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FACTORS ASSOCIATED WITH POOR GLYCEMIC CONTROL AMONG WOMEN WITH TYPE 2 DIABETES ATTENDING OUTPATIENT CLINICS IN JORDAN

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ABSTRACT

Diabetes has an additional effect on women. This study aimed to identify the risk factors associated with poor glycemic control among type 2 Jordanian diabetic women. A cross-sectional study was conducted on women with type 2 diabetes mellitus (T2DM). Sociodemographic data and the disease history were collected. Bodyweight, height, waist and hip circumference were measured; body mass index (BMI); waist to hip ratio and waist to height ratio were calculated. Eating patterns was evaluated using food frequency questionnaire. Glycosylated hemoglobin (HbA1c) and serum lipid levels were evaluated. Women's mean age was 56 years. Thirty percent of the subjects were at reproductive age. Fourteen percent of women had a history of gestational diabetes mellitus (GDM). The magnitude of poor glycemic control was 83.8%. The duration of diabetes (OR = 8.5, 95% CI 1.24-58.3) and not having a history of GDM (OR = 0.151, 95% CI 0.024-0.96) were associated with poor glycemic control. Therefore, a need to empower patients with knowledge and resources to enhance their participation in diabetes self-care.

1. Introduction

Diabetes mellitus is a complex disease affecting millions of people worldwide. The global statistics of diabetes mellitus in the year 2017 indicated, about 425 million people had this disease worldwide and will rise to 629 million in 2045 (1). Type 2 diabetes mellitus (T2DM) makes about 90-95% of all diabetes, the estimated prevalence of T2DM in Jordan is 9.5% in age 20-79 years and expected to be 12.5% in 2045 (2).

It was established that poor glycemic control is associated with diabetes complications, and these complications could be avoided by good diabetic control (3).

Annually, on November 14, the world diabetes day (WDD) is celebrated. It was created in 1991 by the International Diabetes Federation (IDF) and the World Health Organization (WHO) in response to increasing concerns about the intensifying threat of diabetes worldwide. Each year, WDD, which is coordinated by the IDF, carries a particular theme, the theme for WDD 2017was Women and diabetes (4).

Whereas 2018-2019 theme was “diabetes concerns every family”, these two-year timeframe activities to promote the role of the family in caring, preventing and educating to fight against diabetes and associated systemic complications.

In both themes, women are a crucial member of diabetes management; separately from managing their disease, playing an important role in their families as they can influence food and lifestyle choices at home. In addition to having a huge influence on the long-term health status of their children. Women are the caretakers of household nutrition and lifestyle habits and therefore have the potential to drive prevention from the household and beyond.

The statistics showed that there are currently over 199 million women living with diabetes and this number projected to increase to 313 million by 2040, women T2DM are almost 10 times more likely to have coronary heart disease than women without diabetes (4).

Women with diabetes require special attention; they are vulnerable to long-term diabetes complications; they are susceptible to high-risk pregnancy, which would affect both maternal and fetal outcomes.

Glycemic control is important in diabetes management. In addition, for women in reproductive age group, optimum glycemic control before and during pregnancy reduces the risks of fetal complications such as congenital malformations, macrosomia, perinatal mortality and cardiac birth defects (5) as well as risks of future childhood obesity, glucose intolerance, and diabetes mellitus (6).

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Most of the studies concentrated on the overall prevalence of poor glycemic control regardless of gender.

Different magnitudes of poor glycemic control were reported in various countries 85% in Sudan (7), 74.3%in Saudi Arabia (8), 54.7% in Libya (9), 54% in Oman (10), 81.5% in Palestine (11), 41.3% in Malaysia (12), 51.9% in China (13) .

In Jordan, some studies reported a magnitude ranging from 60.8% to 65.1%of poor glycemic control (14-16) in both males and females. In particular, factors associated with poor glycaemic control has not been investigated in Jordanian women with T2DM.

Therefore, this study was conducted to address the factors associated with poor glycaemic control among Jordanian women with T2DM patients.

2. Material and methods

Study design and area

We used data from the research project entitled "prevalence and associated risk factors of diabetes mellitus in Jordan" funded by a SIDA grant from the Swedish Research Council (348-2006-2861) from 2008 to June 2012.

A cross-sectional study was conducted to identify the factors associated with poor glycemic control among T2DM women patients attended the governmental outpatient clinics in Zarqa Directorate (Eastern part of Jordan). It included 456 women who have T2DM.

All procedures followed were in accordance with the Helsinki Declaration of 1964 and later versions. The study approved by Deanship of Scientific Research and Graduate Studies (11 July, 2007 No. 4/2006/2007) and the Ministry of Health. All patients were informed of the aims, procedures and risks of the study and signed informed consent prior to inclusion

Data collection

The data were collected from patients by structured questionnaire-interviews. A fasting blood sample was collected to measure HbA1c and serum lipids.

Anthropometric measurements were recorded using standardized procedures. Height was read to the nearest 0.5 cm. A digital scale with capacity for 180 kg and an accuracy of 100 g was used to measure body weight. Waist circumference (WC) was measured midway between the lower rib margin and the iliac crest with plastic tape to the nearest 1 mm. Hip circumference (HC) was measured at the level of the greater trochanter of the femur. Body mass index (BMI), waist to hip ratio (WHR) and waist to height ratio (WHtR) were calculated.

A qualitative food frequency questionnaire (FFQ) was used to assess the food consumption pattern. Thirteen food items and groups were assessed using over the reference period of one month. The food groups were: whole wheat bread, white bread, rice, fruits, vegetables, red meat, fish, chicken, legumes, nuts, sugar, tea/coffee, and olive oil. For each food item or group, participants were asked to report their consumption. Four ordinal frequency responses options were given: rarely/never, monthly, weekly and daily. The food items listed in the food groups were considered to be representative of the range of foods commonly used in Jordan. The FFQ included 71 food items, divided into food groups that mainly represent the Mediterranean diet, some traditional foods were included.

Blood pressure was measured by trained nursing staff using validated automated device OMRON®. Hypertension is defined as systolic blood pressure (SBP) ⩾140 mm of mercury and or diastolic blood pressure (DBP) ⩾ 90 mm of mercury.

HbA1c was measured using the "NycoCardHbA1c" (Axis -Shield/ Norway).

Serum total cholesterol (TC) and high-density lipoprotein– cholesterol (HDL-C) were measured by an enzymatic colorimetric method using cholesterol oxidase, peroxidase, and the chromogen 4-aminophenazone/phenol Allain et al. (17). Serum triacylglycerols (TAGs) levels were determined by an enzymatic colorimetric method using lipoprotein lipase glycerokinase, glycerphosphate oxidase, and the chromogen 4-aminophenazone/N-ethyl-N (3-sulphopropyl)-nramisidine (Fossati and Prencipe) (18). Low-density lipoprotein – cholesterol (LDL–C) was calculated using Friedwaldet al. (19).

Operational definitions

Glycemic control status was defined according to theHbA1c target of < 7% as recommended by the American Diabetes Association for non-pregnant adults (20). For that reason, HbA1c level of ⩾ 7.0% was defined as 'poor glycemic control. Body Mass Index (BMI) was categorized according to the current World Health Organization guidelines into normal (18.5 - 24.9 kg/m2), overweight (25.0 – 29.9 kg/m2), and obesity (class I, II and II ⩾ 30.0 kg/m^2). A Waist circumference of >80 centimeters and a high waist-hip ratio was defined as a ratio of > 0.85 for women(21); WHtR ⩾ 0.5 (22). Dyslipidemia was defined as total cholesterol ⩾ 200 mg/dl, TG >150mg/dl , LDL-C of >100mg/dl, HDL-C of <45mg/dl (23).

Statistical analyses

Analyses were carried out using Statistical Package for Social Sciences (SPSS) software (IBM Corp. Released 2012. IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp). Continuous variables were described using means and standard deviations (SD), and categorical variables were described using percentages. A Chi-square test was used to compare percentages. Multivariate analysis using binary logistic regression analysis was conducted to determine the factors associated with poor glycaemic control. A P-value of <0.05 was considered statistically significant.

3. Results

Demographic and anthropometric characteristics

Among 456 female patients with T2DM, the overall prevalence of poor glycemic control was 83.8%. The mean ± SD age of the patients was 55.8 ± 10.4.Nearly, two-thirds of females with T2DM were more than or equal 50 years old (68.4%). Just about one-third of the women were in the age reproductive period. The majority of the patients were married and non-employee; the most interesting findings that more than three fourth of the patients were nonsmokers. There was a significant association between the duration of diabetes and HbA1c levels; 148 (90.8%) patients with poor glycemic control have been suffering from diabetes for more than 10 years. It was also significantly higher in patients who had an abnormal waist to hip ratio (87.8% vs. 12.2%, p-value=0.016).

It is also observed that patients who had abnormal waist to height circumference were approached the borderline of the significance of poor glycemic control (p-value=0.076).

Table 1 summarizes the patients' demographic and anthropometric characteristics. Almost 14% of the patients had a history of GDM.

Table 1. Demographic and anthropometric characteristics of the study participants.

Variables	Glycosylated Hemoglobin		p-value
	Good glycemic control N (%)	Poor glycemic control N (%)	
Age (years)			
< 50	21 (14.6)	123 (85.4)	0.518
≥ 50	53 (17.0)	259 (83.0)	
Educational level			
Illiterates	20 (14.0)	123 (86.0)	0.270
School level	46 (16.3)	236 (83.7)	
Higher education	8 (25.8)	23 (74.2)	
Marital status			
Married	73 (16.6)	367 (83.4)	0.270
Unmarried	1 (6.3)	15 (93.8)	
Employment status			
Employee	3 (30.0)	7 (70.0)	0.232
Non-employee	71 (15.9)	375 (84.1)	
Smoking status			
No	63 (15.4)	347(84.6)	0.117
Yes	11 (24.4)	34 (75.6)	
Duration of diabetes (years)			
<5	31 (22.3)	108 (77.7)	0.001
5-9	16 (13.6)	102 (86.4)	
≥ 10	15 (9.2)	184 (90.8)	
BMI (kg/m2)			
Normal	5 (16.1)	26 (83.9)	0.152
Overweight	10 (11.2)	79 (88.8)	
Obese	35(20.8)	133 (79.2)	
Waist circumference (cm)			
Normal	4 (18.2)	18 (81.8)	0.700
Abnormal	58 (15.1)	325 (84.9)	
Waist to hip ratio			
Normal	20 (22.5)	69 (77.5)	0.016
Abnormal	36 (12.2)	259 (87.8)	
Waist to height ratio			
Normal	5 (31.3)	11 (68.8)	0.076
Abnormal	38 (14.7)	221 (85.3)	

Clinical characteristics

The majority of patients were using oral hypoglycemic drugs only, there was no significant association between poor glycemic control and clinical characteristics as shown in table 2.

Table 2. Clinical characteristics of the study participants.

Variables	Glycosylated Hemoglobin		p-value
	Good glycemic control N (%)	Poor glycemic control N (%)	
History of gestational diabetes mellitus			
No	64 (17.5)	301 (82.5)	0.451
Yes	8 (13.6)	51(86.4)	
Women have previously delivered large babies > 4 kg			0.730
No	50 (16.5)	253 (83.5)	
Yes	22 (17.9)	101 (82.1)	
Type of DM treatment			
Diet only	4(14.8)	23 (85.2)	0.149
Insulin only	10 (16.1)	52 (83.9)	
Insulin and oral hypoglycemic drugs	1 (2.8)	35 (97.2)	
Oral hypoglycemic drugs only	58 (17.6)	271 (82.4)	
Hypertension			
No	30 (14.1)	183 (85.9)	0.230
Yes	44 (18.3)	197 (81.7)	
Total cholesterol			
Normal	27 (16.1)	141 (83.9)	0.566
Abnormal	24 (18.6)	105 (81.4)	
HDL Cholesterol			
Normal	20 (15.7)	107 (83.4)	0.905
Abnormal	21 (15.2)	117 (84.8)	
LDL Cholesterol			
Normal	18 (16.8)	89 (83.2)	0.664
Abnormal	23 (14.8)	132 (85.2)	
Triglycerides			
Normal	21 (17.5)	99 (82.5)	0.477
Abnormal	23 (14.4)	137 (85.6)	

Clinical characteristics according to glycemic control

A significant difference in the waist to hip ratio between good glycemic control group and poor glycemic control group (P=0.047) was shown in table 3. While, there is no significant differences in clinical data between the two groups.

Table 3. Patients clinical characteristics according to glycemic control (mean±SD).

Variables	Glycosylated Hemoglobin		p-value
	Good glycemic control	Poor glycemic control	
Age (yrs.)	55.9 ± 11.0	55.6 ± 10.3	
Anthropometric data			
Body mass index ((kg/m2)	32.5 ± 6.1	31.3 ± 5.7	0.156
Waist circumference (cm)	100.7 ± 11.5	100.4 ± 11.5	0.856
Hip circumference (cm)	116.9 ± 12.9	113.8 ± 14.3	0.101
Waist to hip ratio	0.86 ± 0.08	0.89 ± 0.08	0.047
Waist to height ratio	0.61 ± 0.7	0.63 ± 0.7	0.399
Clinical Data			
Systolic blood pressure (mmHg)	133.0 ± 24.1	134.0 ± 23.3	0.793
Diastolic blood pressure (mmHg)	84.6 ± 14.3	84.8 ± 10.3	0.879
Glycosylated hemoglobin (%)	6.3 ± 0.57	9.9 ± 1.9	0.000
Total cholesterol (m/dl)	193.2 ± 81.4	189.3 ± 42.8	0.623
Triglycerides (m/dl)	158.5 ± 69.2	170.4 ± 79.2	0.349
LDL-Cholesterol (m/dl)	105.3 ± 34.7	110.6 ± 37.4	0.406
HDL-Cholesterol (m/dl)	46.2 ± 12.9	44.6 ± 11.7	0.422

Table 4. Eating patterns of the study participants.

Variables	Glycosylated Hemoglobin		p-value
	Good glycemic control N (%)	Poor glycemic control N (%)	
Whole wheat bread			
Rarely	36 (14.1)	219 (85.9)	
Monthly	0 (0.0)	1 (100.0)	0.435
Weekly	1 (33.3)	2 (66.7)	
Daily	18 (20.2)	71 (79.8)	
White bread			
Rarely	10 (16.4)	51(83.6)	
Monthly	0 (0.0)	0(0.0)	0.868
Weekly	1 (25.0)	3(75.0)	
Daily	44 (15.5)	239 (84.5)	
Rice			
Rarely	4 (14.8)	23 (85.2)	
Monthly	2(15.4)	11(84.6)	0.952
Weekly	43(16.3)	220 (83.7)	
Daily	6(13.0)	40(87.0)	
Vegetables			
Rarely	0 (0.0)	1(100.0)	
Monthly	0 (0.0)	1(100.0)	0.415
Weekly	24 (20.0)	96 (80.0)	
Daily	30 (13.5)	192 (86.5)	
Fruits			
Rarely	1 (50.0)	1(50.0)	
Monthly	14 (24.1)	44 (75.9)	0.208
Weekly	21(14.7)	139 (85.3)	
Daily	1 (10.0)	9 (90.0)	
Red meat			
Rarely	4(19.0)	17(81.0)	
Monthly	26 (14.9)	148 (85.1)	0.513
Weekly	0 (0.0)	6 (3.5)	
Daily	0(0.0)	0(0.0)	
Chicken			
Rarely	7 (46.7)	8 (53.3)	
Monthly	0 (0.0)	14(100.0)	0.004
Weekly	41 (15.2)	229 (84.8)	
Daily	7 (14.9)	40 (85.1)	
Fish			
Rarely	13 (13.4)	84 (86.6)	
Monthly	30 (17.3)	143 (82.7)	0.697
Weekly	12 (15.8)	64 (84.2)	
Daily	0 (0.0)	0 (0.0)	
Olive oil			
Rarely	1 (11.1)	8 (88.9)	
Monthly	0 (0.0)	0 (0.0)	0.817
Weekly	1 (25.0)	3 (75.0)	
Daily	53 (15.8)	282 (84.2)	
Legumes			
Rarely	1 (50.0)	1 (50.0)	
Monthly	16 (20.8)	61 (79.2)	0.429
Weekly	25 (16.9)	123 (83.1)	
Daily	0 (0.0)	4 (100)	
Nuts			
Rarely	28 (15.6)	151 (84.4)	
Monthly	5 (19.2)	21 (80.8)	0.756
Weekly	15 (17.9)	69 (82.1)	
Daily	7 (11.9)	52 (88.1)	
Sugar			
Rarely	18 (17.1)	87 (82.9)	
Monthly	1 (100.0)	0 (0.0)	0.091
Weekly	0 (0.0)	5 (100.0)	
Daily	36 (15.2)	201 (84.8)	
Tea/coffee			
Rarely	11(26.8)	30(73.2)	
Monthly	1 (20.0)	4(80.0)	0.210
Weekly	3(17.6)	14(82.4)	
Daily	40(14.0)	245 (86.0)	

Eating patterns

The food consumption pattern of thirteen food items and groups was assessed using a qualitative food frequency questionnaire (FFQ) in terms of the number of times per month the food groups were consumed. It was found that the majority of females consumed vegetables, white bread, olive oil, tea/coffee, and sugar on daily basis; legumes; rice, chicken, and fruits on weekly basis, red meat and fish on monthly basis. Finally, females were reported to rarely consume whole wheat bread and nuts as summarized in table 4.

Multivariate regression analysis

Table 5 shows the multivariate regression analysis of factors associated with the two groups of glycemic control. In poor glycemic control group, the duration of diabetes and not having a history of GDM were significantly associated with poor glycemic control. Compared to those who had a shorter duration of diabetes, females who had a longer duration of diabetes were 8-times (OR = 8.5, 95% CI 1.24-58.3) more likely to have poor glycemic control. Women who had a history of GDM were less likely to have poor glycemic control (OR = 0.151, 95% CI 0.024-0.96). However, the multivariate regression analysis showed that the following results were not statistically significant. Females with family history, abnormal LDL cholesterol; HDL cholesterol; triglycerides; WhtR; WHR and hypertension were more likely to have poor glycemic control respectively (OR=2.6, 2.74, 1.8, 1.3, 1.4, 2.3, 1.9).

Table 5. Multivariate logistic regression analysis for factors related to poor glycemic control among T2DM.

Variables	OR	95% CI	p-value
Duration of diabetes(years)			
< 5	1		
5-9	2.2	0.55- 8.9	0.267
≥ 10	8.5	1.24-58.3	0.029*
History of gestational diabetes mellitus			
No	1		
Yes	0.151	0.024-0.96	0.045*
Family history			
No	1		0.096
Yes	2.6	0.84-8.1	
Age (years)			
<50	1		
≥ 50	0.887	0.253-3.1	0.825
Waist to hip ratio (WHR)			
Normal	1		
Abnormal	2.35	0.79-6.97	0.122
Waist to height ratio (WhtR)			
Normal	1		
Abnormal	1.48	0.06 -36.6	0.810
Body Mass Index (BMI)			
Normal	1		
Overweight	0.781	0.09 – 6.1	0.814
Obese	0.784	0.135- 4.6	0.787
Smoking			
No	1		
Yes	0.495	0.096-2.5	0.399
Hypertension			
No	1		
Yes	1.94	0.575-6.5	0.285
Triglycerides			
Normal	1		
Abnormal	1.39	0.44-4.34	0.569
LDL Cholesterol			
Normal	1		
Abnormal	2.74	0.728-10.3	0.136
HDL Cholesterol			
Normal	1	0.375-8.8	0.458
Abnormal	1.8		

4. Discussion

To the best of our knowledge, this is the first study to examine the factors associated with poor glycemic control among women with T2DM. This study has revealed that more than three-fourths (83.7%) of diabetic women had poor glycemic control. In Jordan, unlike studies have been assessed the magnitude of glycemic control among T2DM patients regardless of gender; the result of these studies showed a lower levels of poor glycemic control compared to the results of the current study (14-16), whereas, Adham found that women were found to have worse glycemic control than men (24).

There are several possible explanations for the variation in the magnitude of poor glycemic control between different studies may be elucidated by the differences in the study design, sample size, dose of diabetes medications, self-monitoring of blood glucose, quality and quantity of meals and snacks, and engagement in physical activity.

The findings of the current study were in agreement with those from a large cross- sectional study involving 30,427 younger women attending Malaysian public primary care clinics, it reported that 12.5% of reproductive age women and 18.0% of non-reproductive age women that achieved glycemic control (25). It is also consistent with Ashur et al. (9) who reported that 81.1% of women had poor glycemic control. This result may be explained by the fact that the quality of the diet of the subjects was characterized by high carbohydrates sugar and artificial juices consumption and low consumption of whole grains. Another possible explanation for this result that two-third of the subjects were more than 50 years' age, therefore physical activity is not a part of the culture for this age group. The observed increased magnitude of poor glycemic in women could be attributed to many women's responsibilities in providing care for her family who may neglect their health care (3). Furthermore, the workload at home and thus be less likely to follow their medical appointments, medications intake responsively, less adherent to their lifestyle modification therapies.

It is important to identify the factors associated with poor glycemic control, several studies have been conducted to explore these factors, they were mostly conducted in Western countries. These factors might differ from one community to another based on differences in socioeconomic status, cultural and health care system, studies from different parts of the world have found a variety of risk factors that determine poor glycemic control, in this study, the two factors found to influence glycemic control were duration of diabetes mellitus and history of GDM.

Longer duration of diabetes of more than 10 years was declared to be associated with poor glycemic control in many studies (7, 8, 15, 25, 26). There are several explanations for this results, it is associated with progressive diminishing of insulin secretion through time because of β cell failure which, makes the response to the regimen of treatment and diet unlikely to succeed(27); another possible reason that the amount of glucose attached to HbA1c increases with increasing duration of diabetes (28). Additionally, difficulties arise for the patients to continue monitoring blood glucose levels and adjust with diet and medications as it is a lifelong process. Eventually, treatment will change as the disease progresses, which doesn't mean that the previous therapy has failed (29), this indicates the need of the patient to understand this point and follow the new regimen of treatment.

The most important clinically relevant finding was women who had a history of GDM were less likely to have poor glycemic control. GDM is the most specific important risk factor for the development of T2DM (30). Women who had a history of GDM usually striving to take control of their health during pregnancy by following all advised lifestyle changes such as diet and exercise. In some women, gestational diabetes will respond to changes in diet and exercise; the majority of women will need oral blood glucose-lowering agents or insulin therapy if changes in diet and exercise do not control gestational diabetes effectively (31). The existence of GDM had given women the experience of blood glucose monitoring, diet changes, and the importance of exercise. In addition, the significance of received health education in intrapartum, neonatal and postpartum. For the previous-mentioned reasons, women who didn't have a history of GDM and did not go through the sequence of management of GDM, which might increase the risk to have poor glycemic control.

Medical nutrition therapy (MNT) is an integral part in the management, and preventing or delaying the rate of development of diabetes complications. The Mediterranean is recommended by the American Diabetes Association (ADA) for its valuable effect on glycemic control(32). Many studies showed that there are many different eating patterns that can be helpful in managing diabetes such as The Mediterranean diet, Dietary Approaches to Stop Hypertension (DASH) and a plant-based diet. Generally, the MNT recommendations emphases on. First, carbohydrate-rich fiber sources such as fruits, vegetables, whole grains, legumes, and low-fat milk. Second, avoiding sugar-sweetened beverages such as tea, coffee, and carbonated beverages. Third, eating fish, nuts, and seeds. Fourth, eating elements of a Mediterranean-style diet rich in monounsaturated and polyunsaturated fats such as olive oil (33). The current study showed that the majority of patients eating patterns was incompatible with the MNT recommendations, which includes: daily dependence on refined carbohydrate sources such as white bread and rice, in addition, daily consumption of sugar to sweeten tea. Whole wheat bread and nuts were rarely consumed, also fruit consumption was on a weekly basis. Some foods such as fish and red meat were consumed on a monthly basis.The good eating behaviorwas daily consumption of vegetables and olive oil.

In Jordan, bread is a staple food and eaten almost on each meal and specifically the white one, consumption of rice, and low consumption of fruits and whole wheat bread might decrease fiber consumption. Furthermore, sugar consumption might increase caloric intake. Consequently, inappropriate eating behavior might lead to poor glycemic control.

Nevertheless, in this study, it was observed that patients with a family history of diabetes were more likely to have poor glycemic control, but this effect was not statistically significant (p=0.096). The association between family history (especially first relative degree) of type 2 diabetes and glycemic control; a possible explanation for this might be that the patients may be familiar seeing family members having higher blood glucose levels and may be less concerned about glycemic control (34).

In preparing this manuscript, it was observed that the prevalence of poor glycemic control was more than 40% of subjects in the mentioned studies regardless of developed or developing countries.

This an evidence that it is not a matter of use medications because it is available everywhere, the problem might be with lifestyle modification including diet and exercise. More intensive educational programs on diet modification, exercise, the use of diabetes medications, and self-monitoring of blood glucose.

It seems to emphasize the need for a modification in the approach and strategies in diabetes care in achieving the intended glycemic target in order to achieve target glycemic control.

In conclusion, poor glycemic control as a consequence of many factors including poor continuity to primary care, limited diabetes clinic visits, couldn't afford to eat a balanced diet and no enough information in managing diabetes. Further studies are needed to elucidate the risk factors that anticipated to poor glycemic control and not mentioned in this study.

Our study has strengths and limitations. The strength of this study is that it is the first study highlighted the factors associated with poor glycemic control. It also has some worth mentioning limitations. First, we missed information on physical activity, medication-taking practices and caloric and nutrients intake, which could aid in understanding the reasons for the results obtained. Second, the nature of a cross-sectional design does not prove causality.

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