Ali B. K., et al., Yemeni J Med Sci. 2026; 20(1):15 -23
https://doi.org/10.20428/yjms.v20i1.3401
https://journals.ust.edu/index.php/yjms

OPEN ACCESS Original Article

The Extent of Diabetic Patients' Adherence to Quarterly HbA1c Testing: A Cross-Sectional Study, Aden, Yemen

Belal Kamel Ali[1], Mantallah Adeb Baggash[1], Abdullah Nasser[1], Samaya Ragheed[1], Ameera Alhumidi[1*], Lyan Abdulrahman Jamel, Awadh Ali Ahmed[1], Amr Khaled Bin Zafar[1], Baraah Manwar[1], Fadhl Al-rdfani[1], Maram Fares Abdallah[1], Jamal Mohammad Saleh[1], Rana Gazem Abdullah[1], Khaled Adel Al-hasani[1], Haneen M. Dabwan[1], Aya Emad[1], Noori Ehab Abdulwhab[1], Athmar waheeb Saleh[1]

[1] *Department of Basic Sciences, Faculty of Medicine and Health Sciences, University of Science and Technology, Aden, Yemen.*

ABSTRACT

Background: Type 2 diabetes is the most common form of diabetes, estimated to account for 85-90% of diabetes cases.
Objective: This study investigates the awareness of diabetic patients in Aden, Yemen about periodic HbA1c testing.
Methods: A cross-sectional study was conducted on 120 diabetic patients. Data were collected using questionnaires covering demographic information, diabetes information, HbAlc testing, barriers to HbA1c testing, importance of HbA1c testing, information sources. Adherence and improvement, as well as awareness and support. The analysis was performed using SPSS.
Results: Most participants were married women between the ages of 45 and 60, many of whom were housewives; most had type 2 diabetes, but 46.7% were not sure what type of diabetes they had; 85.8% knew about HbA1c testing, but only 35.8% followed the recommended three month testing schedule; obstacles included lack of symptoms, high costs, and busy schedules, Health education was a major factor; approximately 93.3% supported increased awareness with the majority preferring text message reminders.
Conclusion: This study's cross-sectional design and structured questionnaire effectively collected important information on diabetic patients' knowledge about HbA1c testing in Aden. The method worked well for spotting behavioral patterns and awareness gaps that would help improve diabetes care adherence and support focused public health Initiatives.

Keywords: Diabetes-HbA1c.Monitoring-Patient Compliance-Cross-sectional study-Aden-Yemen.

**** Corresponding author address:*** *ameeraalhumidi@gmail.com*

https://doi.org/10.20428/yjms.v20i1.3401
https://journals.ust.edu/index.php/yjms

INTRODUCTION

The high prevalence of diabetes mellitus (DM) has emerged as a worldwide public health problem in the past 20 years. Type 2 diabetes is the most common form of diabetes, estimated to account for 85-90% of diabetes cases [1]. Control must be long-term if complications are to be prevented [2]. Patients with diabetes who have chronic hyperglycemia suffer from serious tissue damage, organ dysfunction, and ultimately irreversible organ failure, particularly in the eyes, kidneys, heart, and blood vessels. Numerous consequences, including blindness, renal failure, cardiovascular disease, and limb amputations, are linked to diabetes mellitus [3]. Chronic inflammatory disorders like diabetes have been linked to the formation and progression of toll-like receptors (TLRs). Inflammation is a major factor in insulin resistance and pancreatic β-cell dysfunction in diabetics [4]. Glycated hemoglobin (HbA1c) assessment is a prime monitoring tool for glycemic control and reflects the average plasma glucose levels over the previous 2–3 months [5]. Reduced testing frequency for glycated Hemoglobin, HbA1c, is Associated with Deteriorating Diabetes Control [6]. The International Diabetes Federation (IDF) and the American Diabetes Association (ADA) both recommend testing HbA1c at least twice a year for patients meeting treatment goals and quarterly for those whose therapy has changed or who are not meeting glycemic goals [7]. Even though these established guidelines exist, actual Adherence is irregular and frequently insufficient. Previous studies have identified socioeconomic status, educational level, healthcare access, and physician engagement as significant determinants influencing patients' adherence to HbA1c testing recommendations [8]. For example, a study conducted in the United Kingdom revealed that only 58% of patients adhered to the recommended HbA1c testing schedule [9]. Furthermore, digital health interventions and reminders (such as SMS alerts and telemedicine follow-ups) have been found to significantly improve HbA1c testing adherence and glycemic control [10]. Despite these technological advancements, there has been no comprehensive empirical study in certain regions—particularly in low- and middle-income countries—on how consistently patients adhere to these guidelines [11,12]. Therefore, the current study aims to determine how frequently Patients undertake HbA1c testing every three months, as well as to discover potential factors impacting their level of compliance.

METHODS

Study Design

This study employed an observational descriptive cross-sectional design to assess adherence to recommended glycated hemoglobin (HbA1c) testing intervals among patients with diabetes mellitus and to identify factors associated with compliance.

Study Setting

The study was conducted at the Diabetes Care Center of Al-Jumhuriyyah Teaching Hospital, Aden, Yemen. This center provides outpatient diabetes management services and routine follow-up for patients with diabetes mellitus.

Study Population

The study population consisted of adult patients diagnosed with diabetes mellitus who were attending the Diabetes Care Center during the study period.

Sample Size Determination

The sample size was calculated using the World Health Organization (WHO) sample size calculator for prevalence studies. Assuming a confidence level of 95%, a margin of error of 5%, and an anticipated adherence prevalence of 50% (to maximize sample size in the absence of prior local data), and the minimum required sample size was calculated. After accounting for potential non-response, a total of 120 participants were included in the study using a simple random sampling technique.

Sampling Technique

A simple random sampling method was applied to select eligible participants from the patient registry at the Diabetes Care Center during the study period.

Inclusion Criteria

- Patients aged 18 years and older.
- Diagnosed with diabetes mellitus (type 1 or type 2) for at least six months.

https://doi.org/10.20428/yjms.v20i1.3401
https://journals.ust.edu/index.php/yjms

- Receiving follow-up care at the Diabetes Care Center of Al-Jumhuriyyah Teaching Hospital.
- Able and willing to provide informed consent.

Exclusion Criteria

- Newly diagnosed patients with diabetes mellitus (diagnosis < 6 months).
- Patients with gestational diabetes.
- Patients with severe acute illness or cognitive impairment that limited their ability to respond reliably.
- Patients who declined to participate in the study.

Data Collection

Data were collected through a combination of a structured interviewer-administered questionnaire and a review of patients' medical records. The collected data encompassed sociodemographic characteristics, clinical information related to diabetes, frequency of glycated hemoglobin (HbA1c) testing during the preceding year, and factors influencing adherence to recommended HbA1c testing intervals.

Study Instrument

The questionnaire was developed based on relevant literature and study objectives and consisted of the following sections:

1. Sociodemographic Data

This section included information on:

- Age
- Marital status
- Occupation

2. Clinical Data

This section focused on diabetes-related variables, including:

- Frequency of HbA1c testing
- Barriers to regular HbA1c testing
- Perceived importance of HbA1c testing

3. Importance of HbA1c Testing

Participants were asked questions assessing their perceptions and education regarding the role of HbA1c testing in diabetes management.

4. Awareness and Practice of HbA1c Testing

This section evaluated participants' awareness, attitudes, and practices related to HbA1c testing and diabetes follow-up.

Study Variables

HbA1c Testing

Participants were asked the following questions:

- Have you heard of HbA1c testing؟
- Do you know the purpose of HbA1c testing؟
- How often do you undergo HbA1c testing؟
- Did your physician recommend HbA1c testing every three months؟

Barriers to HbA1c Testing

Participants were asked to identify reasons for not adhering to HbA1c testing every three months. Multiple responses were permitted.

Importance of HbA1c Testing

This subsection included questions such as:

- Do you think HbA1c testing is important for diabetes management؟
- Have you received health education regarding the importance of HbA1c testing؟

Awareness and Practice of HbA1c Testing

Participants were asked:

- Do you think there is a need for increased awareness about the importance of HbA1c testing؟
- Would you like to receive additional information on how to control blood glucose levels؟
- Would you prefer a reminder system for HbA1c testing؟
- What is the most suitable method for reminding diabetic patients to follow up on HbA1c testing؟

Ethical Consideration

Verbal consent was obtained from each participant, and they were informed that their participation was voluntary and that they had the right to withdraw at any time without any effect on the medical care they receive.

Confidentiality of the information was assured, and the data will not be used for purposes other than scientific research .

Patients' privacy was respected, and we ensured that no psychological or physical harm was caused to any of the participants.

All ethical guidelines and instructions of the Research Ethics Committee were strictly followed.

https://doi.org/10.20428/yjms.v20i1.3401
https://journals.ust.edu/index.php/yjms

Data Analysis

Data were entered and analyzed using the Statistical Package for the Social Sciences (SPSS), version 22 (SPSS Inc., Chicago, Illinois, USA). Descriptive statistics were used to summarize the study variables. Inferential analysis was conducted to assess differences between groups. The Mann–Whitney U test was applied for comparisons between groups with non-normally distributed variables. Statistical significance was set at a p-value of less than 0.05.

RESULTS

The majority of participants are married (80%) and between the ages of 45 and 60 (38.3%) males are slightly outnumbered by females. The fact that 45.8% of them are housewives may have an impact on awareness levels. Although educational attainment is balanced, the most common levels are secondary (30.8%) and university (30%) (Table 1) .

Table 1: Patient demographic data, (n=120)

Variable	Category	Frequency	Percent (%)
Age	Less than 35	7	5.8
	35–45	37	30.8
	45–60	46	38.3
	Over 60	30	25.0
Marital Status	Single	7	5.8
	Married	96	80.0
	Divorced	5	4.2
	Widowed	12	10.0
Occupation	Employed	42	35.0
	Unemployed	21	17.5
	Student	2	1.7
	Housewife	55	45.8
Sex	Male	55	45.8
	Female	65	54.2
Educational Level	Uneducated	26	21.7
	Primary	21	17.5
	Secondary	37	30.8
	University	36	30.0

The most common type of diabetes is type 2 (41.7%), but a startling 46.7% of people are unsure of their diabetes type. Long-term risk exposure and the requirement for ongoing care are indicated by the fact that the majority of patients (60.8%) have had diabetes for more than five years (Table 2).

https://doi.org/10.20428/yjms.v20i1.3401
https://journals.ust.edu/index.php/yjms

Table 2: Percentage of diabetes type and duration, (n=120)

VARIABLE	FREQUENCY	PERCENT	VALID PERCENT
HISTORY OF DISEASES OF DIABETES			
Type 1	14	11.7	11.7
Type 2	50	41.7	41.7
Uncertain	56	46.7	46.7
Total	120	100.0	100.0
DURATION OF DIABETES			
Less than 1 year	17	14.2	14.2
1–5 years	30	25.0	25.0
More than 5 years	73	60.8	60.8
Total	120	100.0	100.0

Regarding knowledge of HbA1c testing, the awareness of HbA1c testing is high (85.8%), and 74.2% know its purpose, reflecting moderate knowledge. Still, a quarter lack clarity, underscoring the need for continued education about the test's role in long-term glucose monitoring (Table 3).

Table 3: Knowledge data about HbA1c testing, (n=120)

VARIABLE	FREQUENCY	PERCENT	VALID PERCENT
HAVE YOU HEARD OF HbA1c TESTING			
Yes	103	85.8	85.8
No	17	14.2	14.2
Total	120	100.0	100.0
DO YOU KNOW THE PURPOSE OF HbA1c TESTING			
Yes	89	74.2	74.2
No	31	25.8	25.8
Total	120	100.0	100.0

Only 35.8% of respondents regularly comply with doctors' recommendations for testing every three months, despite 67.5% reporting this. Busy schedules (28.3%) and lack of symptoms (31.7%) are major obstacles (Table 4). On the plus side, 78.3% change their treatment or lifestyle as a result of the findings.

https://doi.org/10.20428/yjms.v20i1.3401
https://journals.ust.edu/index.php/yjms

Table 4: Practices related to HbA1c testing among participants (n=120)

Category	Option / Reason	Frequency	Percent	Valid Percent	Cumulative Percent
How often do you undergo HbA1c testing?	Every 3 months	43	35.8%	35.8%	35.8%
	Every 6 months	21	17.5%	17.5%	53.3%
	Once a year	11	9.2%	9.2%	62.5%
	Rarely	32	26.7%	26.7%	89.2%
	Never	13	10.8%	10.8%	100.0%
	Total	120	100.0%	100.0%	
Did your doctor recommend HbA1c testing every 3 months?	Yes	81	67.5%	67.5%	67.5%
	No	21	17.5%	17.5%	85.0%
	I don't remember	18	15.0%	15.0%	100.0%
	Total	120	100.0%	100.0%	
Reasons for not adhering to HbA1c testing every 3 months	Lack of knowledge about the importance of testing	23	19.2%	19.2%	19.2%
	No new symptoms	38	31.7%	31.7%	50.8%
	High testing cost	25	20.8%	20.8%	71.7%
	Busy schedule	34	28.3%	28.3%	100.0%
	Total	120	100.0%	100.0%	
Do you use the test results to adjust your lifestyle or treatment?	Yes	94	78.3%	78.3%	78.3%
	No	26	21.7%	21.7%	100.0%
	Total	120	100.0%	100.0%	

Diabetes Duration and HbA1c Purpose. Knowledge, Diabetes understanding of the purpose of HbA1c do not statistically significantly correlated (P>0.05). This implies that merely having diabetes for a longer period of time does not guarantee that one will comprehend its monitoring tools better.

https://doi.org/10.20428/yjms.v20i1.3401
https://journals.ust.edu/index.php/yjms

Table 5: Duration of diabetes correlated to knowledge of the purpose of HbA1c testing, (n=120)

		Do you know the purpose of HbA1c testing		Total	
		Yes	No		P- value
Duration of Diabetes	less than 1 year	12	5	17	0.458
	1-5 years	21	9	30	
	more than 5 years	56	17	73	
Total		89	31	120	

DISCUSSION

In our research, the majority of participants were 45–60 years old (38.3%), and the majority were married (80%). This finding is consistent with past research which reported the mean age of participants was 58.2 (± 16.2) years old [13]. However, other studies did not align with our research with the majority of participants being over 60 years old [14]. In our opinion, variation in study populations and healthcare-seeking patterns is the most likely explanation for this discrepancy.

A major portion of the sample were housewives (45.8%), which can perhaps make them differ in terms of their awareness level depending upon presumably limited access to health information relative to workers. Sex-wise distribution, the females made up a slightly higher percentage (54.2%) than the males (45.8%). This was supported by an earlier study that presumes such groups are less accessible and exposed to hospitals [15]. Another research contradicted this with the claim that diabetes is found more frequently in men than women [1]. This may be due to women—housewives, specifically—may be more accessible and available to respond to questionnaires related to their health, therefore leading to more female over representation in some population samples.

The results indicate that participants with higher educational attainment, particularly those at the university level, demonstrated greater awareness of the importance of HbA1c testing. This was supported by a study indicating that lower education level has an impact on diabetes knowledge [8]. We believe that higher educated people are more likely to be more health literate, which allows them to comprehend medical terms like "HbA1c," its significance for managing diabetes, and its role in long-term glucose control.

Type 2 diabetes was the commonest type among the respondents, at 41.7%. However, 46.7% of the respondents were unaware of their diabetes type. According to disease duration, (60.8%) of the respondents had diabetes for more than five years. These facts are substantiated by a past research that reported a prevalence of type 2 diabetes at a high level in the study population [14]. From our supposition, type 2 diabetes prevalence is due to the low level of awareness, delayed diagnosis, and extended management that allows the disease to become even more entrenched in the population.

Awareness of HbA1c testing was found to be high with 85.8% of participants were familiar with the test, and 74.2% of them knew its purpose. This result was consistent with a previous study which implies awareness and use of HbA1c testing [5]. However, other research has produced different findings [6]. From our perspective, the difference in findings may be due to variations in healthcare systems, access to diabetes education, and patient follow-up.

Though 67.5% of the participants agreed that they need their HbA1c tested every three months, 35.8% of them follow their doctors' advice consistently. The two most frequent reasons mentioned for the lack of following through on checks were the absence of symptoms (31.7%) and lifestyles being too hectic (28.3%). Positively, according to their test results, 78.3% of respondents said they changed their lifestyle or course of treatment. Our findings were supported by a previous study that supports the positive impact of regular HbA1c testing and the idea that patients adjust behavior based on test results [6]. While other research shows improved HbA1c levels due to high medication adherence [9]. This discrepancy between awareness and actual compliance may be attributed to several behavioral and psychological factors. Many patients

may underestimate the seriousness of diabetes in the absence of symptoms, leading to reduced motivation for regular monitoring .

In our study, despite (56.7%) from participants have not received any health education, the majority (86.7%) believe the test is crucial. The overwhelming majority of respondent's report improvements when testing recommendations are followed, and 93.3% of them support greater awareness efforts. These findings are consistent with a previous study showing that even with gaps in lifestyle adherence patients still understand or act upon medication and testing importance [6]. While other study suggests low testing adherence and possibly lower awareness or belief in testing importance in some groups [8]. Even though they had no formal health education, the majority of participants are aware of the necessity of HbA1c testing, implying that awareness could be determined by social issues, experience, and interaction with medical professionals, among others. Attitude toward diabetes control is favorable, as indicated by the strong belief in the necessity of the test and the perceived improvements if advice is followed.

CONCLUSION

This cross-sectional study conducted in Aden, Yemen, provides valuable new information regarding diabetic patients' knowledge beliefs, and behaviors about HbA1c testing. While a majority of participants value the HbA1c test and understand the purpose of the test, there is a substantial degree of non-adherence to the three-month recommendation for testing. The main reasons for the failure to test, which was noted by only 35.8% of patients, listed the lack of symptoms, cost, and time, despite their knowledge about HbA1c, it is important to note that improved knowledge and adherence were significantly correlated with education and having structured health education. By indicating an important gap in both knowledge and adherence, the study shows the potential for directed and strategic public health interventions. These findings underscore the value of continuing health education, availability for testing, and support materials, such as reminder systems, to promote ongoing testing and adherence.

Author's contributions

B.K.A., M.A.B., A.N., and S.R. participated in drafting the abstract, introduction, objectives, methodology, data collection, results, and data analysis. M.A.B., A.N., and S.R. also contributed to discussion and interpretation. A.A. and J.M.S. contributed to manuscript writing, results, and conclusion. L.A.A., A.A.A., and A.K.B.Z. supported methodology, data analysis, and data collection; A.K.B.Z. also performed data entry into SPSS. Authors A.E., R.G.A., F.A., and R.G.A. contributed to data collection and literature review. Authors K.A.A., H.M.D., N.E.A., A.W.S., A.E. supported literature review and data collection. A.H. served as research supervisor. All authors read and approved the final manuscript.

Acknowledgement

We would like to extend our sincere thanks to Management of Al-Jumhuriya Teaching Hospital and the staff for their kind treatment and cooperation.

Conflict of Interest

The authors declare that there is no conflict of interest.

Funding

This research did not receive a special funding .

REFERENCES

[1] Chen L, Magliano DJ, Zimmet PZ. The worldwide epidemiology of type 2 diabetes mellitus—present and future perspectives. Nature reviews endocrinology. 2012 Apr;8(4):228-36.

[2] Vinik AI, Vinik E. Prevention of the complications of diabetes. American Journal of Managed Care. 2003 Mar 1;9(3; SUPP):S63-80.

[3] Ali AM. Evaluation of hypoglycemic activity of Boswellia carterii and Cissus rotundifolia in streptozotocin/nicotinamide-induced diabetic rats. Yemeni Journal for Medical Sciences. 2022 Sep 25.

[4] Khalaf SA, Mohsin IH, Abd Mohammed Z, Ahmed SS. Toll-Like Receptors (TLRs) and Their Role in Diabetic Mellitus Disease: A Review. Yemeni Journal for Medical Sciences. 2025 Jul 20;19.(٧)

[5] Dailey G. Assessing glycemic control with self-monitoring of blood glucose and hemoglobin A1c measurements. InMayo Clinic Proceedings 2007 Feb 1 (Vol. 82, No. 2, pp. 229-236). Elsevier.

https://doi.org/10.20428/yjms.v20i1.3401
https://journals.ust.edu/index.php/yjms

[6] Driskell OJ, Holland D, Waldron JL, Ford C, Scargill JJ, Heald A, Tran M, Hanna FW, Jones PW, Pemberton RJ, Fryer AA. Reduced testing frequency for glycated hemoglobin, HbA1c, is associated with deteriorating diabetes control. Diabetes care. 2014 Oct 1;37(10):2731-7.

[7] American Diabetes Association. Standards of medical care in diabetes—2022 abridged for primary care providers. Clinical Diabetes. 2022 Jan 1;40(1):10-38.

[8] Arts DL, Voncken AG, Medlock S, Abu-Hanna A, van Weert HC. Reasons for intentional guideline non-adherence: a systematic review. International journal of medical informatics. 2016 May 1;89:55-62.

[9] Imai C, Li L, Hardie RA, Georgiou A. Adherence to guideline-recommended HbA1c testing frequency and better outcomes in patients with type 2 diabetes: a 5-year retrospective cohort study in Australian general practice. BMJ quality & safety. 2021 Sep 1;30(9):706-14.

[10] Nwaokolo PI. Implementation of Text Messaging Intervention to Impact HbA1c Levels (Doctoral dissertation, Grand Canyon University).

[11] Mechael P, Batavia H, Kaonga N, Searle S, Kwan A, Goldberger A, Fu L, Ossman J. Barriers and gaps affecting mHealth in low and middle income countries: Policy white paper.

[12] Imai C, Li L, Hardie RA, Georgiou A. Adherence to guideline-recommended HbA1c testing frequency and better outcomes in patients with type 2 diabetes: a 5-year retrospective cohort study in Australian general practice. BMJ quality & safety. 2021 Sep 1;30(9):706-14.

[13] Lerner N, Shani M, Vinker S. Predicting type 2 diabetes mellitus using haemoglobin A1c: a community-based historic cohort study. The European journal of general practice. 2014 Jun 1;20(2):100-6.

[14] van Mark G, Tittel SR, Sziegoleit S, Putz FJ, Durmaz M, Bortscheller M, Buschmann I, Seufert J, Holl RW, Bramlage P. Type 2 diabetes in older patients: an analysis of the DPV and DIVE databases. Therapeutic advances in endocrinology and metabolism. 2020 Sep;11:2042018820958296.

[15] Perseh L, Peimani M, Ghasemi E, Nasli-Esfahani E, Rezaei N, Farzadfar F, Larijani B. Inequalities in the prevalence, diagnosis awareness, treatment coverage and effective control of diabetes: a small area estimation analysis in Iran. BMC Endocrine Disorders. 2023 Jan 18;23(1):17.