Dia N, Ferekh S, Jabbour S, Akiki Z, Rahal M, Khoury M, Akel M. Knowledge, attitude and practice of patients with diabetes towards diabetic nephropathy, neuropathy and retinopathy. Pharmacy Practice 2022 Jan-Mar;20(1):2608.
https://doi.org/10.18549/PharmPract.2022.1.2608

Original Research

Knowledge, attitude, and practice of patients with diabetes towards diabetic nephropathy, neuropathy and retinopathy

Nada Dia, Sara Ferekh, Stephanie Jabbour, Zeina Akiki, Mohamad Rahal, Maya Khoury, Marwan Akel

Received (first version): 12-Dec-2021 Accepted: 01-Mar-2022 Published online: 03-Mar-2022

Abstract

Background: Epidemiological and knowledge, attitude and practice (KAP) studies about diabetic microvascular complications are lacking. The goals of this study are: determining 1) the prevalence of diabetes mellitus subtypes and microvascular complications, 2) the KAP towards the complications and 3) health-seeking behavior, barriers to follow-up, stigma and sources of information. **Methods:** A cross-sectional study was conducted from January to October 2020 enrolling 380 Lebanese patients with diabetes asked about socio-demographic and lifestyle characteristics, medical, therapeutic, supplement, and dietary history, KAP scores, health-seeking behavior, stigma, barriers to compliance, and sources of information. **Results:** The prevalence of diabetes type II, type I, gestational, and the microvascular complications was 82.23%, 15.65%, 2.12%, and 33.07% respectively. Factors with significant association were: 1) good quality of life (β=-0.03; p=0.005) and presence of microvascular complications (β=3.58; p=0.001) with knowledge score, 2) good quality of life (β=-0.01; p=0.02) and absence of the complications (β=-0.33; p=0.001) with attitude score, 3) advanced age (β=0.01; p=0.01), no metformin (β=-0.39; p=0.005), and low-protein diet (β=0.6; p=0.02) with practice score. Patients visited community pharmacies (41.84%) and clinics (46.32%). Barriers were costs (33.42%) and time (30.53%). Few talked about the complications to the family (19.74%). Sources of information were healthcare workers. **Conclusion:** Awareness campaigns should be tailored accordingly to retard the microvascular complications.

Keywords: Diabetes mellitus; Microvascular complications; Knowledge; Attitude; Practice

INTRODUCTION

Diabetes mellitus (DM) represents a group of metabolic diseases that are characterized by abnormal insulin secretion and/or insulin action leading to chronic hyperglycemia.[1] In 2015, 422 million individuals worldwide had DM among which 1.6 million died annually. Assuming this number is still viable in 2020 at a prevalence of 11%, a half-million Lebanese live with DM.[2,3]

There is no cure for DM, but it can be controlled. The management of DM aims to prevent the associated symptoms and delay the micro- and macro-complications. The microvascular complications involve retinopathy, nephropathy, and neuropathy, corresponding to damage to the eyes, kidneys, and nerves. The result is blindness, renal failure and loss of sensation respectively. Additionally, infection(s) in a neuropathic patient with diabetes may lead to diabetic foot disorders and lower limb amputation.[4]

Studies showed that treatment on time and periodic screening slow down the development of complications.[5] In absence of sufficient financial and human resources in under-developed countries, the most cost-effective tool to prevent diabetic complications is awareness and education.[6,7] An evaluation of the gaps in the knowledge, attitude, and practice (KAP) of patients with DM is therefore important. In Lebanon, epidemiological data and KAP studies about the complications of DM are lacking; they are assessed meticulously in this research, with a focus on the microvascular complications.

OBJECTIVE

This study aims to 1) determine the prevalence of the subtypes of DM and the diabetic microvascular complications, 2) assess the KAP towards the diabetic microvascular complications, and 3) report health-seeking behavior, the barriers to follow-up, the stigma towards diabetic microvascular complications, and the sources of information, in a representative sample in the Lebanese population.

Nada DIA. PharmD, MSc. School of Pharmacy, Lebanese International University, Beirut, Lebanon. nadadia29@gmail.com
Sara FEREKH. PharmD. School of Pharmacy, Lebanese International University, Beirut, Lebanon. 11330575@students.liu.edu.lb
Stephanie JABBOUR*. PharmD. School of Pharmacy, Lebanese International University, Beirut, Lebanon. jabbourstephanie@hotmail.com
Zeina AKIKI. PhD. School of Pharmacy, Lebanese International University, Beirut, INSPECT-LB: Institut National de Santé Publique, Épidémiologie Clinique et Toxicologie - Liban, Beirut, Lebanon. zeina.akiki@liu.edu.lb
Mohamad RAHAL. PhD. School of Pharmacy, Lebanese International University, Beirut, Lebanon. Mohamad.rahal@liu.edu.lb
Maya KHOURY. PharmD. School of Pharmacy, Lebanese International University, Beirut, Lebanon. Maya.Khoury@liu.edu.lb
Marwan AKEL. PharmD, MPH, PhD. School of Pharmacy, Lebanese International University, Beirut, INSPECT-LB: Institut National de Santé Publique, Épidémiologie Clinique et Toxicologie - Liban, Beirut, Lebanon. Marwan.Akel@liu.edu.lb

www.pharmacypractice.org (eISSN: 1886-3655 ISSN: 1885-642X)

METHODS

Study design

This cross-sectional study was conducted from January to October 2020. Before the COVID-19 pandemic, two independent pharmacists approached Lebanese subjects who were on anti-diabetic medication(s) at various pharmacy stores distributed across the Lebanese districts (i.e., Beirut, Bekaa, Mount Lebanon, North, and South). The two pharmacists independently selected a representative sample of pharmacy stores that opened their doors for more than a half-a-year, provided patients counseling, and were located in residential communities. The pharmacy stores in Lebanon are owned and operated by at least one pharmacist. They sell medications, cosmetics, vitamins, and health products. The counseling is free-of-charge. With the start of the COVID-19 outbreak, a national lockdown was imposed forcing the use of Google form as an online platform to distribute the questionnaire. Patients who were diagnosed with any type of diabetes, maintained on anti-diabetic medications, and living more than a half-a-year in Lebanon were eligible to participate. Short-term residents and mentally-unstable patients were excluded.

Ethical approval

This observational non-experimental, non-interventional study was approved by the Institutional Review Board at the pharmacy school of the Lebanese International University, Beirut, Lebanon. An informed consent respecting the latest version of the Declaration of Helsinki was signed before the distribution of the questionnaire; in case the participant was less than 18 years old, the signature of a legal guardian was obtained.

Data collection and measurement

A literature review was conducted in PubMed to identify relevant studies and variables that should be considered. The questionnaire was adapted from previous studies in English and later translated into Lebanese Arabic.[8-13] The maximum number of patients representative of the population can be recruited using these two languages. For back-translation, the Lebanese Arabic version was translated by two independent Lebanese-English translators who did not know about the presence of the original English version. The two new versions were equivalent to the original English version, allowing the use of the Lebanese version. The content validity was evaluated in the first 20 participants through the following three questions: 1) "Do you consider the questions relevant to the topic?", 2) "Is the questionnaire difficult to answer?" and 3) "Indicate which questions you would like to adjust or add, and how?". Minor modifications at the level of the layout were made based on feedback. The reliability of the questionnaire was tested by the calculation of Cronbach's alpha coefficient. A reliability index of a minimum 0.6 was considered acceptable. Initially, patients were approached in pharmacy stores located across the Lebanese districts. With the uprising COVID-19 outbreak in February 2020 and the imposition of a national lockdown, a web-based questionnaire created on Google form substituted the hard copy. The link was shared publicly on social networking sites (e.g., Facebook, WhatsApp, Twitter, Instagram). The inclusion/exclusion criteria were assessed in online questions. Approximately 20 minutes were needed to fill-up the questionnaire which was formed of two sections. The first section included 10 modules that cover the aspects of the socio-demographic and lifestyle characteristics (e.g., age, gender, residence area, type of job, monthly income, smoking status, and physical activity), details about DM (e.g., type, quality of life, presence of diabetic microvascular complications), comorbidities, current anti-diabetic medications, supplements, dietary habits, health-seeking behavior, stigma towards diabetic microvascular complications, the barriers to compliance with periodic follow-up, and the sources of information. The questionnaire provided multiple answers per question except for age. Options per question are listed in Table 1, Table 2, and Table 4. Quality of life was calculated as suggested by Burroughs et al.[10]

Table 1. Bivariate analysis of the socio-demographic and lifestyle characteristics with the knowledge, attitude, and practice scores

Variables (N = 380)	Values	Frequency (%) or Mean ± SD	Knowledge score		Attitude score		Practice score	
			Mean ± SD or r	P-value	Mean ± SD or r	P-value	Mean ± SD or r	P-value
Age (years)		57.54 ± 15.32 [Min: 8-Max: 92]	0.4*	**<0.001**	-0.028*	0.6	0.3*	**<0.001**
Gender	Female	194 (51.73)	2.29 ± 2.28	0.4	2.13 ± 0.68	0.6	1.77 ± 0.82	0.3
	Male	181 (48.27)	2.49 ± 2.51		2.18 ± 0.63		1.9 ± 0.83	
Residence area	Beirut	128 (33.86)	2.42 ± 2.36	0.2	2.14 ± 0.68	0.8	1.85 ± 0.84	0.1
	North	24 (6.35)	1.79 ± 1.74		2.28 ± 0.75		1.71 ± 0.85	
	Mount Lebanon	198 (52.38)	2.36 ± 2.23		2.12 ± 0.63		1.81 ± 0.8	
	Bekaa	10 (2.65)	4.9 ± 4.65		2.25 ± 0.71		2.8 ± 0.45	
	South	18 (4.76)	2.78 ± 3.35		2.25 ± 0.62		1.8 ± 0.84	
Type of job	Medical	9 (2.54)	2.78 ± 3.27	0.2	2 ± 0.63	0.4	2.2 ± 0.84	0.5
	Para-medical	21 (5.93)	1.52 ± 1.12		1.93 ± 0.7		1.63 ± 0.74	
	Non-medical	324 (91.53)	2.44 ± 2.4		2.17 ± 0.66		1.84 ± 0.83	

Monthly income (x 10^6 L.L.)	<1	187 (49.87)	2.56 ± 2.54	0.7	1.98 ± 0.84	0.1	2.2 ± 0.61	0.06
	1 - 2	91 (24.27)	2.34 ± 2.45		1.63 ± 0.77		1.98 ± 0.61	
	2 - 5	75 (20)	2.19 ± 1.91		1.71 ± 0.78		2.38 ± 0.62	
	>5	22 (5.87)	2.09 ± 2.16		2 ± 0.88		2.15 ± 0.66	
Smoking status	Never	139 (36.77)	2.37 ± 2.69	0.09	2.19 ± 0.63	0.6	1.82 ± 0.82	0.3
	Previous	117 (30.95)	2.81 ± 2.33		2.1 ± 0.66		1.88 ± 0.83	
	Current	122 (32.28)	2.14 ± 2.16		2.15 ± 0.69		1.83 ± 0.84	
Physical activity	Yes	123 (32.63)	2.29 ± 2.57	0.2	2.13 ± 0.66	0.6	1.68 ± 0.81	0.1
	No	215 (57.03)	2.38 ± 2.26		2.19 ± 0.66		1.89 ± 0.84	
	Cannot	39 (10.34)	3.1 ± 2.72		2.07 ± 0.59		2.04 ± 0.76	

*Correlation coefficient
%- percentage; SD- standard deviation; r- correlation coefficient; min- minimum; max- maximum; L.L.- Lebanese Lira.

KAP scores

This instrument was based on previous studies.[8-13] The knowledge scale consisted of five questions while each of the attitude and practice scales included three questions. Each correct answer was given a 1-point. There were 15 correct answers in the knowledge module while there were 3 correct answers in the attitude as well as in the practice section. The final score for each category was calculated by the sum scores of the correct answers. Cronbach's alpha of the KAP scores were 0.772, 0.688, and 0.706 respectively.

Sample size calculation

The minimal sample size was calculated according to the population survey rule of the Epi Info version 7.0 (CDC, Atlanta, Georgia, USA)[14] assuming knowledge about diabetic nephropathy of 43%.[15] An enrollment of 376 patients with diabetes was needed at a confidence level of 95%.

Statistical analysis

IBM Statistical Package for Social Sciences (SPSS) version 21.0 (IBM Corp., Armonk, N.Y., USA) was used to analyze the data.[16] Continuous variables were presented as mean ± standard deviation (SD) while categorical variables were tabulated as frequencies and percentages. The association between a score and a dichotomous variable was examined through a Student t-test while the association with a categorical variable with more than 2 means was assessed by a one-way ANOVA test. Parametric tests were replaced by non-parametric tests if needed. Quantitative variables were examined by Pearson or Spearman correlation tests as appropriate. The multiple linear regression model contained variables that had a p-value less than 0.05 in the bivariate analysis. The findings are tabulated as unstandardized β with 95% confidence interval (CI). P-values were two-sided and significant at a value less than 0.05.

RESULTS

Socio-demographic and lifestyle characteristics

A total number of 380 patients with diabetes participated in the study of which 194 (51.73%) participants were females. The mean age ± SD was 57.54 ± 15.32 years with a range of 8.00 - 92.00 years. The majority (91.53%) worked in non-medical fields (n=324) and the third was engaged in physical activity (n=123). The bivariate analysis showed that age was significantly associated with the knowledge score in a positive moderate correlation (r=0.4; p<0.001). It was also significantly associated with the practice score in a positive weak correlation (r=0.3; p<0.001). Table 1 shows the results of the bivariate analysis of the socio-demographic and lifestyle characteristics with the KAP scores. Noteworthy that a lower score of quality of life reflects a better life.

Bivariate analysis of the medical, therapeutic, supplement and dietary history

Table 2 deciphers the associations of the medical, therapeutic, supplement and dietary history with the KAP scores. Among the 380 patients, 310 (82.23%) had diabetes type II while 59 (15.65%) had diabetes type I. Only 8 (2.12%) reported

Table 2. Bivariate analysis of the medical, therapeutic, supplement and dietary history with the knowledge, attitude, and practice scores

Variables (N = 380)	**Values**	**Frequency (%) or Mean ± SD**	**Knowledge score**		**Attitude score**		**Practice score**	
			Mean ± SD or r	**P-value**	**Mean ± SD or r**	**P-value**	**Mean ± SD or r**	**P-value**
Type of diabetes	I	59 (15.65)	2.80 ± 2.99	0.09	2.1 ± 0.74	0.7	1.97 ± 0.82	0.3
	II	310 (82.23)	2.39 ± 2.32		2.16 ± 0.63		1.82 ± 0.83	
	GD	8 (2.12)	1.00 ± 0.01		2.29 ± 0.76		NA	
Diabetes Quality of Life		38.69 ± 7.3	0.2*	**0.003**	-0.2*	**0.001**	0.2*	**0.02**
Diabetic microvascular complications	No	251 (66.93)	1.11 ± 0.32	**<0.001**	2.28 ± 0.67	**<0.001**	1.6 ± 0.76	**<0.001**
	Yes	124 (33.07)	5.11 ± 2.65		1.9 ± 0.52		2.07 ± 0.82	
Comorbidities								

Coronary artery disease	No	299 (79.1)	2.09 ± 2.26	**<0.001**	2.17 ± 0.67	0.4	1.68 ± 0.77	**<0.001**
	Yes	79 (20.9)	3.7 ± 2.64		2.09 ± 0.56		2.24 ± 0.82	
Dyslipidemia	No	167 (43.95)	1.9 ± 2.08	**<0.001**	2.16 ± 0.68	0.9	1.78 ± 0.79	0.4
	Yes	213 (56.05)	2.84 ± 2.59		2.15 ± 0.63		1.89 ± 0.84	
Hypertension	No	187 (49.21)	1.97 ± 2.1	**<0.001**	2.15 ± 0.67	0.9	1.79 ± 0.8	0.4
	Yes	193 (50.79)	2.87 ± 2.63		2.16 ± 0.64		1.89 ± 0.85	
Hypertriglyceridemia	No	290 (76.52)	2.3 ± 2.39	0.07	2.13 ± 0.67	0.4	1.73 ± 0.8	**0.001**
	Yes	89 (23.48)	2.84 ± 2.49		2.22 ± 0.62		2.14 ± 0.82	
Venous insufficiency	No	373 (98.42)	2.42 ± 2.43	0.5	2.15 ± 0.65	0.3	1.86 ± 0.83	0.1
	Yes	6 (1.58)	3.17 ± 1.94		2.4 ± 0.89		1.25 ± 0.5	
Anti-diabetic medications								
Metformin (Biguanide)	No	116 (30.61)	2.73 ± 2.78	0.1	2.24 ± 0.61	0.1	2.14 ± 0.84	**<0.001**
	Yes	263 (69.39)	2.3 ± 2.24		2.11 ± 0.68		1.7 ± 0.78	
Dipeptidyl peptidase-4 inhibitor	No	269 (70.98)	2.4 ± 2.47	0.7	2.13 ± 0.67	0.3	1.85 ± 0.84	0.9
	Yes	110 (29.02)	2.51 ± 2.33		2.22 ± 0.61		1.86 ± 0.78	
Sulfonylurea	No	274 (72.3)	2.48 ± 2.49	0.5	2.2 ± 0.64	0.05	1.91 ± 0.84	0.07
	Yes	105 (27.7)	2.3 ± 2.26		2.01 ± 0.69		1.67 ± 0.76	
Thiazolidinedione	No	368 (97.1)	2.45 ± 2.44	0.6	2.16 ± 0.65	0.6	1.85 ± 0.82	0.7
	Yes	11 (2.9)	1.82 ± 1.54		2 ± 0.89		2 ± 1	
Meglitinide	No	371 (97.89)	2.43 ± 2.44	0.6	2.16 ± 0.66	0.5	1.86 ± 0.82	0.2
	Yes	8 (2.11)	2.38 ± 1.59		2 ± 0.58		1.4 ± 0.89	
Glucagon-like peptide-1 agonist	No	358 (94.46)	2.41 ± 2.43	0.2	2.17 ± 0.65	0.09	1.81 ± 0.81	0.2
	Yes	21 (5.54)	2.81 ± 2.34		1.85 ± 0.69		2.38 ± 0.81	
Sodium-glucose co-transporter-2 inhibitor	No	351 (92.61)	2.44 ± 2.44	0.8	2.15 ± 0.65	0.8	1.84 ± 0.84	0.6
	Yes	28 (7.39)	2.36 ± 2.23		2.17 ± 0.72		1.9 ± 0.64	
Insulin	No	274 (72.3)	2.32 ± 2.45	0.1	2.18 ± 0.66	0.2	1.7 ± 0.8	**<0.001**
	Yes	105 (27.7)	2.72 ± 2.34		2.07 ± 0.63		2.14 ± 0.81	
Supplements								
Gingko Biloba	No	306 (80.74)	2.44 ± 2.51	0.5	2.2 ± 0.65	**0.02**	1.88 ± 0.83	0.4
	Yes	73 (19.26)	2.23 ± 1.79		1.96 ± 0.65		1.77 ± 0.81	
Omega-3 fatty acids	No	305 (80.26)	2.48 ± 2.53	0.4	2.19 ± 0.65	**0.04**	1.89 ± 0.83	0.1
	Yes	75 (19.74)	2.23 ± 1.94		1.98 ± 0.64		1.67 ± 0.81	
Vitamins	No	242 (63.68)	2.49 ± 2.51	0.5	2.18 ± 0.66	0.4	1.88 ± 0.84	0.5
	Yes	138 (36.32)	2.31 ± 2.26		2.11 ± 0.64		1.8 ± 0.81	
Dietary restrictions								
Vegetarian	No	347 (91.32)	2.26 ± 2.16	**0.008**	2.14 ± 0.67	0.3	1.84 ± 0.82	0.7
	Yes	33 (8.68)	4.21 ± 3.91		2.29 ± 0.53		1.91 ± 0.9	
Low-salt	No	213 (56.05)	2.2 ± 2.28	**0.04**	2.12 ± 0.69	0.4	1.77 ± 0.84	0.2
	Yes	167 (43.95)	2.71 ± 2.57		2.19 ± 0.6		1.91 ± 0.81	
High fiber	No	334 (87.89)	2.34 ± 2.35	0.07	2.19 ± 0.66	**0.04**	1.82 ± 0.82	0.3
	Yes	46 (12.11)	3.04 ± 2.82		1.95 ± 0.61		2 ± 0.83	
Low-protein	No	360 (94.74)	2.32 ± 2.33	**0.001**	2.15 ± 0.66	0.4	1.78 ± 0.81	**<0.001**
	Yes	20 (5.26)	4.35 ± 3.23		2.31 ± 0.48		2.67 ± 0.49	
Low carbohydrates	No	298 (78.42)	2.41 ± 2.39	0.8	2.12 ± 0.67	0.07	1.82 ± 0.82	0.4
	Yes	82 (21.58)	2.5 ± 2.54		2.29 ± 0.59		1.93 ± 0.84	

*Correlation coefficient
%- percentage; SD- standard deviation; r- correlation coefficient; GD- gestational diabetes ; NA- not applicable.

gestational diabetes. Half of the sample was satisfied with the quality of life regarding diabetes and the third reported development of diabetic microvascular complications.

It was found that the score of quality of life among patients with diabetes was significantly associated with the knowledge and the practice scores positively (r=0.2; p=0.003 and r=0.2; p=0.02 respectively), and the attitude score negatively (r=-0.2; p=0.001). Participants had a significantly higher knowledge score in the presence compared to the absence of: diabetic microvascular complications (5.11 ± 2.65 versus 1.11 ± 0.32; p<0.001), coronary artery disease (3.7 ± 2.64 versus 2.09 ± 2.26; p<0.001), dyslipidemia (2.84 ± 2.59 versus 1.9 ± 2.08; p<0.001), hypertension (2.87 ± 2.63 versus 1.97 ± 2.1; p<0.001). The same result was found in participants on vegetarian diet (4.21 ± 3.91 versus 2.26 ± 2.16; p=0.008), low-salt diet (2.71 ± 2.57 versus 2.2 ± 2.28; p=0.04), and low-protein diet (4.35 ± 3.23 versus 2.32 ± 2.33; p=0.001) compared to other patients with diabetes. Regarding the attitude, a significantly lower score was found in the presence compared to the absence of diabetic microvascular complications (1.9 ± 0.52 versus 2.28 ± 0.67; p<0.001). Supplements of Gingko Biloba (1.96 ± 0.65 versus 2.2 ± 0.65; p=0.02) and Omega-3 fatty acids (1.98 ± 0.64 versus 2.19 ± 0.65; p=0.04) were significantly associated with lower attitude score in patients with diabetes compared to those who are not on the previously mentioned supplements. A similar result was established for patients with diabetes on a high fiber diet (1.95 ± 0.61 versus 2.19 ± 0.66; p=0.04) compared to others. On the other hand, patients with diabetes had a significantly higher practice score in the presence compared to the absence of diabetic microvascular complications (2.07 ± 0.82 versus 1.6 ± 0.76; p<0.001), coronary artery disease (2.24 ± 0.82 versus 1.68 ± 0.77; p<0.001), hypertriglyceridemia (2.14 ± 0.82 versus 1.73 ± 0.8; p=0.001). Participants on metformin (i.e., biguanide) had a lower significant practice score (1.7 ± 0.78 versus 2.14 ± 0.84; p<0.001) whereas a higher significant score was found in participants on insulin (2.14 ± 0.81 versus 1.7 ± 0.8; p<0.001) compared to those who are not on the aforementioned medication. Patients with diabetes on a low-protein diet had a significantly higher practice score compared to others (2.67 ± 0.49 versus 1.78 ± 0.81; p<0.001).

Multivariable analysis of the KAP scores

The significant results of the multiple linear regression analysis for the KAP scores are shown in Table 3. A higher knowledge score was associated with a lower score of the quality of life score among patients with diabetes (β=-0.03; p=0.005) and the presence of diabetic microvascular complications (β=3.58; p=0.001). On the other hand, a higher attitude score was associated with a lower score of the quality of life score among patients with diabetes (β=-0.01; p=0.02) and absence of diabetic microvascular complications (β=-0.33; p=0.001), while a higher practice score was found in patients with diabetes of an advanced age (β=0.01; p=0.01) and on a low-protein diet (β=0.6; p=0.02). In addition, practice score and the use of metformin were negatively associated (β=-0.39; p=0.005).

Health-seeking behavior, stigma, barriers to compliance, and sources of information

As seen in Table 4, patients with diabetes sought healthcare at a community pharmacy and clinic in an almost equal proportion (41.84% and 46.32% respectively). Participants favored not to talk about the diabetic microvascular complications to a close family member (80.26%) among which 0.79% of respondents never talked to any person. The most common barriers to compliance with periodic follow-up were: medical expenses (33.42%) and time (30.53%). Participants chose physicians, pharmacists, and other medical workers as the top three sources

Table 3. Multivariable analysis for the significant associations between the KAP scores and the socio-economic and lifestyle characteristics, the medical, therapeutic, supplement and dietary history of participants

Knowledge score, Mean ± SD: 2.21 ± 2.12		
Variables*	**Unstandardized β (95% CI)**	**P-value**
Diabetes Quality of life	-0.03 (-0.05; -0.01)	0.005
Diabetic microvascular complications	3.58 (3.2; 3.97)	0.001
Attitude score, **Mean ± SD**: 2.17 ± 0.67		
Variables*	**Unstandardized β (95% CI)**	**P-value**
Diabetes Quality of life	-0.01 (-0.02; -0.002)	0.02
Diabetic microvascular complications	-0.33 (-0.52; -0.15)	0.001
Practice score, **Mean ± SD**:1.81 ± 0.83		
Variables*	**Unstandardized β (95% CI)**	**P-value**
Age (years)	0.01 (0; 0.02)	0.01
Metformin (i.e., biguanide)	-0.39 (-0.66; -0.12)	0.005
Low-protein diet	0.6 (0.11; 1.08)	0.02

*Reference is no unless stated otherwise
SD- standard deviation; 95% CI- 95 percent confidence interval.

Table 4. Health-seeking behavior, stigma, barriers to compliance and sources of information

	Frequency (%)
Health-seeking behavior*	
Community pharmacy	159 (41.84)
Hospital	100 (26.32)
Clinic	176 (46.32)
Other	1 (0.26)
Stigma towards diabetic microvascular complications	
Close family member	75 (19.74)
No one	3 (0.79)
Other	302 (79.47)
Barriers to compliance with periodic follow-up	
Medical expenses	127 (33.42)
Time concern	116 (30.53)
Difficulties with transportation	45 (11.84)
Do not want to find out that something is wrong	32 (8.42)
Do not trust medical workers	34 (8.95)

Not sure of where I should go	24 (6.32)
Sources of information	
Physician	297 (78.16)
Pharmacist	228 (60)
Another medical worker	79 (20.79)
Brochures and posters	58 (15.26)
Radio, TV, and internet	36 (9.47)
Newspapers and magazines	26 (6.84)
Family, friends, neighbours, colleagues	18 (4.74)
Teacher	17 (4.47)

*Variables with a yes or no outcome
%- percentage.

of information they learn from about diabetic microvascular complications (78.16%, 60%, and 20.79% respectively).

DISCUSSION

To our knowledge, this study is the first to estimate the prevalence of diabetic microvascular complications, investigate the KAP scores, and report health-seeking behavior, the barriers to follow-up, stigma, and sources of information in Lebanon.

The main goals were to 1) determine the prevalence of subtypes of DM and the diabetic microvascular complications, 2) assess the associations between the KAP scores, the socio-demographic and lifestyle characteristics, the medical, therapeutic, supplement and dietary history of participants and 3) identify the health-seeking behavior, stigma, barriers to follow-up, and the sources of information. This is of great importance in establishing a better strategy to improve the KAP of patients with diabetic microvascular complications, tackle the stigma and the barriers for follow-up through the most common sources of information.

Our study indicated that the prevalence of diabetes type II, diabetes type I, gestational diabetes and diabetic microvascular complications was 82.23%, 15.65%, 2.12% and 33.07% respectively. It has also shown that the knowledge score was positively associated with reporting a better quality of life and having microvascular complications. The factors positively associated with a higher attitude score were: better quality of life and absence of diabetic microvascular complications. As for the practice score, there was a positive association with advanced age and commitment to a low-protein diet while a negative association was established with the use of metformin. The majority favored not to talk about diabetic microvascular complications to a close family member. Participants asked physicians, pharmacists and other medical workers for further information.

KAP scores

This study reported a ratio of type I DM over type II DM of 1: 5 which is high than the estimated ratio by the IDF 2015 atlas (i.e., 1:9).[2] The aforementioned study stated that this ratio represents the developed countries rather than the middle-to-low income countries that Lebanon belongs to. As it is rare to under-diagnose cases of DM, the high ratio could be due to poor management of type II DM at an advanced age, leading to death affecting by that prevalence. It might be also caused by the method of data collection which was biased towards technologically literate; thus more accessible to the young adults with type I DM. Furthermore, the prevalence of diabetic microvascular complications in Lebanon was lower than the 56.9% estimated prevalence of microvascular complications in Pakistan.[17] This is because the participants in the latest study were recruited from a tertiary care unit whereas ours targeted patients with diabetes from the community.

In the current study, enough proof is provided to show that diabetic microvascular complications can be retarded by looking into the presence of complications, the quality of life, the age, use of metformin, and commitment to a low-protein diet. The study revealed that age was significantly associated with knowledge and attitude contrary to Rahaman et al. study.[18] A reasonable explanation for that is that the elderly knows as much as young about the diabetic microvascular complications in matters of knowledge and attitude. Young, however, feel less at risk of developing microvascular complications and seek less healthcare assistance compared to those at an advanced age. In addition, there exists a discrepancy regarding genders in Hoque et al. study.[19] This could be related to the fact that females are as much as educated as males in Lebanon; hence both genders enjoy similar KAP levels.

We found that good knowledge comes along with a good quality of life. This is confirmed in Literature: a higher knowledge of appropriate care positively lessens the risk of developing complications hence sustains the quality of life.[20] Same applies to attitude. Presence/absence of complications is a factor to consider. Patients with complications understand better their medical condition now they are in while those without complications managed through with their attitude. For the first time, it is reported that patients with diabetes on metformin had a lower practice score compared to those who don't take this medication. Metformin is a cornerstone anti-diabetic medication that is commonly prescribed, known for its low side effects profile and convenient mode of administration. We argue that patients feel more confident and less stressed with the numerous advantages of metformin. The present study indicates also for the first time that a low-protein diet was associated with a higher practice score. A meta-analysis of randomized controlled studies conducted in 2019 indicated the pivotal role a low-protein diet has on diabetic nephropathy.[21] Patients on this diet felt better and had a greater willingness to abide by the guidelines.

Health-seeking behavior, stigma, barriers to compliance, and sources of information

There is no previous report on the prevalence of appropriate health-seeking behavior among patients with diabetes in Lebanon. Yet, the result is different than a study conducted in Malaysia where 63.4% of participants favored visiting practitioners.[22] The visits to physicians and emergency rooms decreased[23] because the role of pharmacists has expanded in middle-income countries like Lebanon, over time to include

additional responsibilities like the promotion of health status and targeted therapy.

Patients with diabetes reported stigma by family members which is a finding in agreement with Literature.[24-26] A Japanese study found that numerous weddings were canceled when one of the spouses revealed for the other having type I DM.[26] A possible explanation may include avoidance of having a partner who is ill or children who hold genes of DM. Because of this social stigmatization, participants may have felt distress to disclose the disease to the family members thus they hide their medical condition. The likelihood of non-adherence to diet, exercise, and medication increases, putting the patients at higher risk to develop the complications.[27]

Medical expenses and time were the most common barriers to compliance, a finding that is in alignment with the research conducted in Bangladesh[28] and Malaysia.[29] The financial burden is of no surprise a barrier in non-communicable chronic disease that requires a daily intake of medications and periodic visits to clinics and laboratories. In addition, time is needed to have a better outcome: the selection of healthy food and the involvement in continuous physical activity is part of the management.

Patients with diabetes talked with physicians, pharmacists and other medical workers for information, a finding that is supported by previous studies.[18,30] The three are in the health sector and are trustworthy sources of information about diabetes and its complications.

Strength and limitations

The findings of this study are a wake-up call for professional healthcare employees to establish an educational program that goes along with the needs of patients and improves the KAP scores despite the limitations. The sample was not random consequently the results of the study can't be generalized to the entire Lebanese patients with diabetes. Findings are likely over-estimated because 8.47% of participants work in healthcare. The cross-sectional nature of the study does not allow inference of causal associations. Self-reporting the data implies that information bias may have occurred. A non-random sample increases the likelihood of selection bias. There might also be a residual confounding bias linked to the non-inclusion of all factors affecting the scores.

CONCLUSION

Despite the limitations of the study, it provides valuable information about patients with diabetes in Lebanon. This study may help in designing a support program to educate patients with diabetes and train healthcare professionals to slow down the development of complications and speed up the detection.

Patients with diabetes who experience a poor quality of life, those who are on metformin, those who are young, and those who are not on a low-protein diet need greater attention in educational campaigns.

ACKNOWLEDGMENTS

We thank all the patients with diabetes who participated in the study.

FUNDING

None.

DECLARATION OF INTEREST

None.

STATEMENTS OF ETHICAL APPROVAL

The methods were conducted according to the latest version of the Helsinki declaration. The study was approved by the ethics committee at the school of pharmacy of the Lebanese international university, Beirut, Lebanon. Written informed consent was signed by all participants before the start of the study. All the personal identifying information was removed from the data set out of respect to the autonomy and confidentiality of participants.

DATA STATEMENT

The data is available upon request to the corresponding author out of respect to the confidentiality of the enrolled patients.

References

1. Kaul K, Tarr JM, Ahmad SI, et al. Introduction to diabetes mellitus. Diabetes: Springer. 2013;1-11.
2. International Diabetes Federation. IDF Diabetes Atlas, 7th edn. Brussels, Belgium: International Diabetes Federation. 2015.
3. Diabetes. 2020 [cited 9 May 2020]. Available from: https://www.who.int/health-topics/diabetes#tab=tab_1.
4. Forbes JM, Cooper ME. Mechanisms of diabetic complications. Physiological reviews. 2013;93(1):137-88. https://doi.org/10.1152/physrev.00045.2011
5. Saaristo T, Moilanen L, Korpi-Hyövälti E, et al. Lifestyle intervention for prevention of type 2 diabetes in primary health care: one-year follow-up of the Finnish National Diabetes Prevention Program (FIN-D2D). Diabetes Care. 2010;33(10):2146-51. https://doi.org/10.2337/dc10-0410
6. Zhou X, Siegel KR, Ng BP, et al. Cost-effectiveness of Diabetes Prevention Interventions Targeting High-risk Individuals and Whole Populations: A Systematic Review. Diabetes Care. 2020;43(7):1593-616. https://doi.org/10.2337/dci20-0018
7. Narayan KMV, Zhang P, Williams D, et al. How should developing countries manage diabetes? Canadian Medical Association

Journal. 2006;175(7):733.
8. World Health Organization. Advocacy, communication and social mobilization for TB control: a guide to developing knowledge, attitude and practice surveys Geneva. 2008. http://www.stoptb.org/assets/documents/resources/publications/acsm/ACSM_KAP%20GUIDE.pdf
9. Food and Agriculture Organization of the United Nations. Adaptable KAP model questionnaires in MS Word. 2020. http://www.fao.org/economic/kap/en
10. Burroughs TE, Desikan R, Waterman BM, et al. Development and validation of the diabetes quality of life brief clinical inventory. Diabetes Spectrum. 2004;17(1):41-9.
11. Memon MS, Shaikh SA, Shaikh AR, et al. An assessment of knowledge, attitude and practices (KAP) towards diabetes and diabetic retinopathy in a suburban town of Karachi. Pakistan journal of medical sciences. 2015;31(1):183. https://doi.org/10.12669/pjms.311.6317
12. Ng S, Chan K, Lian Z, et al. Reality vs Illusion: Knowledge, Attitude and Practice among Diabetic Patients. International Journal of Collaborative Research on Internal Medicine & Public Health. 2012;4:709.
13. Rani P, Raman R, Subramani S, et al. Knowledge of diabetes and diabetic retinopathy among rural populations in India, and the influence of knowledge of diabetic retinopathy on attitude and practice. Rural & Remote Health. 2008;8(3):838.
14. Centers for Disease Control and Prevention. Epi Info. Epi Info™ V.3.5.1. 2008. http://www.cdc.gov/epiinfo
15. Cummings E, Khan A, Singh J, et al. Knowledge attitude and practices of persons diagnosed with type II diabetes mellitus with regards to nephropathy as a complication. South American Journal of Public Health. 2014;2(2):151-67.
16. SPSS IBM. IBM SPSS statistics version 21 Boston, Mass: International Business Machines Corp. 2012;126.
17. Abro M, Zafar AB, Fawwad A, et al. Prevalence of diabetic micro vascular complications at a tertiary care unit of Karachi, Pakistan. International Journal of Diabetes in Developing Countries. 2019;39(2):325-30.
18. Rahaman KS, Majdzadeh R, Naieni KH, et al. Knowledge, attitude and practices (KAP) regarding chronic complications of diabetes among patients with type 2 diabetes in Dhaka. International journal of endocrinology and metabolism. 2017;15(3):e12555. https://doi.org/10.5812/ijem.12555
19. Hoque MA, Islam MS, Khan MAM, et al. Knowledge of diabetic complications in a diabetic population. Journal of Medicine. 2009;10(2):90-3.
20. Desalu O, Salawu F, Jimoh A, et al. Diabetic foot care: self reported knowledge and practice among patients attending three tertiary hospital in Nigeria. Ghana Medical Journal. 2011;45(2):60-5. https://doi.org/10.4314/gmj.v45i2.68930
21. Li X-F, Xu J, Liu L-J, et al. Efficacy of low-protein diet in diabetic nephropathy: a meta-analysis of randomized controlled trials. Lipids in Health and Disease. 2019;18(1):82. https://doi.org/10.1186/s12944-019-1007-6
22. Khongbuh B, Walia I, Kapoor S. Prevalence of diabetes and treatment seeking behaviour among adult populatio at villahe Dhanas, UT, Chandigarh. Nursing and Midwifery Research. 2005;1(3).
23. Pande S, Hiller JE, Nkansah N, et al. The effect of pharmacist-provided non-dispensing services on patient outcomes, health service utilisation and costs in low-and middle-income countries. Cochrane Database of Systematic Reviews. 2013;28(2):CD010398. https://doi.org/10.1002/14651858.CD010398
24. Liu NF, Brown AS, Folias AE, et al. Stigma in people with type 1 or type 2 diabetes. Clinical Diabetes. 2017;35(1):27-34. https://doi.org/10.2337/cd17-er01
25. Schabert J, Browne JL, Mosely K, et al. Social stigma in diabetes. The Patient-Patient-Centered Outcomes Research. 2013;6(1):1-10.
26. Sato E, Ohsawa I, Kataoka J, et al. Socio-psychological problems of patients with late adolescent onset type 1 diabetes-analysis by qualitative research. Nagoya journal of medical science. 2003;66(1/2):21-30.
27. Shiu AT-Y, Kwan JJY-M, Wong RY-M. Social stigma as a barrier to diabetes self-management: implications for multi-level interventions. Journal of clinical nursing (Print). 2003;12(1):149-50. https://doi.org/10.1046/j.1365-2702.2003.00735.x
28. Vanderlee L, Ahmed S, Ferdous F, et al. Self-care practices and barriers to compliance among patients with diabetes in a community in rural Bangladesh. International Journal of Diabetes in Developing Countries. 2016;36(3):320-6.
29. Inche Zainal Abidin S, Sutan R, Shamsuddin K. Prevalence and determinants of appropriate health seeking behaviour among known diabetics: results from a community-based survey. Advances in Epidemiology. 2014.
30. Hamed ABA. Knowledge, Attitude and practice of Diabetes Mellitus among Diabetic patient toward their Disease at Gabir Abualiz Diabetic Center, Khartoum State, Sudan (2013): University of Gezira. 2014.