

Barriers to Blood Glucose Control in Type 2 Diabetic Patients with Poor Glycemic Control in Kirkuk City/Iraq

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Abstract

Background Despite the presence of glycemic control guidelines, and the global trends in the delivery of patient care, especially on the primary health care level, many diabetics do not achieve the needed glycemic, blood pressure and cholesterol levels. Better glycemic control is critical in allowing patients to perform at their best in terms of diabetes management and preventing long-term complications.

Objective To identify barriers that may contribute to poor glycemic control in a sample of Iraqi diabetic patients in Kirkuk city, Iraq.

Methods A cross-sectional study conducted during 2019 in outpatient's diabetic clinic in Azadi Teaching Hospital in Kirkuk, Iraq on diabetic patients with poor glycemic control.

Results The study included 195 diabetic patients with mean age of 55.54±9.260 years; while their mean HbA1c was 9.74±1.696 mg/dl. Duration of diabetes was 6 to 10 years among 86 (44.1%) patients, 154 (74.4%) patients used oral antidiabetic drug, 5 (2.6%) used insulin treatment. Regarding barriers, 126 (65.3%) lack of confidence in using insulin regimens, lack of necessary knowledge about insulin therapy 117 (60.6%), difficulty to perform exercise 125 (64.4%) and influence of complications or other chronic disease 100 (51.8%).

Conclusion Main barriers against good glycemic control reported by type 2 patients in this study were mainly poor knowledge regarding treatment, side effects of the disease itself or the medication and some social factors like unemployment and poor access to health care.

Keywords Glycemic control, barriers, diabetes complication

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List of abbreviations: BMI = Body mass index, DM = Diabetes mellitus, HbA1c = Hemoglobin A1c, NCDs = Non communicable diseases

Introduction

Diabetes mellitus (DM) type 2 is an increasing health problem worldwide and specially in Middle East region. DM is becoming more common in Middle Eastern countries, as Iraq ⁽¹⁾. Prevalence in Iraq ranges from 8.5% to 13.9%, according to reports. Iraq

has set targets for preventing and controlling non-communicable diseases (NCDs) such as DM, hypertension, and breast cancer ⁽²⁾. However, safety confrontation and governmental insecurity have made these objectives difficult to achieve. Physical inactivity, bad food, body over weight, lack of health awareness, health beliefs, stance and life style are central auxiliary factors for type 2 DM, which is prevalent in Middle Eastern countries. Diabetes care need a high focus in

order to reduce morbidity and costs, as diabetic patients use greater resources in the ambulatory and in-patient settings than non-diabetic patients ⁽³⁾.

Improved glycemic control is crucial for individuals to reach their full potential in managing their diabetes and avoiding complications. Glycemic management, hemoglobin A1c (HbA1c), concentration of less than 7.0%) is challenging to accomplish but essential for delaying or preventing diabetes-related consequences ⁽⁴⁾. It is critical to identify the barriers to better glycemic control so that patients can do their best to improve diabetes control and reduce long-term complications. Health, wealth, availability of care, prior care experiences, and individual circumstances are just few of the variables that might affect how well an individual is able to self-manage their condition. A comprehensive understanding of patient, provider, and system-level barriers are needed to inform the development of interventions to support self-management and improve outcomes for diabetes patients ⁽⁵⁾.

In Iraq, primary care facilities and knowledge are weak, and healthcare supply is mainly reliant on secondary and tertiary care. Primary care schedule for soon diagnosis of hypertension, DM, and breast cancer were designed, but they were not successful. At the same time, patients with diabetes are burdened by complex treatment regimens including administration of medications, clinical monitoring, and dietary and lifestyle changes. Patients must also make decisions about when and how to seek medical care ⁽⁶⁾.

Many diabetics still do not achieve their target glycemic, blood pressure, and cholesterol levels, despite the existence of glycemic control guidelines and global trends in the delivery of patient care, particularly at the primary health care level ⁽⁷⁾. It had been proved that a positive attitude, self-management, and motivation are as essential as diet and exercise therapy, which are the basis of DM type 2 therapy. Patient education was reported as useful in achieving good glycemic control and in reducing the

incidence and risk of complications. When there is a barrier to optimum glycemic control, even proper medical therapy delivered by a specialist physician will not be enough and probably will not be carried out by the patient ^(8,9). Therefore, this study aimed to identify barriers that may contribute to poor glycemic control in a sample of Iraqi diabetic patients.

Methods

Study design, duration and setting

A cross-sectional study was conducted from January to July 2019 in Outpatients Diabetic Clinic in Azadi Teaching Hospital in Kirkuk, Iraq. Kirkuk city is located 238 kilometres north of Baghdad, with current population in 2022 is 1,052,000, a 2.04% increase from 2021. The city involves a wide sociodemographic diversity as it is a home to a diverse population of Turkmen, Arabs, Kurds, and Assyrians ⁽³⁾.

Sampling

A convenient sample of 195 type 2 DM patients who had been diagnosed by a specialist clinician/ endocrinologist in the same hospital after full investigation. Comorbidities was relying on self-reporting by patients.

Inclusion criteria

Patients who were more than 35 years old, whose period of diagnosis was at least 6 months, also, patients who were taking medication but whose compliance with lifestyle adjustments was uncertain were also considered.

Exclusion criteria

Patients on steroid therapy, pregnant women, gestational DM, pediatrics, and in patients were excluded.

Data collection tool

A detailed questionnaire obtained from qualified published article ⁽¹⁰⁾ was distributed to the patients and filled by the researcher, it contained two parts:

First part: sociodemographic data of the patients including age, gender, smoking status

and comorbidities in addition to current HbA1c level and body mass index (BMI).

Second part: contained detailed questions regarding barriers faced by the patients regarding good glycemic control. The answers of the barrier's questions were arranged in 5 points Likert scale (extremely agree, agree, uncertain, disagree, and extremely disagree).

Definition of variables

Body mass index

BMI was calculated by dividing the dry weight over the squared height in meters, and was classified according to the World Health Organization categorization for patients as follows: underweight ($<18.5 \text{ kg/m}^2$), underweight to normal (≥ 18.5 - $<22.5 \text{ kg/m}^2$), normal (>22.5 - $<25 \text{ kg/m}^2$), overweight (≥ 25 - $<30 \text{ kg/m}^2$), and obese ($\geq 30 \text{ kg/m}^2$) ⁽¹¹⁾.

Access to care

The utilization of personal health services at the appropriate time to get the greatest possible outcomes for one's health, as well as the patient's capacity to see a qualified health practitioner within a reasonable amount of time ⁽¹²⁾.

Barriers to glycemic control

Any factor that makes progress difficult in the process of blood glucose control ⁽⁹⁾.

Current smokers

Adults who reported they have smoked at least 100 cigarettes in their entire life and that they now smoke some days or every day ⁽¹¹⁾.

Ex-smokers

Individual who has quit cigarette and/or tobacco smoking for at least 6 months ⁽¹¹⁾.

Ethical considerations

The hospital administration was provided with the information, and approval from the Ethics Review Committee of the Kirkuk Health Directorate was acquired. Participants were informed orally and verbal agreement was sought for the research. Each participant's anonymity and confidentiality were ensured,

and they gave their informed consent to take part in the study.

Statistics

Analysis of data with SPSS (Statistical Package for the Social Sciences) (SPSS 20). Statistics (frequency, percentage, mean, and standard deviation) used to describe the subjects and their demographics. To determine if there is a statistically significant correlation or dissimilarity between the variables, analytic statistics, Chi square test (χ^2), was used. A p-value of less than 0.05 indicates statistical significance.

Barrier scoring

Two points was given for the strong agree and agree answer, 1 point for uncertain answers, and zero for strongly disagree and disagree answers. Total score of 50% or less was considered as poor. Total score of 51-74% was considered fair. Total score of equal to or more than 75% was considered as good.

Results

The participants in this study consisted of 195 people with diabetes who had inadequate glycemic control. Participants' ages ranged from 30-76, with a mean of 55.54 ± 9.26 years; their mean HbA1c was $9.74 \pm 1.7 \text{ mg/dl}$; and 52 (or 26.7%) were male (Table 1). Out of the total; there were 130 (66.7%) patients were within age group (50-59) years, 143 (73.3%) females, 146 (74.9%) patients' lives in urban area, and 145 (74.4%) married patients. Unemployed patients represented 63.6% (124) of the total, 60 (30.8%) patients were illiterate, 49 (25.1%) with primary education. Current smoker represented 31.3% (61) of the total. Patients who smoking >20 -40 Cigarette/day were 44 (62.9%). Irregular access to the care units was found among 147 (75.4%) patients. According to the disease onset; 92 (47.2%) patients have DM at 40-49 years old, duration of DM was 6 to 10 years among 86 (44.1%) patients. Family history of DM was positive among 154 (79.0%) patients, 145 (74.4%) patients used oral antidiabetic drug, 5 (2.6%) used insulin treatment, while 41 (21.0%) used combined treatment. Diet and life style

modification was used by only 4 (2.1%) monitoring of blood glucose as shown in figure 1.
patients. Only 51 (26.3%) patients have self-

Table 1. Baseline features of participants

Features		N	%
Age groups/ years	30-49	51	26.2
	50-69	130	66.7
	≥70	14	7.2
Sex	Male	52	26.7
	Female	143	73.3
Residency	Urban	146	74.9
	Rural	49	25.1
Marital status	Single	7	3.6
	Married	145	74.4
	Divorced	10	5.1
	Widow	33	16.9
Occupation	Employed	71	36.4
	Unemployed	124	63.6
Education	Illiterate	60	30.8
	Primary	49	25.1
	Intermediate	39	20.0
	Secondary	28	14.4
	Higher education	19	9.7
Cigarette smoking	Ex-smoker	9	4.6
	Current smoker	61	31.3
	None	125	64.1
Duration of smoking/ years n=70	≤10 years	32	45.7
	>10 years	38	54.3
No. of Cigarette smoking/day n=70	≤20	18	25.7
	>20-40	44	62.9
	>40-60	8	11.4
Access to care	Regular	48	24.6
	Irregular	147	75.4
BMI	Normal	69	35.4
	Overweight	65	33.3
	Obese	61	31.3
Total		195	100.0

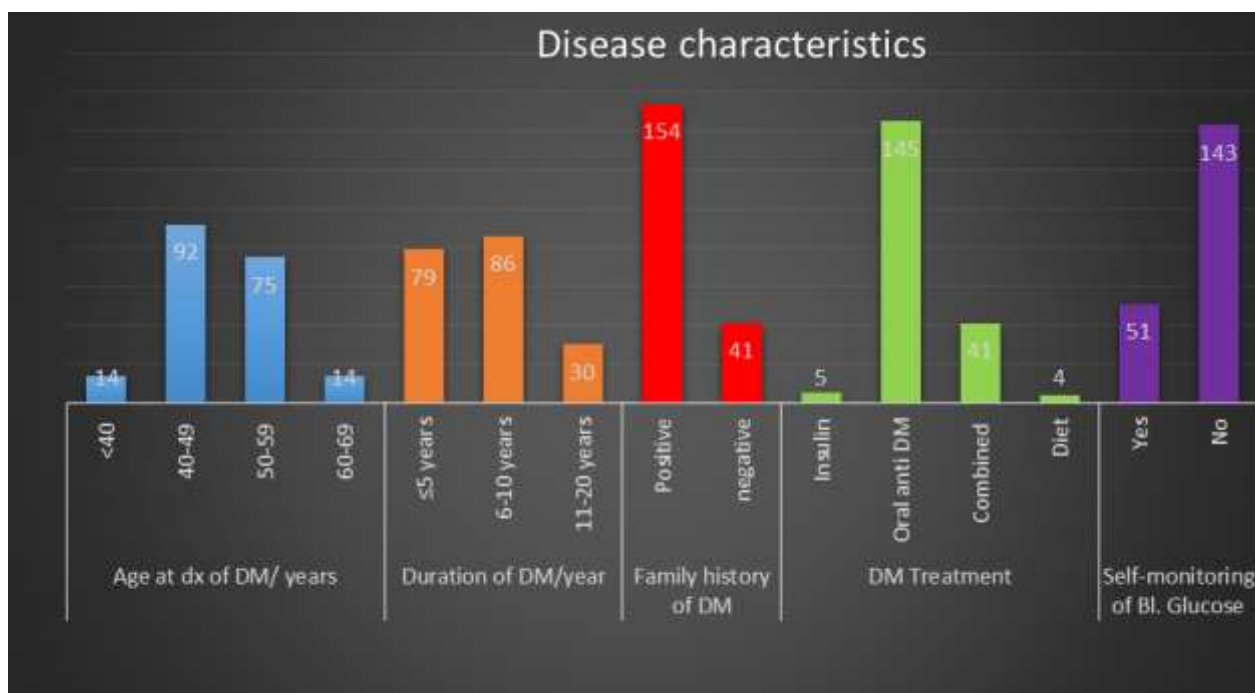


Figure 1. Disease characteristics and treatment

Past medical history (PMH) was represented by Figure 2. There were 32 (16.4%) patients without comorbidity, while there were 163 (83.6%) patients have other comorbidities (Figure 2).

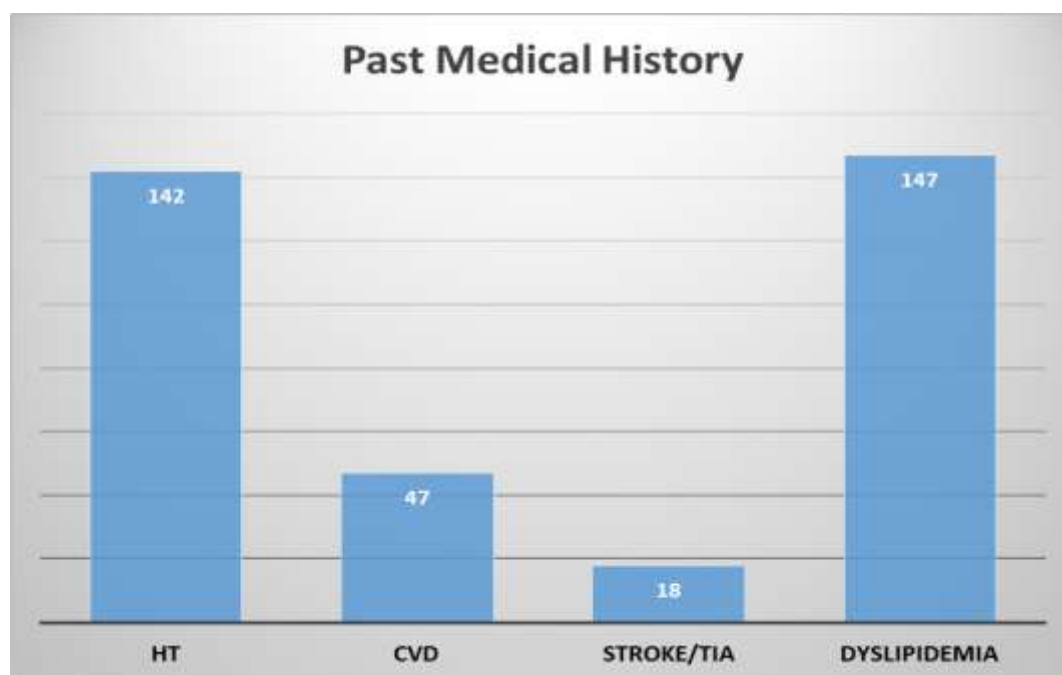


Figure 2. Disease characteristics and treatment

Table (2) demonstrated the responses of participants regarding the obstacles to glycemic management. About two third of participants were agreed that the [Difficulty to control because of lack of confidence in using insulin regimens and how to intensify therapy for patients not reaching glycemic control, 126 (65.3%); and difficulty to control because of lack of necessary knowledge about insulin therapy (storage, injection sites and titration) 117 (60.6%)] and strongly agreed that (difficulty to perform exercise therapy, 125

(64.4%)). About half of participants stated that the cause behind difficult glycemic control were [difficulty to control due to the influence of complications or other chronic disease 100 (51.8%); difficulty to undergo examination regularly 109 (55.9%), difficulty to control due to polypharmic (≥ 4 drugs) 96 (49.2%), difficulty to control because of side effects of medication 102 (52.3%), difficulty to control due to psychosocial factors related to the patient 102 (52.3%).

Table 2. Participants' respondents about barriers against glycemic control

Barriers		Strongly disagree	Disagree	Uncertain	Agree	Strongly agree
Difficulty to perform diet therapy	N	2	21	5	72	95
	%	1.0	10.8	2.6	36.9	48.7
Difficulty to perform exercise therapy	N	2	7	6	54	125
	%	1.0	3.6	3.1	27.8	64.4
Difficulty to perform drug therapy	N	7	47	21	84	36
	%	3.6	24.1	10.8	43.1	18.5
Lack of concern about diabetes mellitus	N	5	27	31	66	66
	%	2.6	13.8	15.9	33.8	33.8
Difficulty to control due to the influence of complications or other chronic dis.	N	5	16	30	100	42
	%	2.6	8.3	15.5	51.8	21.8
Difficulty to undergo examination regularly	N	1	17	22	109	46
	%	0.5	8.7	11.3	55.9	23.6
Difficulty to control due to polypharmic (≥ 4 drugs)	N	0	17	46	96	36
	%	0.0	8.7	23.6	49.2	18.5
Patient lack necessary knowledge about DM, being not familiar with diabetes	N	2	26	50	89	28
	%	1.0	13.3	25.6	45.6	14.4
Difficulty to control because of side effects of medication	N	0	27	41	102	25
	%	0.0	13.8	21.0	52.3	12.8
Difficulty to control due to financial burden, cost and availability of medication	N	4	36	24	87	44
	%	2.1	18.5	12.3	44.6	22.6
Difficulty to control due to psychosocial factors related to the patient	N	0	4	12	77	102
	%	0.0	2.1	6.2	39.5	52.3
Difficulty to control because of health believes of the patient (herbal using instead of medication and using of oral antidiabetic or insulin therapy will cause adaptation or causing cancer	N	6	64	63	56	5
	%	3.1	33.0	32.5	28.9	2.6
Difficulty to control due to resistance to taking insulin and problems with patient self-management	N	0	23	11	45	115
	%	0.0	11.9	5.7	23.2	59.3
Difficulty to control because of lack of necessary knowledge about insulin therapy (storage, injection sites and titration)	N	0	14	18	117	44
	%	0.0	7.3	9.3	60.6	22.8
Difficulty to control because of lack of confidence in using insulin regimens and how to intensify therapy for patients not reaching glycemic control	N	0	3	17	126	47
	%	0.0	1.6	8.8	65.3	24.4

Figure 3 showed the barriers score. High barriers represented 66.2% (129) of participants' respondents, while fair barriers represented 33.8% (66) of participants' respondents.

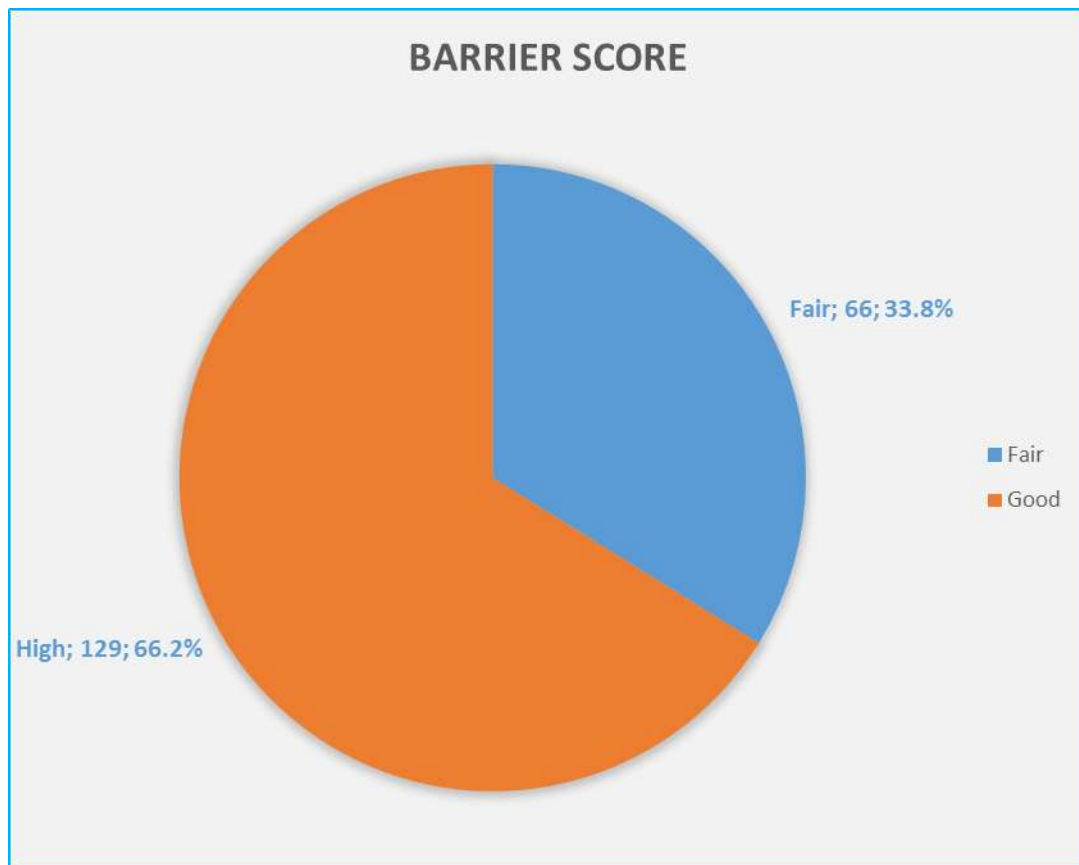


Figure 3. Barrier scores according to participants' response

Distribution of sociodemographic features of participants according to the score of barriers against glycemic control was elucidated in table 3. Unemployed participants and irregular access to care units were significantly associated with high barriers, ($P=0.018$ and $P<0.001$, respectively).

Distribution of disease features and PMH of participants according to the score of barriers

against glycemic control was elucidated in table 4. Participants that not monitoring blood glucose by themselves, with comorbidities, hypertension, and dyslipidemia were significantly associated with high barriers, ($P=0.001$, $P=0.015$, $P=0.043$, and $P=0.008$), respectively.

Table 3. Distribution of sociodemographic features of participants according to the score of barriers against glycemic control

Sociodemographic features		Barrier score				P value
		Fair		High		
		N	%	N	%	
Age group/ years	30-49	20	39.2	31	60.8	0.22
	50-69	44	33.8	86	66.2	
	≥70	2	14.3	12	85.7	
Sex	Male	17	32.7	35	67.3	0.49
	Female	49	34.3	94	65.7	
Residency	Urban	54	37.0	92	63.0	0.12
	Rural	12	24.5	37	75.5	
Marital status	Single	2	28.6	5	71.4	0.56
	Married	53	36.6	92	63.4	
	Divorced	2	20.0	8	80.0	
	Widow	9	27.3	24	72.7	
Occupation	Employed	32	45.1	39	54.9	0.018
	Unemployed	34	27.4	90	72.6	
Education	Illiterate	13	21.7	47	78.3	0.08
	Primary	16	32.7	33	67.3	
	Intermediate	16	41.0	23	59.0	
	Secondary	11	39.3	17	60.7	
	Higher EDUCATION	10	52.6	9	47.4	
Cigarette smoking	EX-smoker	2	22.2	7	77.8	0.7
	Current smoker	20	32.8	41	67.2	
	None	44	35.2	81	64.8	
Duration of smoking/years	≤10 years	11	34.4	21	65.6	0.8
	>10 years	11	28.9	27	71.1	
No. of Cigarette smoking/day	≤20	5	27.8	13	72.2	0.48
	>20-40	13	29.5	31	70.5	
	>40-60	4	50.0	4	50.0	
Access to care	Regular	35	72.9	13	27.1	<0.001
	irregular	31	21.1	116	78.9	
BMI	Normal	25	36.2	44	63.8	0.31
	Overweight	25	38.5	40	61.5	
	Obese	16	26.2	45	73.8	

Table 4. Distribution of disease features and PMH of participants according to the score of barriers against glycemic control

Parameters		Barrier score				P value
		Fair		High		
		N	%	N	%	
Age at diagnosis of DM/ years	<40	5	35.7	9	64.3	0.09
	40-49	30	32.6	62	67.4	
	50-59	28	37.3	47	62.7	
	60-69	3	21.4	11	78.6	
Duration of DM/year	≤5 years	34	43.0	45	57.0	0.06
	6-10 years	22	25.6	64	74.4	
	11-20 years	10	33.3	20	66.7	
Family history	Positive	48	31.2	106	68.8	0.14
	negative	18	43.9	23	56.1	
DM Treatment	Insulin	2	40.0	3	60.0	0.05
	Oral antidiabetic drug	50	34.5	95	65.5	
	Combined	13	31.7	28	68.3	
	diet and life style modification	1	25.0	3	75.0	
Self-monitoring of Bl. Glucose	Yes	27	52.9	24	47.1	0.001
	No	38	26.6	105	73.4	
Comorbidities	Without comorbidity	17	53.1	15	46.9	0.015
	With comorbidities	49	30.1	114	69.9	
Hypertenstion	Yes	42	29.6	100	70.4	0.043
	No	24	45.3	29	54.7	
Cardiovascular disease	Yes	12	25.5	35	74.5	0.22
	No	54	36.5	94	63.5	
Stroke/Transient ischemic attack	Yes	5	27.8	13	72.2	0.79
	No	61	34.5	116	65.5	
Dyslipidemia	Yes	42	28.6	105	71.4	0.008
	No	24	50.0	24	50.0	

Discussion

The high rate of poorly controlled type-2 DM is found to be associated with many negative outcomes among patients ⁽¹⁰⁾. Despite the vast research findings that have focus on the importance of diet, physical activity, drug treatment, blood glucose monitoring and care of foot, the level of glycemic control is still unsatisfactory among patients worldwide. The findings of this research showed factors that influence diabetes self-glycemic control ⁽¹¹⁾. Furthermore, this study highlighted the influence of barriers, and lifestyles as

determinants of patients control over the glycemic level.

These sociodemographic and disease criteria reported in the current study are slightly different from a Canadian study sample in which patients were of HbA1c ≥10% had an average age of 57.1 years, but the majority were males and employed and most of them were on insulin. A large proportion of the participants with high HbA1c in this study were significantly more likely to report fair or poor health status, have chronic illnesses like hypertension and cardiac diseases, be obese, and have depressive symptoms, and be taking

anti-hypertensive and/or cardio protective medications ⁽¹²⁾.

Participants' unemployment status and their lack of regular access to care facilities were found to be significantly associated with high barriers. Previous research has suggested a link between stress and the development of type 2 DM; however, the current study lacks sufficient data to draw any firm conclusions. Stress and economic deprivation likely activate the hypothalamic-pituitary-adrenal (HPA) axis and cause increased cortisol production, which contributes to this phenomenon physiologically ⁽¹³⁾. Behavioral factors may also be playing a role. Occurrence peaks in those between 40-64 years of age and it has been hypothesized that employment-related stressors and the impact of shift work could underlie this progression. Access to care was also reported as a factor aiding in diabetic control in a USA study by Zhang et al. ⁽¹⁴⁾. The study measured by patient health insurance coverage, area, and the number of times health care was received. Those who reported no health care visits were more likely to have an HbA1c of more than 9%, in comparison with those who reported four or more health care visits in the previous year. This is significant given that 6.0% of known diabetic adults in the USA were uninsured ⁽¹⁴⁾. The Iraqi healthcare system offers in its guidelines universal healthcare coverage and patients' socio-economic characteristics should not be a barrier for access. However, little is known about the extent to which patients achieve equal opportunities to access the standardized care services, and how this associated with patient characteristics ⁽¹⁵⁾.

People with type 2 DM with poor glycemic control had a range of barriers that lead to reduced their self-management of the diabetes condition. Main barriers reported in this study are lack of confidence in using insulin regimens, lack of necessary knowledge about insulin therapy, difficulty to perform exercise therapy influence of complications or other chronic disease and some psychosocial factors. Some of these challenges are shared with other studies conducted in New Zealand, such as the findings of Chepulis et al. in 2021, who found that despite the availability of diabetes

education resources, the limited resources provided to people with DM in New Zealand may be a direct barrier to good glycemic control and self-management over their condition. Participants in that study stated that their health care providers often failed to provide adequate or updated information specially those who were trying to control their health condition and diet had reported difficulty in finding information that was useful to them ⁽¹⁶⁾.

Patients from another study conducted by Tang et al. were more likely to identify financial hurdles, such as the lack of prescription insurance or the inability to purchase a healthy diet. In addition, their findings suggest a link between cost and glycemic control. Financial barriers found to increase the risk of non-compliance and are associated with poor utilization of care services among patients with chronic disease like diabetics ⁽¹⁷⁾. Patients with poor HbA1c control were more likely to be elderly, who may have limited access to affordable, healthy food, as well as limited ability to prepare good foods items and maintain adequate meal spacing. This phenomenon was attributed by Chan et al. to the increased need for medication insurance and programs of nutritional assistance in these communities in order to overcome financial barriers ⁽¹⁸⁾. In Arab societies, the elderly is typically cared for at home by their children and other relatives, hence these considerations are rarely put into practice. Weak understanding of the importance of healthy habits, peer pressure, and calorie-dense food all play a part. The high prevalence of overweight and obesity may be traced back to a number of factors, including the increasing urbanization of the population and the accompanying shifts in lifestyle, which include higher rates of food intake and less time spent ⁽¹⁹⁾.

On the other hand, in the latter study in New Zealand many participants also indicated that the side effects of medication formed as a barrier to good glycemic control ⁽¹⁶⁾. As a result, these participants didn't adhere to their medication, or actively changed their medication, or tried to find alternate

medicines, which is usually remedies or herbs that fit with lifestyle like prolonged periods of stopping their diabetic medication, using cinnamon to help control their blood glucose level. However, the complications of these alternatives resulting in substantial increase in HbA1c levels and reduced quality of life like teasing from friends and disappointment.

Essential factors that influence adherence to the diabetes glycemic control were identified, and they extend beyond the level of the individual and the patient to include cultural, organizational, social, and policy influences such as local food habits, religious beliefs and traditions, and a lack of appropriate medical care ⁽²⁰⁾. Health care practitioners should expand the reach of health promotion to influence social norms and attitudes, leading to better patient outcomes, by identifying the factors that affect the health of individuals and diabetes patients.

In conclusion, patients with type 2 DM who participated in this study reported that a lack of education about the disease and its treatment, as well as social factors such as unemployment and limited access to medical care, were the most significant obstacles to achieving and maintaining good glycemic control.

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Author contribution

Dr. Rashid: Data collection and editing. Dr. Naji: Study design and writing. Dr. Ismaeel: Editing and Statistical analysis.

Conflict of interest

None.

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References

1. Meo SA, Usmani AM, Qalbani E. Prevalence of type 2 diabetes in the Arab world: impact of GDP and energy consumption. *Eur Rev Med Pharmacol Sci*. 2017; 21(6): 1303-12.
2. Iraqi Research Foundation for analysis. Health in Iraq. Available at: <http://www.irfad.org/?s=health>. accessed at December 2022
3. Mansour AA, Al-Maliky AA, Kasem B, et al. Prevalence of diagnosed and undiagnosed diabetes mellitus in adults aged 19 years and older in Basrah, Iraq. *Diabetes Metab Syndr Obes*. 2014; 7: 139-44. doi: 10.2147/DMSO.S59652.
4. Meo SA, Sheikh SA, Sattar K, et al. Prevalence of type 2 diabetes mellitus among men in the Middle East: A Retrospective Study. *Am J Mens Health*. 2019; 13(3): 1557988319848577. doi: 10.1177/1557988319848577.
5. Blonde L, Aschner P, Bailey C, et al. Gaps and barriers in the control of blood glucose in people with type 2 diabetes. *Diab Vasc Dis Res*. 2017; 14(3): 172-83. doi: 10.1177/1479164116679775.
6. Abusaib M, Ahmed M, Nwayyir HA, et al. Iraqi experts consensus on the management of type 2 diabetes/prediabetes in adults. *Clin Med Insights Endocrinol Diabetes*. 2020; 13: 1179551420942232. doi: 10.1177/1179551420942232.
7. Mohammad SH, Abu-Raghib AR, Fadhil NN. Effects of metforminalone, metformin with flaxseeds oil on serum 1,5 anhydroglucitol, adiponectin and insulin resistance in patients with type 2 diabetes mellitus. *Iraqi J Med Sci*. 2016, 14(1): 67-74.
8. Inzucchi SE, Bergenstal RM, Buse JB, et al. Management of hyperglycemia in type 2 diabetes, 2015: a patient-centered approach: update to a position statement of the American Diabetes Association and the European Association for the Study of Diabetes. *Diabetes Care*. 2015; 38(1): 140-9. doi: 10.2337/dc14-2441.
9. Yoshioka N, Ishii H, Tajima N, et al. Differences in physician and patient perceptions about insulin therapy for management of type 2 diabetes: the DAWN Japan study. *Curr Med Res Opin*. 2014; 30(2): 177-83. doi: 10.1185/03007995.2013.855187.
10. Arakawa S, Watanabe T, Sone H, et al. The factors that affect exercise therapy for patients with type 2 diabetes in Japan: A nationwide survey. *Diabetol Int*. 2015; 6: 19-25.
11. International Diabetic Federation. IDF diabetes atlas. 8th ed. 2017.
12. Sharara E, Akik C, Ghattas H, et al. Physical inactivity, gender and culture in Arab countries: A systematic assessment of the literature. *BMC Public Health*. 2018; 18(1): 639. doi: 10.1186/s12889-018-5472-z.
13. McBrien KA, Naugler C, Ivers N, et al. Barriers to care in patients with diabetes and poor glycemic control-A cross-sectional survey. *PLoS One*. 2017; 12(5): e0176135. doi: 10.1371/journal.pone.0176135.
14. Zhang X, Bullard KM, Gregg EW, et al. Access to health care and control of ABCs of diabetes. *Diabetes Care*. 2012; 35(7): 1566-71. doi: 10.2337/dc12-0081.
15. Mikhael EM, Hassali MA, Hussain SA, et al. Self-management knowledge and practice of type 2 diabetes mellitus patients in Baghdad, Iraq: a

- qualitative study. *Diabetes Metab Syndr Obes.* 2018; 12: 1-17. doi: 10.2147/DMSO.S183776.
16. Chepulis L, Tamatea JAU, Wang C, et al. Glycaemic control across the lifespan in a cohort of New Zealand patients with type 1 diabetes mellitus. *Intern Med J.* 2021; 51(5): 725-31. doi: 10.1111/imj.14816.
17. Tang KL, Ghali WA, Manns BJ. Addressing cost-related barriers to prescription drug use in Canada. *CMAJ.* 2014; 186(4): 276-80. doi: 10.1503/cmaj.121637.
18. Chan J, DeMelo M, Gingras J, et al. Challenges of diabetes self-management in adults affected by food insecurity in a large urban centre of Ontario, Canada. *Int J Endocrinol.* 2015; 2015: 903468. doi: 10.1155/2015/903468.
19. Tremblay MS, Aubert S, Barnes JD, et al. Sedentary Behavior Research Network (SBRN) - Terminology Consensus Project process and outcome. *Int J Behav Nutr Phys Act.* 2017; 14(1): 75. doi: 10.1186/s12966-017-0525-8.
20. American Diabetes Association. What we recommend; types of activity; 2020. Available from: <https://diabetes.org/healthy-living/fitness>. Accessed February 15, 2023

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