had poor knowledge (29.75%) regarding medication. The median knowledge score of prevention group was 1.0 (0 – 2) which showed that type 2 diabetics had poor knowledge (30%) regarding prevention of diabetes. The median knowledge score of investigations group was 1.0 (0 – 1) converting the score to percentage showed

that type 2 diabetics had poor knowledge (35%) regarding investigations. The median knowledge score of understanding of diabetes group was 1.0 (1 – 2) again type 2 diabetics had poor knowledge (38%) regarding it.

Discussions

The aim of our study was to assess the DMK of type 2 Saudi diabetics in Almajmaah City, KSA. Poor knowledge related to diabetes is reported in many studies from the developing countries (Bassuk and

Manson, 2005). In this research, type 2 diabetics had overall poor DMK (42.41%). Total 29 items were further divided into 7 groups, results showed that diabetics had poor knowledge in all the domains (symptoms and causes, complications, food and exercise, medication, prevention of diabetes, investigations and understanding of diabetes). A study conducted in Iran by Mohammadi *et al. (*2015a) reported that type 2 diabetics had average knowledge regarding complications and poor knowledge regarding medications. Comparing our study results with the Iranian study, our patients had poor knowledge regarding medication (29.75%) and complications (47.75%). Again, Mohammadi *et al.* (2015a) stated that patient's knowledge and self-care management regarding DM was not sufficient, this result is consistent with our research finding with showed that only 30% of the patients had knowledge about prevention of diabetes.

Study conducted in Slovakia by Magurová, (2012) which compared two groups of patients i.e. those who received diabetes education and those who did not. The results indicated that receiving diabetes education significantly increased the awareness about the disease in patients (p <0.001). Thus, empowering diabetic patients by giving proper diabetes education can help in achieving diabetes care goals. An earlier study by Parimalakrishnan, (2015) concluded that level of diabetes awareness among patients and general population in India was low. In our study, patients' understanding about diabetes was also poor (38%). Shah *et al.* (2009) reported that (63%) of T2DM patients did not know what DM is and the majority was also unaware about its complications. In our research 38% of the patients knew what DM is and the majority were also unaware about its complications i.e., diabetes can cause numbness in hands, fingers, etc. It can damage kidneys (20.6%), eyes (34.3%) and can cause stroke and heart

disease was correctly answered by (19.7%) the patients. Poor knowledge related to diabetes was reported from another study conducted in Nepal by Shrestha *et al.,* (2015). This study also reported a non-significant association between gender and diabetes knowledge. Our study findings are similar to findings of this study, revealing that type 2 diabetics had poor DM knowledge and also gender was not significantly associated with knowledge of diabetes.

Bani (2015) reported that in KSA, majority of the patients (97.3%) males and (93.1%) females were unaware about the importance of monitoring diabetes, however, in our research, the monitoring of diabetes was reported to be high (30%). DM knowledge was also studied in Qatari type 2 diabetics. Patients' knowledge regarding diabetes was very poor, and their knowledge regarding the effect of diabetes on feet was also not appreciable (Kheir *et al.,* 2011). Our study results also confirmed these findings, overall the diabetics had poor DM knowledge (42.41%) and only (35.1%) patients were aware about the effect of diabetes on the feet. Results from a study conducted in Najran (KSA) (Khan and Khan, 2000) reported that almost half of the patients did not have adequate knowledge regarding the diabetes disease. Diabetes knowledge among self-reported diabetic female teachers was studied in Al-Khobar, Saudi Arabia by Abahussain and El-Zubier (2005) and concluded that diabetes knowledge among diabetic female teachers was very poor. In our study, female diabetics also had poor knowledge related to DM (41.48%).

To deal with the issue of poor DM knowledge, patient should be empowered through diabetes self-management education programmes. These educational programmes should be based on, assessing patients' knowledge related to DM, identify the barriers and empower patients to adopt such strategies that can

improve their health through self-determination and self-regulation". As emphasis on these areas are relevant to improve outcomes in the management of DM.

Conclusion

Considering the rapid spread of diabetes in developed countries and reporting poor knowledge related to DM, the evidence revealed that interventions are required and patients should be empowered for better self-management of diabetes as it can bring positive changes in beliefs, expand health information related to diabetes and developed health care skills. By empowering diabetic patients, it is hoped that it will help in dealing with patients having chronic diseases by building capacity to strengthen their knowledge, skills, competencies and abilities, so that they can manage to enhance the quality of their lives.

Acknowledgement

References

Alsunni, A.A., Albaker, W.I. and Badar, A. 2014. Determinants of misconceptions about diabetes among Saudi diabetic patients attending diabetes clinic at a tertiary care hospital in Eastern Saudi Arabia. *J. Family Community Med.,* 21(2) : 93.

Al-Aboudi, I.S., Hassali, M.A. and Shafie, A.A. 2016. Knowledge, attitudes, and quality of life of type 2 diabetes patients in Riyadh, Saudi Arabia. *J. Pharm. Bioall. Sci.,* 8(3) : 195.

Alsulaiman, T.A., Al-Ajmi, H.A., Al-Qahtani, S.M., Fadlallah, I.M., Nawar, N.E., Shukerallah, R.E., Nadeem, S.R., Al-weheedy, N.M., Al-sulaiman, K.A., Hassan, A.A., Shahin, A.A. and Kolib, T.M. 2016. Control of type 2 diabetes in King Abdulaziz Housing City (Iskan) population, Saudi Arabia. *J. Fam. Community Med.,* 23: 1- 5.

Abahussain, N. A. and El-Zubier, A.G. 2005. Diabetes knowledge among self reported diabetic female teachers: Al-Khobar, Saudi Arabia. *J. Family. Community Med.,* 12(1) : 43.

Adibe, M., Aguwa, C., Ukwe, C., Okonta, J. and Udeogaranya, O.P. 2009. Diabetes self-care knowledge among type 2 diabetic outpatients in south-eastern Nigeria. *Int. J. Drug. Dev. Res.,* 1(1) : 85 - 104.

Angeles-Llerenas, A., Carbajal-Sánchez, N., Allen, B., Zamora-Muñoz, S. and Lazcano-Ponce, E. 2005. Gender, body mass index and socio-demographic variables associated with knowledge about type 2 diabetes mellitus among 13 293 Mexican students. *Acta. diabetologica.,*42(1) : 36 - 45.

Bani, I.A. 2015. Prevalence, Knowledge, Attitude and Practices of Diabetes Mellitus among Jazan Population, Kingdom of Saudi Arabia (KSA). *Journal of Diabetes Mellitus.,* 5(02) : 115.

Bassuk, S.S. and Manson, J. E. 2005. Epidemiological evidence for the role of physical activity in reducing risk of type 2 diabetes and cardio vascular disease. *J. Appl. Physiol.,* 99(3) : 1193 - 1204.

Berhe, K., Gebru, H., Kahsay, H. and Kahsay, A. 2014. Assessment of Diabetes Knowledge and its Associated Factors among Type 2 Diabetic Patients in Mekelle and Ayder Referral Hospitals, Ethiopia. *J. Diabetes. Metab.*, 5(5) : 1000378.

Heisler, M., Piette, J.D., Spencer, M., Kieffer, E. and Vijan, S. 2005. The relationship between knowledge of recent HbA1c values and diabetes care understanding and self-management. *Diabetes care.,* 28(4) : 816 - 822.

International Diabetes Federation. 2014. Diabetes in Saudi Arabia. Belgium. Assessed on (December 24, 2015). Retrieved from https://www.idf. org/ membership/mena/saudi-arabia.

Jakicic, J.M. and Otto, A.D. 2005. Physical activity considerations for the treatment and prevention of obesity. *Am. J. Clin. Nutr.,* 82(1) : 226S-229S.

Khan and Khan, S.A. 2000. Level of knowledge and self-care in diabetics in a community hospital in Najran. *Ann. Saudi. Med.,* 20(3/4) : 300 - 301.

Kheir, N., Greer, W., Yousif, A., Al Geed, H. and Al Okkah, R. 2011. Knowledge, attitude and practices of Qatari patients with type 2 diabetes mellitus. *Int. J. Pharm. Pract.,* 19(3) : 185 - 191.

Kriska, A.M., Saremi, A., Hanson, R.L., Bennett, P.H., Kobes, S., Williams, D.E. and Knowler, W.C. 2003. Physical activity, obesity, and the incidence of type 2 diabetes in a high-risk population. *Am. J. Epidemiol.,* 158(7) : 669 - 675.

Magurová, D., Majerníková, ., Hloch, S., Tozan, H., and Goztepe, K. 2012. Knowledge of Diabetes in Patients with Type 2 Diabetes on insulin Therapy from Eastern Slovakia. *Diabetologia Croatica.,* 41(3) : 95 - 102.

Mohammadi, S., Karim, N.A., Talib, R.A. and Amani, R. 2015a. Knowledge, Attitude and Practices on Diabetes Among Type 2 Diabetic Patients in Iran. *A Cross-Sectional Study. Science.,* 3(4) : 520 - 524.

Mohieldein, A.H., Alzohairy, M.A. and Hasan, M. 2011. Awareness of diabetes mellitus among Saudi non-diabetic population in Al-Qassim region, Saudi Arabia. *J. Diabetes Endocrinol.,* 2(2) : 14-19.

Obirikorang, Y., Obirikorang, C., Anto, E.O., Acheam-pong, E., Batu, E.N., Stella, A.D. and Brenya, P.K. 2016. Knowledge of complications of diabetes mellitus among patients visiting the diabetes clinic at Sampa Government Hospital, Ghana: a descriptive study. *BMC Public Health.,* 16(1) : 637.

Oliveira, K.C. S.d. and Zanetti, M.L. 2011. Knowledge and attitudes of patients with diabetes mellitus in a primary health care system. *Revista da Escola de Enfermagem da* USP, 45(4) : 862 - 868.

Parimalakrishnan, S., Dussa, K. and Sahay, R. 2015. Assessment of diabetes knowledge using diabetes knowledge questionnaire among people with type 2 diabetes mellitus. *Asian J. Pharm. Clin. Res.,* 8(2).

Redmon, B., Caccamo, D., Flavin, P., Michels, R., O'Connor, P., Roberts, J. and Sperl-Hillen, J. 2014. Diagnosis and management of type 2 diabetes mellitus in adults. Institute for Clinical Systems Improvement.

Saleh, F., Ara, F. and Afnan, F. 2016. Assessment of Gap between Knowledge and Practices among Type 2 Diabetes Mellitus Patients at a Tertiary-Care Hospital in Bangladesh. *Advances in Public Health.,* 12(2) : 11 - 19.

Shah, V., Kamdar, P. and Shah, N. 2009. Assessing the knowledge, attitudes and practice of type 2 diabetes among patients of Saurashtra region, Gujarat. *Int. J. Diabetes Dev. Ctries.,* 29(3) : 118.

Shrestha, N., Yadav, S., Joshi, A., Patel, B., Shrestha, J. and Bharkher, D. 2015. Diabetes knowledge and associated factors among diabetes patients in central Nepal. *Int. J. Collab. Res. Intern. Med. Public Health.,* 7(3) : 10 - 19.

Weinstein, M.C., O'Brien, B., Hornberger, J., Jackson, J., Johannesson, M., McCabe, C. and Luce, B.R. 2003. Principles of Good Practice for Decision Analytic Modeling in Health-Care Evaluation: Report of the ISPOR Task Force on Good

Research Practices - Modeling Studies. *Value in Health.*, 6(1) : 9 - 17.

Xiao, Z., Storms, R. and Tsang, A. 2006. A quantitative starchiodine method for measuring alpha-amyalase and glucoamaylase activities. *Anal. Biochem.*, 351(1): 146 - 148.

Corresponding Author : Waqas Sami, Department of Public Health & Community Medicine, College of Medicine, Majmaah University, 11952, Kingdom of Saudi Arabia, E-mail: w.mahmood@mu.edu.sa. *©2017, IJALS. All Rights Reserved.* *https://doi.org/10.26627/IJALS/2017/10.02.0029*