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Original article

Factors associated with poor glycemic control in diabetic patients in Kirkuk

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Abstract:

- ***Background*:** Iraq's healthcare system continues to face major challenges in the aftermath of conflict, with no public insurance system and significant barriers to achieving national goals for noncommunicable diseases (NCDs), including diabetes. Effective glycemic control is essential to minimize complications and improve quality of life among diabetic patients. This study aimed to identify the main barriers to achieving optimal glycemic control among diabetic patients in Kirkuk, Iraq.
- ***Methods:*** A cross-sectional study was conducted from April to December 2019 at the Baba Gurgur Diabetes Clinic, K1 Hospital – North Oil Company, in Kirkuk. Adult diabetic patients with uncontrolled blood sugar levels (A1C $\geq$ 7%) were interviewed using a validated questionnaire. Participants were asked to report perceived causes of poor glycemic control and could select multiple responses.
- ***Result:*** Among 1,136 participants, the mean A1C was 8.3 ± 2.1%. Only 256 patients (22.5%) had controlled glycemia (A1C < 7%), while 880 (77.5%) were uncontrolled. The most commonly reported cause of poor glycemic control was lack of medication or inconsistent drug supply from primary health centers (51.1%). Other major contributors included non-compliance with diet and medication (35.1%) and illiteracy (19.8%). Financial hardship, ongoing security concerns, and political instability were also frequently cited as significant influencing factors.
- ***Conclusions:*** Poor glycemic control remains prevalent among diabetic patients in Kirkuk, with key barriers including inadequate drug availability, socioeconomic challenges, and the broader unstable healthcare environment in Iraq.
- **Keywords:** Diabetes Mellitus, Management, Kirkuk

INTRODUCTION

Iraq's healthcare system continues to face major challenges in its recovery from the conflict with the Islamic State. As a result of the war, approximately 1.3 million people remain internally displaced, and nearly nine million continue to require humanitarian assistance. Reconstruction efforts are estimated to cost at least 88 billion USD. Many displaced individuals are unable to return to their homes due to slow infrastructure rebuilding, limited employment opportunities, and restricted access to essential services. Although public healthcare in Iraq has traditionally been free for decades, there is no formal private insurance system to supplement government support [1].

The Iraqi healthcare model is highly centralized and relies on fixed government funding annually. In 2011, Iraq had a physician-to-patient ratio of 7.8 per 10,000, which was lower than that of neighboring countries such as Syria, Lebanon, Jordan, and Palestine [2]. Since the 2003 invasion, the healthcare system has suffered from persistent underperformance despite increased government health spending—from 2.7% of GDP in 2003 to 8.4% in 2010. Nevertheless, inefficiencies in fund allocation continue to hinder the improvement of facilities, staffing, and medication availability [2].

Diabetes mellitus, particularly type 2 (T2DM), is increasingly prevalent in Iraq, with reported rates ranging from 8.5% (IDF age-adjusted) to 13.9% [3]. Iraq has set national targets to reduce the burden of noncommunicable diseases (NCDs) such as diabetes, hypertension, and breast cancer. However, persistent insecurity and weak governance have severely undermined these efforts [3].

Lifestyle factors such as physical inactivity, unhealthy diets, obesity, poor health literacy, and prevailing cultural beliefs significantly contribute to the growing burden of T2DM in Iraq and other Middle Eastern countries [4]. Achieving optimal glycemic control (defined as HbA1c < 7.0%) is critical in delaying or preventing complications of diabetes, including cardiovascular and microvascular diseases [5]. It has been shown that for every 1% reduction in mean HbA1c, there is a 21% decrease in the risk of complications such as myocardial infarction, stroke, amputation, and microvascular damage [6].

In Iraq, diabetic patients typically receive medications—including insulin—through primary healthcare centers (PHCs) [7]. However, the combined impact of the ISIS conflict and declining oil revenues has led to an economic crisis that has weakened primary care infrastructure and shifted reliance toward overburdened secondary and tertiary services. Although national screening programs were proposed for early detection of diabetes, hypertension, and breast cancer, they failed to achieve widespread implementation [3].

Identifying the barriers to effective glycemic control is essential for improving patient outcomes and reducing long-term complications [8]. Diabetic patients utilize more healthcare resources, both in outpatient and inpatient settings, than non-diabetic individuals, making diabetes management a critical public health priority for reducing morbidity and healthcare costs [9,10].

PATIENT and METHOD

This cross-sectional study was conducted from April to December 2019 at the diabetes outpatient clinic of the Baba Gurgur Diabetic Facility, K1 Hospital – North Oil Company, located in Kirkuk city. Participants included both type 1 and type 2 diabetic patients who had been receiving continuous care at the center for at least one year. Final HbA1c values were determined through centralized laboratory analysis. Only patients with uncontrolled glycemic indices (HbA1c $\geq$ 7%) were included in the survey portion of the study. These individuals were interviewed using a validated 12-question questionnaire administered by the center's medical team. The questionnaire allowed patients to indicate perceived causes of poor glycemic control and permitted multiple responses using yes/no answers.

Exclusion criteria for the study included individuals under 18 years of age, pregnant women, those with a duration of diabetes less than one year, those not followed up at the diabetic center for a full year, and patients with missing HbA1c results. Eligible participants were receiving oral antidiabetic drugs (OADs) provided by the Iraqi primary healthcare system, specifically Metformin and Glibenclamide [3]. Smoking status was defined as any tobacco use within the last three months.

Data collection was guided by a specially designed tool developed by the principal investigator, based on contemporary literature. The tool was divided into four parts. The first part collected demographic and behavioral information such as age, sex, smoking status, disease duration, education level, and socioeconomic status. Educational levels were categorized into four groups, ranging from illiteracy to higher education, while financial status was classified based on occupation into high (government employees), middle (retirees), and low (unemployed) income groups [11].

The second part included anthropometric measurements following WHO guidelines. Weight was measured to the nearest 0.1 kg using a calibrated scale, and height was measured barefoot to the nearest 0.1 cm using a stadiometer. Waist circumference was taken at the midpoint between the lowest rib and the iliac crest. Body mass index (BMI) was calculated as weight in kilograms divided by the square of height in meters (kg/m^2).

The third part of the assessment involved clinical measurements. Blood pressure was taken in a sitting position using a standard sphygmomanometer and recorded from the right arm, with the mean of two readings taken five minutes apart. The diagnosis of coronary artery disease was based on Q-wave myocardial infarction, left bundle branch block, echocardiographic abnormalities, coronary angiography findings, or history of revascularization procedures. Cerebrovascular disease was diagnosed based on the presence of a sudden neurological deficit within 24 hours, with or without imaging confirmation. Proteinuria was defined as persistent protein in the urine in the absence of hematuria or pyuria.

Ethical approval for the study was obtained from the Baba Gurgur Diabetic Center, K1 Hospital – Northern Oil Corporation, prior to the commencement of the research.

RESULTS

The mean HbA1c among the study population was $8.3 \pm 2.1\%$. Of the 1,136 diabetic patients enrolled, 256 (22.5%) had controlled glycemia (HbA1c <7%), while 880 (77.5%) had uncontrolled glycemia (HbA1c ≥7%). The mean age of participants was 53.6 ± 11 years, ranging from 18 to 90 years. Men accounted for 51.2% of the total, and women 48.8%. Glycemic control differed significantly by gender, with a higher proportion of men achieving HbA1c <7% compared to women (p=0.0069) (Table 1).

Smoking was more prevalent among patients with poor glycemic control (22.7%) compared to those with good control (13.7%). Obesity was also more common among patients with uncontrolled diabetes, with a higher mean BMI of 32.0 ± 5.55 compared to 29.1 ± 6.55 in those with controlled diabetes (p=0.030). Employment status revealed that 37.5% of uncontrolled patients were unemployed, while 29.4% were government employees and 33.1% were retired (p=0.002). Urban and rural residency did not show a statistically significant association with glycemic control (p=0.747).

Educational level showed a marked impact: 19.8% of patients with HbA1c ≥7% were illiterate compared to 6.6% in the controlled group, and this difference was statistically significant (p=0.001). Regarding diabetes management, the majority (51.1%) were treated with oral antidiabetic drugs (OADs), while 13.1% received insulin alone, and 23.9% received a combination of insulin and OADs (p=0.027). Type II diabetes was predominant (88.8%) across both groups, with no significant difference between them (p=0.842) (Table 1).

Table (1): Demographic and Clinical Characteristics of Study Participants

Variable	HA1c <7% No. (256) % (22.5)	HA1c ≥10% No. (880) % (77.4)	Total	P-value
Age (Means ± SD)	55.1±11.6	52.2±12.7	53.61±11	0.093
Gender				
Men	150 (58.6%)	432 (49.1%)	582 (51.2%)	**0.0069**
Women	106 (41.4%)	448 (50.9%)	554 (48.8%)	
Smoker	35 (13.7%)	200 (22.7%)	235 (20.7%)	-
BMI	29.1±6.55	32.0±5.55	30.5±5.53	**0.030**
Employment				
Government employees	103 (40.2%)	259 (29.4%)	362 (31.8%)	**0.002**
Retired employees	62 (24.2%)	291 (33.1%)	353 (31.1%)	
Unemployed	93 (35.6%)	330 (37.5%)	421 (37.1%)	
Residence				
Urban	140 (54.7%)	469 (53.3%)	609 (53.6%)	0.747
Rural	116 (45.3%)	411 (46.7%)	527 (46.4%)	
Duration of DM				
< 1 year	43 (16.8%)	112 (12.7%)	155 (13.6%)	0.102
1–5 years	85 (33.2%)	288 (32.7%)	373 (32.8%)	
5–10 years	67 (27.2%)	293 (33.3%)	360 (31.7%)	
>10 years	61 (23.8%)	187 (21.3%)	243 (21.8%)	
Education Level				
Illiterate	17 (6.6%)	174 (19.8%)	191 (16.8%)	**0.001**
Low education	40 (15.6%)	332 (37.7%)	372 (32.7%)	
Medium education	102 (39.8%)	198 (22.5%)	300 (26.4%)	
High education	97 (38%)	176 (20%)	273 (24%)	
Treatment				
Oral antidiabetic	131 (51.2%)	450 (51.1%)	581 (51.1%)	**0.027**
Insulin	51 (19.9%)	115 (13.1%)	166 (14.6%)	
Oral + Insulin	49 (19.1%)	211 (23.9%)	260 (22.9%)	
Herbal/None	25 (9.8%)	104 (11.8%)	129 (11.4%)	
Type of DM				
Type I	30 (11.7%)	97 (11.0%)	127 (11.2%)	0.842
Type II	226 (88.3%)	783 (89.0%)	1009 (88.8%)	

In terms of patients' perspectives on barriers to glycemic control, the most frequently cited cause was unavailability of medication or inadequate drug supply at primary healthcare centers (51.1%). Self-monitoring of blood glucose was another major issue, with 49% of patients citing a lack of glucometers and testing strips, either due to absence in governmental facilities or cost barriers in the private sector. Additionally, 39.3% reported that HbA1c testing was either unavailable in primary care or too expensive in private clinics.

Non-compliance with diet and medication was identified by 35.1% of patients, followed by unawareness of diabetes complications (31.8%), illiteracy (19.8%), and spirituality-centered views on disease control (19.2%). Fear of tight glycemic control (18.9%), limited access due to migration or unavailable PHC services (15%), and needle phobia (12.6%) were also noted (Table 2).

Table (2): Patients' Viewpoint about Causes of Poor Glycemic Control in Diabetes depending in HbA1c ≥10%

Variable	No. (HbA1c ≥10%, n=880)	%
Illiteracy	174	19.8%
Unavailability of medication and/or no drug supply from PHC, or shortage of supply and no supply of modern OAD drugs	450	51.1%
Unawareness of diabetic complications	280	31.8%
Reluctance to use home monitoring, no supply of glucometer and strips from governmental health system, or high cost in private sector	429	49%
Diabetes is untreatable (lack of understanding of disease and consequences)	176	20%
Needle phobia	111	12.6%
Lack of awareness of HbA1c and its value; limited availability of HbA1c testing in PHC and high cost in private sector	346	39.3%
Lack of trust in public healthcare system	44	5%
Spirituality and GOD-centered locus of control	169	19.2%
Migration and access difficulties and/or PHC unavailability	132	15%
Non-compliance with diet and medication	309	35.1%
Fear of tight glycemic control	166	18.9%

DISCUSSION

The findings of this study indicate that a significant proportion of patients with diabetes in Iraq exhibit poor glycemic control, as reflected by a mean HbA1c of 8.3 ± 2.1%. Only 22.5% of patients achieved the recommended target of HbA1c <7%, while 77.5% had levels equal to or exceeding this threshold. These findings align with the American Diabetes Association (ADA) guidelines, which associate HbA1c <7% with reduced risk of microvascular complications [12]. Comparatively, the National Diabetes Statistics Report 2020 from the United States found that only about 50% of individuals with self-reported diabetes meet HbA1c targets [13,14].

Insulin use was notably low among the Iraqi diabetic population, with only 14.6% of patients on insulin therapy alone. This is in contrast to findings from the UK Prospective Diabetes Study, which revealed that 53% of patients required insulin initiation within six years to maintain glycemic targets [15]. Barriers to insulin use are frequently attributed to patient-related factors, such as fear of injections, perceived interference with daily life, and misconceptions regarding side effects, all of which contribute to reluctance in starting insulin therapy [16].

Inadequacies in diabetes care between the public and private sectors in Iraq further exacerbate these outcomes. Among patients with HbA1c ≥10%, 21.3% had diabetes for over 10 years, 51% were on oral antidiabetic medications, and 19.8% were illiterate. Additionally, 37.5% were unemployed, indicating a correlation between socioeconomic status and suboptimal diabetes management. Factors such as age, disease duration, type of treatment, and educational level are known to influence patient engagement in self-management practices [17].

Religious beliefs and psychological factors also play a role in glycemic control. In this study, 19.2% of patients cited spirituality and a God-centered locus of control as barriers to effective management. Other cited factors included poor health literacy, lifestyle limitations, emotional distress, and lack of empowerment. Furthermore, 39.3% of patients reported either unavailability or unaffordability of glucometers and testing strips. The significance of self-monitoring of blood

glucose (SMBG) is well established in diabetes guidelines, which emphasize that patients should be provided with appropriate tools based on their needs and preferences [19].

Knowledge gaps surrounding HbA1c were evident; many patients lacked understanding of what HbA1c is and its target value. Limited availability of HbA1c testing in primary healthcare (PHC) settings, and high costs in secondary and private sectors, were reported by 39.3% of participants. This presents a significant challenge to disease monitoring. According to ADA guidelines, maintaining HbA1c at or below 7% effectively reduces the risk of microvascular complications in both type 1 and type 2 diabetes [20].

Additionally, 15% of participants blamed migration or lack of access to PHC services for their poor glycemic control. Following the 2014 conflict in Iraq, internal displacement and strained health resources led to drug shortages, particularly in PHCs. Consequently, over half of the study population (51.1%) cited drug unavailability at PHCs as a reason for poor diabetes control. Many were forced to purchase medications from private pharmacies, incurring significant out-of-pocket costs. Distrust in government healthcare services and laboratory investigations further contributed to patient reliance on more expensive private healthcare facilities. The absence of a public insurance system intensifies these financial burdens, as highlighted by the 39.3% of patients who identified cost as a barrier to care [2,3].

CONCLUSION

Diabetic patients confirmed poor glycemic control, with the majority of cases being linked to Iraq's current health situation.

Ethical Clearance:

In accordance with the 2013 WMA Helsinki Declaration, all ethical aspects of this study were approved. Before enrolling the participants, an informed oral consent was obtained from their families as an ethical agreement. Additionally, approval from the hospital administrator was obtained.

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Conflicts of interest: There are no conflicts of interest**.**

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