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ORIGINAL RESEARCH

Evaluation of Factors Affecting Glycemic Control in Type 2 Diabetic Patients at Akkapi Family Health Center

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Abstract

Objective and Aim

Type 2 diabetes mellitus (T2DM) is a major public health problem, and achieving glycemic control is critically important in primary care settings. This study aimed to determine the sociodemographic, lifestyle, treatment adherence, healthcare access, and psychosocial factors affecting glycemic control (HbA1c) in patients with T2DM followed at a family health center.

Material and Methods

This cross-sectional study was conducted between 15 April and 15 June 2025 at Akkapi No. 2 Family Health Center, Seyhan, Adana, Türkiye. A total of 120 registered patients with T2DM (out of 254 registered diabetic patients) were included after sample size calculation. Data were collected via a comprehensive questionnaire covering demographic characteristics, lifestyle and dietary habits, treatment adherence, healthcare utilization, and perceived glycemic control. Laboratory results, including HbA1c, were obtained from patient records. Statistical analyses were performed using SPSS 23; $p<0.05$ was considered significant.

Results

The mean age of the participants was 57.51 ± 11.13 years, mean body mass index (BMI) was 28.68 ± 4.65 kg/m^2, and mean duration of diabetes diagnosis was 8.44 ± 7.61 years. When lifestyle and dietary habits were examined, 93.3% of the participants consumed at least two main meals per day, 38.3% consumed snacks, and 81.7% slept 7–8 hours per night. Regarding healthcare services and follow-up, 40% of the participants had not attended a doctor's visit in the last 6 months, 70% had received diabetes education, and 87.5% reported no difficulty in treatment adherence. When the relationship between HbA1c levels and sociodemographic characteristics was evaluated, statistically significant differences were found between HbA1c and education level, treatment adherence, type of treatment, and physical activity (p1=0.039, p2=0.000, p3=0.004, p4=0.033).

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Conclusions

The main factors associated with better glycemic control in primary care are higher education and income levels, regular physical activity, and strong treatment adherence. The findings emphasize the importance of tailored diabetes education programs, especially for individuals with low literacy, promoting regular physical activity, enhancing treatment adherence with supportive tools, and removing barriers to healthcare access.

Keywords: Glycemic Control, Hba1c, Family Medicine, Treatment Adherence

1. Introduction

Diabetes mellitus is a carbohydrate metabolism disorder characterized by hyperglycemia, resulting from relative or absolute insulin deficiency or "insulin resistance" developed in peripheral tissues, affecting multiple organs and causing multisystemic involvement(1). According to WHO reports, the number of individuals with diabetes increased from 200 million in 1990 to 830 million in 2022(2). In 2021, diabetes was directly responsible for 1.6 million deaths. Despite this, one-third of diabetic patients still do not receive treatment(2). According to the Turkish Society of Endocrinology and Metabolism (TEMD) guidelines, the glycemic control target for adults is reported as HbA1c ≤7% (53 mmol/mol)(1). More flexible glycemic control targets may be set depending on the patient's life expectancy, risk of hypoglycemia, presence of diabetes-related complications, decline in renal function, and accompanying comorbidities. The glycemic targets established for diabetic patients in family medicine should contribute to improving patients' quality of life, preventing diabetes-related complications, and determining the necessary treatment management.

Type 2 diabetes, the diagnosis of which is relatively straightforward and strongly associated with unhealthy lifestyle habits, is a particularly significant disease for family physicians who represent the first point of contact with the healthcare system and provide longitudinal care throughout all stages of life. Today, the Turkish Ministry of Health has introduced the Disease Management Platform (HYP), an interface that enables family physicians to make early diagnoses of chronic diseases and control symptoms and findings with appropriate treatment plans in line with evidence-based guidelines(3). This platform has revolutionized the management of common chronic diseases, especially diabetes, by increasing motivation through positive performance feedback. The current family medicine practice plays a crucial role in chronic disease management, and identifying factors affecting glycemic control failure in patients with Type 2 diabetes mellitus (DM) is of critical importance for both individual and public health outcomes.

This study aims to investigate the sociodemographic, lifestyle, treatment adherence, healthcare access, and psychosocial factors affecting glycemic control (HbA1c) in patients with Type 2 diabetes. It is intended to strengthen the role of family medicine in diabetes management.

2. Materials and Methods

2.1 Study type

This cross-sectional study was conducted between April 15, 2025, and June 15, 2025, at Akkapi No. 2 Family Health Center in the Seyhan district of Adana province.

2.2. Study group

Patients diagnosed with Type 2 diabetes who were registered at Akkapi No. 2 Family Health Center were included in the study. Using the Epi Info(4) statistical program, the sample size was calculated as 113 with a 95% confidence interval and a 0.05 margin of error, based on a universe size of 264. Questionnaires with incomplete data from 6 participants were excluded, and the study was concluded with 120 patients who met the inclusion criteria.

2.3 Procedures

In the study, a questionnaire was administered to the participants that included the following sections: Demographic data (Age, Gender, Height, Weight, Year of diabetes diagnosis, Educational status, Employment status, Monthly income, Smoking status, Alcohol consumption), Lifestyle and dietary habits (Number of main meals per day, Daily snack consumption, Number of weekly physical activity sessions, Daily sleep duration, Self-assessed stress level, Weekly fast-food consumption, Daily water intake), Treatment adherence assessment questions (Treatment regimen, Regularity of medication use, Frequency of blood glucose monitoring, History of hypoglycemia and hyperglycemia, HbA1c level, Level of knowledge about the disease), Health services and follow-up evaluation (How many times did you visit a doctor in the last 6 months?, Have you received diabetes education?, Have you consulted a dietitian or diabetes nurse?, Do you experience difficulties in adhering to treatment?, What is the most challenging aspect of your diabetes follow-up process?), Evaluation of glycemic control status (Have you experienced blood sugar fluctuations in the last 3 months?, Do you think your diabetes is under control?, To what extent do you think diabetes affects your daily life?, Do you experience restrictions in your social life because of diabetes?, Are you worried about the progression of your diabetes?), Laboratory measurements (HbA1c, Fasting/random glucose, Lipid profile [cholesterol panel], Body fat percentage/analysis, Complete blood count [Hemogram], Thyroid function tests [TFT]). The questionnaire consisted of questions covering all the above-mentioned areas.

2.4 Statistical analysis

Data analysis was performed using SPSS 23 at a 95% confidence level. Descriptive statistics, including mean, standard deviation, median, frequency, percentage, minimum, and maximum, were employed to assess the study data. For comparisons between two groups, the Student's t-test was used for normally distributed parameters, while the Mann-Whitney U test was applied for non-normally distributed parameters. For numerical data comparisons across more than two groups, the One-Way ANOVA test was used for normally distributed data, and the Kruskal-Wallis test was used for non-normally distributed data. The chi-square test was utilized for comparisons involving two or more categorical variables. A p-value of <0.05 was considered statistically significant.

3. Results

The mean age of the participants was 57.51 ± 11.13 years, the mean body mass index (BMI) was 28.68 ± 4.65 kg/m^2, and the mean duration of diabetes was 8.44 ± 7.61 years. Of the participants, 65% were female.

When lifestyle and dietary habits were examined, 93.3% of the participants consumed at least two main meals per day, 38.3% consumed snacks, and 81.7% slept 7–8 hours per night. The proportion of those with a moderate stress level was 85.8%, those who never consumed fast food was 90.8%, and those who drank 2 liters or more of water daily was 34.2%.

Regarding treatment adherence, 73.3% of the participants were using oral antidiabetic drugs, 95.8% took their medications regularly, and 43.3% measured their blood glucose regularly. In the last 3 months, 1.7% experienced hypoglycemia and 25.0% experienced hyperglycemia.

In terms of healthcare services and follow-up, 40% of the participants had not visited a doctor in the last 6 months, 70% had received diabetes education, and 87.5% reported no difficulty in adhering to treatment.

Regarding glycemic control status, 92.5% of the participants had not experienced blood glucose fluctuations in the last 3 months, 97.5% believed their diabetes was completely or partially under control, and 97.5% stated that they had no restrictions in their social life.

Table 1: Sociodemographic and Clinical Characteristics

		Mean		SD		Min-Max	
Age		57.51		11.13		28-84	
BMI		28.68		4.65		20.94-48.89	
How many years have you had diabetes?		8.44		7.61		1-40	
		N	Mean	SD	Min.	Max.	p
Gender	Female	78	7.14	1.86	5.00	13.32	
	Male	42	7.01	1.76	5.00	11.94	0.708
Education	Illiterate	64	7.32	2.00	5.00	13.32	0.392
	Primary	34	7.06	1.75	5.00	11.94	
	Middle	15	6.73	1.35	5.00	9.90	
	High	7	6.04	0.51	5.17	6.70	
Employment status	Employed	32	6.98	1.67	5.00	11.94	0.144
	Unemployed	75	7.29	1.96	5.00	13.32	
	Retired	13	6.24	0.91	5.00	8.10	
Smoking	Yes	21	6.88	1.34	5.60	10.84	0.549
	No	99	7.14	1.91	5.00	13.32	
Monthly income	0-5000	8	8.60	2.73	5.72	11.90	0.008
	5001-10000	9	7.91	2.07	5.70	11.20	
	10001-15000	23	7.49	2.21	5.50	13.32	
	>15001	80	6.74	1.43	5.00	11.94	

When the relationship between HbA1c levels and sociodemographic characteristics was evaluated, a statistically significant difference was found between education level and HbA1c (p=0.039); all high school graduates were in the HbA1c <7% group. However, no significant differences were found in terms of gender (p=0.708), employment status (p=0.144), smoking (p=0.549), or age/weight (p=0.562; p=0.650). A significant difference was also found between monthly income and HbA1c; HbA1c levels were lower in the higher income group (≥15,001 TL).

Regarding the relationship between lifestyle/dietary habits and HbA1c levels, a significant difference was found with physical activity level (p=0.033); the proportion of HbA1c <7% was higher in those who engaged in physical activity 5 or more days per week. No significant differences were observed for number of main meals (p=0.285), snack consumption (p=0.059), sleep duration (p=0.468), stress level (p=0.884), or fast-food consumption (p=0.370).

In terms of treatment adherence and HbA1c levels, significant differences were found for the type of diabetes treatment (p=0.000) and regular medication use (p=0.004); HbA1c levels were lower in those managed with diet only and in those who took their medications regularly. A significant relationship was also found between hypoglycemia and HbA1c (p=0.046); all participants who experienced hypoglycemia were in the HbA1c ≥7% group.

Regarding perceived glycemic control and HbA1c levels, significant differences were found for restrictions in social life (p=0.033) and worry about disease progression (p=0.032); HbA1c levels were higher in those who experienced restrictions in social life and those who were worried about the progression of their disease.

Discussion

At the Family Health Center where this study was conducted, there were 254 registered diabetic patients in the enrolled population, and the prevalence of Type 2 DM was calculated as 7.18%. In one of the largest studies conducted in Türkiye, the TURDEP study by Satman et al., diabetes was reported to be more common in women than men, and the prevalence of Type 2 diabetes in our society was 7.2% (5).

Table 2: HbA1c Levels and Diabetes Management Behaviors in Patient Groups

			What was your HbA1c level in the last 3 months?		Total	p
			<7	>7		
Do you take your medications regularly?	Yes	n	74	41	115	0.065
		%	98.7%	91.1%	95.8%	
	No	n	1	4	5	
		%	1.3%	8.9%	4.2%	
Do you ever forget to take your diabetes medications?	No	n	41	23	64	0.418
		%	54.7%	51.1%	53.3%	
	Rarely	n	34	21	55	
		%	45.3%	46.7%	45.8%	
	Often	n	0	1	1	
		%	0.0%	2.2%	0.8%	
Do you measure your blood sugar regularly?	Yes	n	30	22	52	0.342
		%	40.0%	48.9%	43.3%	
	No	n	45	23	68	
		%	60.0%	51.1%	56.7%	
Have you experienced low blood sugar (hypoglycemia) in the last 3 months?	Diet only	n	12	3	15	0.007
		%	16.0%	6.7%	12.5%	
	Oral antidiabetic	n	58	30	88	
		%	77.3%	66.7%	73.3%	
	Insulin	n	3	3	6	
		%	4.0%	6.7%	5.0%	
	Insulin+OAD	n	2	9	11	
		%	2.7%	20.0%	9.2%	
Have you experienced low blood sugar (hypoglycemia) in the last 3 months?	Yes	n	0	2	2	0.046
		%	0.0%	4.4%	1.7%	
	No	n	75	43	118	
		%	100.0%	95.6%	98.3%	
Have you experienced high blood sugar (hyperglycemia) in the last 3 months?	Yes	n	16	14	30	0.231
		%	21.3%	31.1%	25.0%	
	No	n	59	31	90	
		%	78.7%	68.9%	75.0%	

In our study, the fact that the vast majority of participants (92.5%) reported no blood glucose fluctuations in the past 3 months suggests that glycemic control is generally stable. The high perception that diabetes is under control (97.5% answered "yes" or "partially") supports this finding. However, this is a perception-based result and should be evaluated together with objective biochemical parameters (such as HbA1c). Indeed, the mean HbA1c value in our study was 7.09 ± 1.81%, which is slightly above the <7.0% target recommended by ADA and TEMD guidelines. This indicates that participants are generally at a good level in diabetes management but still have room for improvement.

Skipping snacks is important for achieving glycemic control and reducing the risk of hypoglycemia. In our study, 93.3% of participants reported consuming two main meals per day, while the rate of snack consumption was only 38.3%. In a thesis study titled "The effect of psychosocial status on glycemic control in diabetic patients," only 26.92% of participants consumed two main meals, whereas 80.8% consumed snacks(6).

When mean HbA1c values were evaluated by gender, the value was 7.14% in women and 7.01% in men, with no statistically significant difference (p=0.708). This finding shows that gender alone is not a determining factor in glycemic control. The literature similarly reports that gender by itself does not affect HbA1c levels and that glycemic control is more closely related to lifestyle factors, treatment adherence, and socioeconomic status(1).

Regarding education level, the lowest mean HbA1c (6.04%) was observed among high school graduates, and a decreasing trend in HbA1c was noted as education level increased. However, this difference was not statistically significant (p=0.392). Nevertheless, numerous studies emphasize that individuals with higher education have better knowledge about diabetes and higher treatment adherence, which positively affects glycemic control(7).

No significant difference was found between smoking status and HbA1c levels (p=0.549). Mean HbA1c was 6.88 ± 1.34% in smokers and 7.14 ± 1.91% in non-smokers. Although the literature highlights that smoking increases insulin resistance and adversely affects metabolic control(8), the lack of a significant difference in this study may be explained by the sample size and individual lifestyle variations.

When the relationship between monthly income and HbA1c was examined, a statistically significant difference was found (p=0.008). Mean HbA1c was 8.60 ± 2.73% in the lowest income group, decreasing markedly as income increased, reaching 6.74 ± 1.43% in the ≥15,001 TL income group. This result demonstrates that socioeconomic status is an important determinant of glycemic control. Low income can negatively affect HbA1c levels due to limited access to healthy nutrition, difficulties in treatment adherence, and challenges in accessing regular healthcare services(9).

In conclusion, gender, education, employment status, and smoking were not found to have a significant effect on HbA1c levels in this study. However, education and especially income level were observed to play an important role in diabetes control. It was concluded that individuals should be supported not only biologically but also socioeconomically and educationally in diabetes management.

When HbA1c values were evaluated according to the number of daily main meals, the highest mean HbA1c (8.15 ± 3.23%) was found among those consuming three or more meals. However, no statistically significant difference was detected between groups (p=0.285). This finding suggests that meal content and portion control may be more decisive for glycemic control than the number of meals. The literature also states that meal timing is important, but carbohydrate distribution and glycemic index have a stronger effect on HbA1c(10).

Regarding daily snack consumption, HbA1c levels were higher (7.49 ± 2.14%) in those who consumed snacks compared to those who did not. Although the difference between groups was not statistically significant (p=0.059), this may be related to the type of foods chosen as snacks. Unhealthy snacking can adversely affect HbA1c levels. Indeed, the literature emphasizes that healthy snacks (e.g., fresh fruit, nuts) support glycemic control, whereas high-calorie, high-carbohydrate snacks increase HbA1c(11).

When the relationship between physical activity and HbA1c levels was examined, the lowest mean HbA1c (6.49 ± 1.19%) was found among those who exercised 5 or more days per week. A decreasing trend in HbA1c was observed as the number of active days increased, although the difference was not statistically significant (p=0.084). Numerous studies have demonstrated that regular physical activity improves glycemic control by increasing insulin sensitivity(12). Although statistical significance was not reached in our study, the observed trend is consistent with the literature.

In terms of stress level, mean HbA1c was 6.76 ± 0.94% in individuals with low stress and 7.24 ± 1.57% in those with high stress. Although there was no significant difference between groups (p=0.884), the tendency for HbA1c to increase with stress is noteworthy. It is known that stress in diabetes can increase cortisol levels, thereby raising insulin resistance and complicating glycemic control(13).

Regarding weekly fast-food consumption, mean HbA1c was 7.14 ± 1.88% in those who never consumed fast food and 6.63 ± 0.98% in those who consumed it 1–2 times per

week (p=0.370). Although not statistically significant, this result is thought to be due to the small sample size. In general, numerous studies report that fast-food consumption adversely affects HbA1c levels because of its high energy density and saturated fat content (14).

In terms of daily water consumption, mean HbA1c was 6.96 ± 1.73% in those consuming 2 liters or more, similar to those consuming less (p=0.781). Although water intake has limited direct effect on HbA1c, adequate hydration is reported to indirectly support diabetes management through its benefits on kidney function and metabolic balance (15).

When treatment adherence and HbA1c levels were examined, a statistically significant difference was found according to the type of diabetes treatment used (p=0.000). Mean HbA1c was lowest (6.54 ± 1.61%) in individuals receiving diet-only therapy, while it was significantly higher (9.68 ± 2.23%) in those using a combination of insulin and oral antidiabetic agents. This can be explained by the fact that patients requiring combination therapy usually have longer disease duration and more difficult metabolic control. The literature also notes that HbA1c levels rise as treatment is intensified in patients who cannot be controlled with monotherapy, reflecting a more severe clinical picture(1).

In participants who took their medications regularly, mean HbA1c was 7.00 ± 1.74%, compared to 9.37 ± 2.36% in those who did not, and the difference was statistically significant (p=0.004). This result highlights the critical importance of treatment adherence in diabetes management. The literature similarly reports that regular medication use significantly lowers HbA1c levels and that non-adherence increases complication risk(16).

Regarding blood glucose monitoring, mean HbA1c was 7.44 ± 2.20% in those who measured regularly and 6.83 ± 1.43% in those who did not, with no statistically significant difference (p=0.070). However, this finding suggests that individuals who monitor their glucose regularly may generally have more advanced diabetes or greater control difficulties. Some studies report that self-monitoring of blood glucose contributes more noticeably to HbA1c control, particularly in insulin-treated patients(17,18).

When forgetting to take medication was evaluated, mean HbA1c was 7.12 ± 1.93% in those who never forgot, 7.00 ± 1.63% in those who rarely forgot, and 10.84% in those who frequently forgot. Although the difference between groups was not significant (p=0.110), markedly higher HbA1c levels were observed in those who frequently forgot their medication. The literature also reports that forgetting to take medication is one of the most common causes of non-adherence and that it increases HbA1c (19,20).

Conclusions

The finding that individuals who are illiterate have higher HbA1c levels compared to other groups highlights the need for programs specifically designed for individuals at these educational levels.

Lower HbA1c levels in participants who engage in physical activity 5 or more days a week demonstrate the positive effect of regular exercise on glycemic control. Family physicians should offer exercise plans to patients and support the development of programs that encourage physical activity.

The relationship between regular medication use and low HbA1c levels emphasizes the importance of treatment adherence. This adherence can be increased by providing patients with supportive methods such as medication reminder applications, regular follow-up appointments, and motivational counseling.

The fact that attending doctor visits is reported as the most challenging aspect for patients may indicate potential barriers to accessing healthcare services; solutions such as telehealth services and transportation support can increase regular follow-up rates.

Family physicians should be keen to design studies with larger sample sizes and longer follow-up periods to investigate factors that reduce the success rate in the treatment of chronic diseases, especially diabetes, and to obtain solutions.

Ethical Considerations

Ethical approval for the study was obtained from the University of Health Sciences Türkiye, Adana City Training and Research Hospital Clinical Research Ethics Committee. (decision no: 448 date: 2025). We conducted our study in accordance with the Declaration of Helsinki.

Author Contribution Statement

All authors have contributed equally.

Statement of Support and Thanks

The study has not received any form of support. There is no institution or individual to be acknowledged for there assistance.

Conflict of Interest Statement

There is no conflict of interest with any institution or person within the scope of the study.

Availability of Data and Materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request. Thesis number: 963608

Available from:

https://tez.yok.gov.tr/UlusalTezMerkezi/TezGoster?key=ftqJzTasnJUH9hg-S5861tpu5qrgZhJeYweUyfxtKLCA5oA3HJg_zoxFxncCqLUx

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