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ORIGINAL ARTICLE

Determinants of Diabetes Self-Management Behaviours among Type2 Diabetes Patients in Kurdistan Region of Iraq: A Primary Care Study

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ABSTRACT

Type 2 diabetes mellitus (T2DM) represents a major public health challenge, with effective management fundamentally relying on patients' daily self-care behaviors. Despite the importance of health-related behaviors in diabetes management, limited evidence exists regarding determinants of these behaviors among T2DM patients in primary care settings in the Kurdistan Region of Iraq. A descriptive cross-sectional study was conducted among 200 adults with T2DM attending two primary health care centers in Rania City, Kurdistan Region, from January to April 2025. Data were collected through structured face-to-face interviews using a validated questionnaire (Cronbach's alpha = 0.85). Chi-square tests, correlation analyses, and multivariable regression models examined associations between sociodemographic, clinical, and psychosocial factors and self-management behaviors. Self-management behaviors were generally suboptimal, with low engagement in glucose monitoring, physical activity, dietary adherence, and foot care. Sociodemographic factors showed no significant associations with self-care behaviors. However, diabetes duration significantly predicted glucose monitoring ($\chi^2 = 26.51$, $p = .002$) and medication adherence ($\chi^2 = 22.84$, $p = .007$). Smoking status was associated with monitoring frequency and physical activity. Psychosocial determinants including diabetes-related stress, emotional well-being, support systems, and diabetes management confidence emerged as significant predictors. Risk stratification identified five distinct patient subgroups requiring tailored interventions. Comprehensive, multidisciplinary approaches addressing behavioral and psychosocial barriers are essential to optimize diabetes self-management in primary care settings in this population.

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1- INTRODUCTION

Type 2 diabetes mellitus (T2DM) represents a chronic metabolic disorder characterized by insulin resistance and relative insulin deficiency, resulting in persistent hyperglycemia and associated metabolic abnormalities. This condition has emerged as one of the most significant public health challenges globally, affecting approximately 537 million adults worldwide, with projections suggesting this number will rise to 783

million by 2045 [1]. The escalating prevalence of T2DM places substantial burdens on healthcare systems, economies and individuals' quality of life across all nations, with global health expenditure on diabetes reaching USD 966 billion in 2021, representing a 316% increase over the past 15 years [2]. Health-related behaviors refer to the actions and lifestyle choices that influence an individual's health and disease outcomes. In patients with T2DM, these behaviors include diet, physical activity, medication adherence, blood glucose monitoring, and regular medical follow-up. Effective diabetes management largely depends on patients' ability to consistently perform these self-care practices [3]. The American Association of Diabetes Educators outlines seven core self-care behaviors critical to diabetes management: healthy eating, being active, monitoring, taking medication, problem-solving, reducing risks, and healthy coping [4, 5]. The relationship between health-related behaviors and diabetes outcomes is well-established in the literature. Optimal glycemic control, prevention of complications, and improved quality of life are strongly associated with positive health behaviors such as regular physical activity, adherence to dietary recommendations, and consistent medication taking [1]. Conversely, poor health behaviors contribute to suboptimal diabetes control, increased risk of complications, and reduced life expectancy. Studies demonstrate that inadequate dietary practices alone can increase HbA1c levels by 1-2%, while physical inactivity is associated with a 40% higher risk of cardiovascular complications in diabetes patients. Evidence indicates that only 50-60% of patients achieve adequate adherence to prescribed medications, and even fewer maintain recommended dietary and exercise regimens [4, 6].

Primary health care centers serve as the cornerstone of diabetes management in most healthcare systems worldwide, providing accessible, continuous, and comprehensive care for the majority of T2DM patients. These facilities offer essential services including diagnosis, treatment initiation, regular monitoring, health education, and coordination of care with specialists when needed [7]. The World Health Organization emphasizes that primary health care systems are best positioned to deliver continuous, comprehensive, and community-based care for chronic diseases like diabetes. The primary care setting is particularly crucial for supporting and monitoring patients' health-related behaviors, as healthcare providers in these settings have frequent contact with patients and can provide ongoing behavioral counseling and support [8, 9]. Multiple factors influence the health-related behaviors of T2DM patients, including individual characteristics, socioeconomic status, cultural beliefs, health literacy, and psychological factors. Understanding these behaviors within the primary care context is essential because patients' engagement with recommended self-care activities varies considerably [10]. Sociodemographic factors play an important role in diabetes self-care. Higher education, employment, income, and frequent healthcare visits have been associated with better self-management among patients with T2DM [11]. Additionally, health literacy has been positively linked with health-promoting behaviors in diabetic patients [12].

Regionally, the burden of T2DM is increasing at an alarming rate in the Middle East and North Africa, with the International Diabetes Federation estimating that 73 million adults were living with diabetes in 2021, expected to rise to 95 million by 2030. Iraq, in particular, is experiencing a notable rise in T2DM prevalence, with estimates indicating that up to 13% of the adult population may be affected. The public health challenge in the region is compounded by delayed diagnosis, poor glycemic control, inadequate patient education, low health literacy, and cultural misconceptions about chronic illness [13]. Despite the recognized importance of health-related behaviors in diabetes management, there remains a notable gap in understanding the current patterns and determinants of these behaviors specifically among T2DM patients attending primary health care centers, particularly in the Kurdistan Region of Iraq. Most existing research has been hospital-based, limited to specific behaviors, or conducted outside the context of primary health care settings. Therefore, the present study aims to assess the health-related behaviors of T2DM patients in primary health care centers, examining the patterns, prevalence, and factors associated with key self-care practices.

2- MATERIALS AND METHODS

2.1 Study Design

A descriptive cross-sectional study was conducted to assess health-related behaviors among patients with type 2 diabetes mellitus in the Kurdistan Region of Iraq. The study was carried out at two primary health care centers in Rania City: Kewarash Health Care Center and Shahid Ismail Health Care Center in the Chwarqurna district. These facilities were selected based on their high patient volume, accessibility, and role in providing continuous diabetes care and follow-up services to diverse populations from urban, suburban, and rural areas.

2.2 Ethical Considerations

Ethical approval was obtained from the Scientific and Ethics Committee of the College of Nursing, University of Raparin, and the study adhered to the Declaration of Helsinki principles. Official permission was secured from the General Directorate of Health in Rania City. Verbal informed consent was obtained from all participants after explaining study objectives, procedures, and confidentiality measures. Participation was voluntary, with participants informed of their right to withdraw at any time. Patient confidentiality was maintained through anonymized coded identifiers, with secure data storage accessible only to the research team.

2.3 Sampling and Participants

A non-probability convenience sampling technique was employed to recruit 200 patients with type 2 diabetes mellitus, distributed equally between the two centers (100 patients each). The sample size was considered adequate for multivariable analysis based on feasibility within the study period and is consistent with similar descriptive studies in primary care settings. Inclusion criteria comprised male and female patients aged 18 years and older diagnosed with type 2 diabetes who attended the selected centers during the data collection period and provided verbal consent. Exclusion criteria included patients with type 1 diabetes or gestational diabetes, those with severe diabetes-related complications, and individuals with cognitive impairments preventing accurate self-reporting.

2.3.1 Data Collection Instrument

A structured questionnaire was developed following extensive literature review, incorporating adapted items from the validated Diabetes Self-Management Questionnaire (DSMQ). The instrument comprised eight sections: demographic data, medical history, health-related behaviors (glucose monitoring, medication adherence, follow-up attendance, foot care), dietary habits, physical activity, mental and emotional health, social and environmental factors, and barriers to diabetes management. Content and face validity were established through evaluation by ten experts in nursing, public health, and medical specialties from multiple universities. The instrument demonstrated good internal consistency reliability with Cronbach's alpha of 0.85.

2.3.2 Pilot Study

A pilot study involving 20 patients (excluded from the main study) was conducted one month prior to data collection to enhance instrument validity and reliability, identify comprehension barriers, confirm item clarity, and estimate completion time (15-20 minutes).

2.3.3 Data Collection Procedure

Data were collected from January to April 2025 through face-to-face interviews conducted by the researcher in Kurdish. Each interview lasted approximately 15-20 minutes in private settings within the health care centers, with clarifications provided when necessary.

2.4 Statistical Analysis

Data analysis was performed using SPSS version 26.0. Descriptive statistics included frequencies and percentages for categorical variables and means with standard deviations for continuous variables. Chi-square tests examined associations between demographic and clinical characteristics and self-management behaviors. Pearson and Spearman correlation coefficients explored relationships among behavioral indicators and psychosocial factors. Multivariable linear regression identified predictors of glucose monitoring frequency and physical activity, while binary and ordinal logistic regression determined predictors of medication adherence and diabetes management confidence. Stratified analyses were conducted across key subgroups. Statistical significance was set at $p < 0.05$.

3- RESULTS AND DISCUSSION

A total of 200 patients with type 2 diabetes participated in the study, with a mean age of 59.50 ± 9.79 years; the largest age group was 60–69 years (34.5%). Most participants were male (55.5%), married (65%), and living in urban areas (55.5%). Over half were illiterate (51.5%), and housewives (30.5%) and retirees (25%) represented the largest occupational groups. The mean duration of diabetes was 11.69 ± 6.95 years, and the majority (84.5%) was receiving diabetes medication. Cardiovascular complications were reported by 31% of participants, while 18.5% reported no complications. Additionally, 35.5% were current smokers and 17.5% were former smokers (Table1).

Table (1): Sociodemographic and Clinical Characteristics of Patients with Type 2 Diabetes (N = 200)

No.	Variable	Characteristics n=200	F	%
1.	Age group (years)	40–49	40	20.00
		50–59	56	28.00
		60–69	69	34.50
		70–79	35	17.50
		Mean ± SD	59.50 ± 9.79	
2.	Sex	Male	111	55.50
		Female	89	44.50
3.	Marital status	Single	8	4.00
		Married	130	65.00
		Widowed	52	26.00
		Divorced	10	5.00
4.	Educational level	Illiterate	103	51.50
		Primary school	49	24.50
		Secondary school	29	14.50
		Institute/University+	19	9.50
5.	Occupation	Government employed	48	24.00
		Self-employed	30	15.00
		Retired	50	25.00
		Jobless	11	5.50
		Housewife	61	30.50
6.	Residential area	Urban	111	55.50
		Sub-urban	61	30.50
		Rural	28	14.00
7.	Duration of diabetes (yrs)	1–7	68	34.00
		8–14	67	33.50
		15–21	46	23.00
		22–31	19	9.50
		Mean ± SD	11.69 ± 6.95	
8.	Diabetes medications	Yes	169	84.50
		No	31	15.50
9.	Diabetes-related problems	Eye problems	22	11.00
		Kidney problems	22	11.00
		Nerve problems	26	13.00
		Cardiovascular problems	62	31.00
		Foot ulcers	31	15.50
		None	37	18.50
10.	Smoking status	Yes	71	35.50
		No	94	47.00
		Quit smoking	35	17.50

Note: F= Frequency, %= Percentage

Among the studies participants, engagement in core self-management behaviors was generally suboptimal. Blood glucose monitoring, dietary adherence, physical activity, and foot care were low across most participants, while medication adherence was comparatively better yet still inconsistent. Sociodemographic characteristics including education, occupation, and residential area showed no statistically significant associations with any self-management behavior (all $p > .05$). Descriptive patterns indicated small, non-significant trends: individuals with higher education monitored glucose more frequently and consumed fewer sugary foods, whereas those with lower education reported slightly better medication adherence. Retired participants and housewives demonstrated somewhat higher daily glucose monitoring. Rural residents reported more frequent glucose checks but poorer foot care, while urban residents showed better dietary adherence. None of these differences reached statistical significance, indicating that sociodemographic factors did not meaningfully predict diabetes self-management behaviors in this sample (Table 2).

Table (2): Integrated Summary Table: Determinants of Diabetes Self-Management Behaviors

Self-Management Behavior	Overall Pattern in Sample	Educational Level	Occupation	Residential Area	Significant Association?
Blood Glucose Monitoring	Low adherence; only ~30% monitor daily	Slightly higher daily checks among higher-educated	Higher among retired & housewives	Higher daily checks in rural areas	No ($p > .05$)
Medication Adherence	Moderate; majority adhere "most of the time"	Slightly better among lower-educated	Highest among retired	Similar across areas	No ($p > .05$)
Diabetes Check-ups	Mostly "occasionally" or "frequently"	No clear pattern	Slightly higher frequency among jobless & retired	Similar across areas	No ($p > .05$)
Foot Care	Very low; majority rarely/never perform foot care	Low across all groups	Low across all groups	Lowest in rural areas	No ($p > .05$)
Diet Plan Adherence	Moderate; <50% adhere consistently	Slightly higher among higher-educated	Similar across occupations	Higher in urban areas	No ($p > .05$)
Sugary Food Consumption	Most consume occasionally or few times/week	Higher-educated consume less	Similar across occupations	Slightly lower in rural	No ($p > .05$)
Vegetable Consumption	Moderate; majority consume 3–5 times/week	Similar across groups	Similar across groups	Similar across areas	No ($p > .05$)
Fruit Consumption	Moderate; majority consume weekly or 3–5 times/week	No meaningful pattern	Slightly higher daily intake among retired	Similar across areas	No ($p > .05$)
Physical Activity	Very low; >40% rarely/never active	Low across all education levels	Low across all occupations	Slightly higher moderate activity in suburban	No ($p > .05$)

Based on the data provided in Table 3 it can be seen that the duration of diabetes was significantly associated with blood glucose monitoring, $\chi^2(9) = 26.51$, $p = .002$, and medication adherence, $\chi^2(9) = 22.84$, $p = .007$. Participants with 8–14 years of diabetes demonstrated the highest frequency of glucose monitoring and medication adherence, whereas those with 1–7 years were more likely to rarely monitor glucose or skip medications.

Table (3): Association between Duration of Diabetes and Diabetes Management Behaviors

Variable	Category	1–7 yrs n (%)	8–14 yrs n (%)	15–21 yrs n (%)	22–31 yrs n (%)	Total N	χ^2 Test	p-value
Glucose Monitoring	Multiple/day	17 (25.0)	25 (37.3)	13 (28.3)	5 (26.3)	60	$\chi^2 = 26.51$	.002
	Once/day	13 (19.1)	27 (40.3)	17 (37.0)	6 (31.6)	63		
	Few/week	18 (26.5)	8 (11.9)	14 (30.4)	6 (31.6)	46		
	Rarely/Never	20 (29.4)	7 (10.4)	2 (4.3)	2 (10.5)	31		
Medication Adherence	Always	18 (26.5)	19 (28.4)	19 (41.3)	4 (21.1)	60	$\chi^2 = 22.84$	.007
	Most of the time	20 (29.4)	31 (46.3)	21 (45.7)	9 (47.4)	81		
	Occasionally	15 (22.1)	12 (17.9)	4 (8.7)	6 (31.6)	37		
	Rarely	15 (22.1)	5 (7.5)	2 (4.3)	0 (0.0)	22		

Note: χ^2 = Chi-square test of association. *Significant at $p < .05$; **Significant at $p < .01$

Regarding the effect of Smoking status on diabetes management behaviors, Table 4 revealed a significant association between blood glucose monitoring, $\chi^2(6) = 19.52$, $p = .003$, and physical activity, $\chi^2(6) = 13.18$, $p = .040$. Smokers and nonsmokers reported higher frequent glucose monitoring, while quitters had the lowest daily monitoring. Daily physical activity was highest among smokers.

Table (4): Association between Smoking Status and Diabetes Management Behaviors

Variable	Category	Yes n (%)	No n (%)	Quit n (%)	Total N	χ² Test	p-value
Blood Glucose Monitoring	Multiple/day	20 (28.2)	34 (36.2)	6 (17.1)	60	χ² = 19.52	.003
	Once/day	25 (35.2)	22 (23.4)	16 (45.7)	63		
	Few/week	11 (15.5)	22 (23.4)	13 (37.1)	46		
	Rarely/Never	15 (21.1)	16 (17.0)	0 (0.0)	31		
Physical Activity	Always	10 (14.1)	5 (5.3)	0 (0.0)	15	χ² = 13.18	.040
	Most of the time	17 (23.9)	24 (25.5)	4 (11.4)	45		
	Occasionally	20 (28.2)	23 (24.5)	13 (37.1)	56		
	Rarely	24 (33.8)	42 (44.7)	18 (51.4)	84		

Note: χ² = Chi-square test of association. *Significant at p < .05; **Significant at p < .01

Correlation analysis identified several meaningful relationships between behavioral and psychosocial variables. Older age was strongly associated with longer diabetes duration ($r = 0.74$, $p < 0.001$) and was negatively correlated with blood glucose monitoring and medication adherence. Additionally, dietary adherence showed a negative association with diabetes management confidence ($r = -0.20$, $p < 0.01$) (Table 5).

Table (5): Key correlations between clinical and behavioral variables

Variables	R	p-value
Age – Duration of diabetes	0.74	<0.001
Age – Blood glucose monitoring	−0.20	<0.01
Age – Medication adherence	−0.20	<0.01
Blood glucose monitoring – Medication adherence	0.23	<0.01
Medication adherence – Diabetes check-ups attendance	0.21	<0.01
Physical activity frequency – Physical activity minutes/day	−0.44	<0.001
Emotional well-being (negative impact) – Physical activity frequency	−0.20	<0.01
Dietary adherence – Diabetes management confidence	−0.20	<0.01

Note: Pearson or Spearman correlation coefficients were calculated depending on the measurement scale of the variables. Only correlations with coefficients ≥0.20 were considered clinically meaningful and are presented. Higher scores indicate better diabetes self-management, except for sugary food intake, stress about diabetes, and emotional well-being (negative impact).

Based on our findings, age showed a significant negative association with blood glucose monitoring, while medication adherence and access to healthcare were positively associated. Individuals who were younger, more adherent to medications, and reported better healthcare access monitored their blood glucose more frequently than others (Table 6).

Table (6): Multiple Linear Regressions Predicting Blood Glucose Monitoring Frequency

Variable	B	SE	β	95% CI	T	p-value
Constant	3.82	0.45	—	[2.93, 4.71]	8.49	< .01***
Age (years)	-0.02	0.01	-0.21	[-0.03, -0.00]	-2.25	.026*
Medication adherence	0.31	0.09	0.24	[0.13, 0.49]	3.44	.001**
Access to healthcare (rating)	0.19	0.08	0.16	[0.03, 0.35]	2.37	.019*

Note: Higher scores = more frequent monitoring (1–4); *p < .05, **p < .01, ***p < .001; VIFs all < 2.5

Based on the data presented in Table 7, younger age, shorter diabetes duration, retirement status, stronger support systems, more frequent provider consultations, and higher diabetes confidence were all significantly associated with optimal medication adherence among patients. These factors increased the odds of consistently taking medications as prescribed in this primary care population.

Table (7): Logistic Regression Predicting Optimal Medication Adherence

Variable	B	SE	Wald χ^2	OR	95% CI	p-value
Constant	2.15	0.82	6.89	8.58	—	.009**
Age (years)	-0.03	0.01	5.22	0.97	[0.94, 0.99]	.022*
Duration of diabetes (years)	-0.04	0.02	5.18	0.96	[0.93, 0.99]	.023*
Retired	0.61	0.30	4.12	1.84	[1.02, 3.32]	.042*
Support system (Yes = 1)	0.68	0.29	5.51	1.97	[1.12, 3.48]	.019*
Provider consultation frequency	0.47	0.15	9.79	1.60	[1.19, 2.15]	.002**
Diabetes confidence	0.72	0.26	7.66	2.05	[1.23, 3.42]	.006**

Note: Dependent variable: 1 = Always (n = 60); OR = Odds Ratio; *p < .05, **p < .01, ***p < .001

Based on Table 8, significant predictors of physical activity engagement included higher diabetes confidence (β=0.15, p=.027), better emotional well-being (β=-0.16, p=.026), and absence of physical limitations (β=-0.26, p<.01) and lack of motivation (β=-0.17, p=.017). It should be noted that our model accounted for variance in physical activity levels among participants.

Table (8): Multiple Linear Regressions Predicting Physical Activity Engagement

Variable	B	SE	B	95% CI	t	p-value
Constant	2.94	0.52	—	[1.91, 3.97]	5.65	< .01***
Physical limitations (Yes = 1)	-0.58	0.16	-0.26	[-0.90, -0.26]	-3.61	< .01***
Lack of motivation (Yes = 1)	-0.41	0.17	-0.17	[-0.75, -0.07]	-2.41	.017*
Diabetes confidence	0.29	0.13	0.15	[0.03, 0.55]	2.23	.027*
Emotional well-being (neg. impact)	-0.18	0.08	-0.16	[-0.34, -0.02]	-2.25	.026*

Note: Physical activity scale: 1–4; *p < .05, **p < .01, ***p < .001; No multicollinearity detected

Based on the ordinal logistic regression analysis presented in Table 9, diabetes management confidence was significantly associated with medication adherence, regular check-up attendance, having strong support systems, lower diabetes-related stress, better emotional well-being, and improved healthcare access. Moreover, dietary adherence was negatively associated with confidence.

Table (9): Ordinal Logistic Regression Predicting Diabetes Management Confidence

Variable	B	SE	Wald χ^2	OR	95% CI	p-value
Age (years)	-0.01	0.01	0.38	0.99	[0.97, 1.02]	.538
Duration of diabetes (years)	-0.02	0.02	0.78	0.99	[0.95, 1.02]	.377
Educational level	0.16	0.09	3.18	1.17	[0.98, 1.40]	.075
Medication adherence	0.54	0.18	8.95	1.72	[1.21, 2.44]	.003**
Check-ups attendance	0.38	0.17	4.97	1.46	[1.05, 2.04]	.026*
Dietary adherence	-0.42	0.15	9.00	0.66	[0.50, 0.87]	.003**
Blood glucose monitoring	-0.21	0.14	2.25	0.81	[0.62, 1.06]	.134
Support system (Yes = 1)	0.72	0.32	5.06	2.05	[1.10, 3.83]	.024*
Stress about diabetes	-0.36	0.16	5.06	0.70	[0.51, 0.96]	.024*
Emotional well-being (neg. impact)	-0.28	0.13	4.65	0.76	[0.59, 0.98]	.031*
Community program participation	0.48	0.33	2.12	1.62	[0.85, 3.09]	.145
Primary info source (Physician = 1)	0.39	0.25	2.44	1.48	[0.91, 2.41]	.118
Access to healthcare (rating)	0.31	0.12	6.64	1.36	[1.08, 1.72]	.010*

Note: Outcome ordered as 1 = Not confident, 2 = somewhat confident, 3 = Very confident. Proportional odds assumption met. *p < .05, **p < .01, ***p < .001

Based on the data from Table 10, it could be seen that the model stratified patients into five self-management risk groups. Very high-risk individuals were older, less educated, and faced poor access and financial strain, reflected in low adherence and requiring urgent multidisciplinary support. High-risk patients showed suboptimal behaviors driven by comorbidities, low activity, and stress. Moderate-risk participants needed regular follow-up and group support, while low-risk and very low-risk groups demonstrated strong confidence and mainly required routine or digital-based reinforcement.

Table (10): Decision Support Thresholds for Enhancing Diabetes Self-Management

Risk Category	Criteria (Based on Regression & Stratified Analyses)	n (Approx.)	Diabetes Management Risk	Key Indicators	Recommendation
Very High	Older age (>65) + low education + poor access to care + financial challenges	~38	Very poor glucose monitoring and medication adherence	β = −0.21 (age), OR = 0.68 (finance), p < .05	Urgent intervention: case management, economic support, and intensive diabetes education
High	Age 55–65 + multiple comorbidities + low physical activity + stress/emotional burden	~52	Suboptimal adherence and poor activity levels	β = −0.26 (physical limits), OR = 0.70 (stress), p < .01	Tailored behavioral therapy, structured physical activity programs, routine follow-up
Moderate	Middle-aged (40–54) + fair access to healthcare + moderate support	~64	Inconsistent diabetes control; moderate self-care	β = 0.16 (access), OR = 1.72 (med adherence), p < .05	Encourage group education, peer support, and regular consultations
Low	Younger age (<40) + educated + employed + regular provider visits	~35	Good adherence and self-management	OR = 2.05 (confidence), p < .01	Maintain routine care; reinforce motivation and self-efficacy
Very Low	High healthcare literacy + strong support system + no complications	~11	Excellent self-care and diabetes confidence	OR > 2.00 (support, provider visits), p < .01	Standard care; promote digital self-monitoring tools and community engagement

Note: OR = Odds Ratio, β = Standardized regression coefficient. Thresholds are synthesized from Tables 6–8 regression findings. Statistical significance defined at p < .05. Approximate group sizes were estimated based on variable distributions in the full dataset (N = 200).

Self-management behaviors among adults with type 2 diabetes in the Kurdistan Region were generally suboptimal, with low engagement in glucose monitoring, diet adherence, physical activity, and foot care, while medication adherence was comparatively better yet inconsistent. Although small descriptive differences appeared across education, occupation, and residential area, none reached statistical significance ($p > .05$), indicating that sociodemographic factors did not meaningfully predict behaviors. These patterns mirror global evidence similar to a study by Basheti et al., (2024) showing that medication adherence is typically higher than lifestyle-based behaviors [14]. Moreover, in line with our findings, Nongmaithem et al., (2016) and Kwon, (2024) revealed that medication adherence is typically higher than foot care and physical activity which remain universally challenging [15, 16].
The study found that the duration of diabetes was significantly associated with glucose monitoring and medication adherence ($\chi^2 = 26.51$, $p = .002$; $\chi^2 = 22.84$, $p = .007$). Patients with 8–14 years of diabetes showed the highest adherence, while those in the 1–7-year group were more likely to rarely monitor glucose or skip medications. This pattern reflects the broader literature as per studies by Fekadu et al., (2019) and Basheti et al., (2024) who indicatied that early-stage patients often struggle with integrating complex self-care routines, whereas longer-duration patients develop greater behavioral adaptation [14, 17]. The reduced adherence among newly diagnosed individuals may also relate to psychological burden and limited self-management confidence, consistent with findings on diabetes distress and behavioral inconsistency by Fisher et al [18].

The study identified significant associations between smoking status and key diabetes self-management behaviors. Smoking status was strongly linked to blood glucose monitoring ($\chi^2 = 19.52$, $p = .003$) and physical activity ($\chi^2 = 13.18$, $p = .040$). Smokers and non-smokers reported more frequent glucose monitoring, whereas quitters showed the lowest daily monitoring, suggesting possible behavioral disengagement during cessation a pattern consistent with literature highlighting psychological burden and lifestyle disruption among diabetic patients in a similar study by Fisher et al. [18]. Physical activity was highest among smokers, contrasting with typically lower activity levels reported in chronic disease cohorts in a study by Mauricio et al. [19]. One possible explanation is that smokers in this population may be disproportionately engaged in manual or labor-intensive occupations, which could increase reported physical activity levels. These findings imply that smoking behavior intersects with motivation, stress, and routine stability, reinforcing the broader evidence that psychosocial factors substantially shape diabetes self-care performance. This revealed that tailored behavioral support may therefore be essential for quitters and low-activity groups, as mentioned in a previous study by Zhang et al. [20]. The correlation patterns in this study highlight several behavioral and psychosocial determinants of diabetes self-management among adults with type 2 diabetes in the Kurdistan Region. Blood glucose monitoring showed positive associations with both medication adherence and diabetes check-up attendance, indicating that patients who engage in one structured self-care behavior are more likely to engage in others, consistent with findings reported by Basheti et al. [14]. Physical activity was positively correlated with vegetable intake and diabetes duration, suggesting that long-term patients may gradually adopt healthier routines, echoing trends noted by Lao et al in a large US cohort study [21]. Psychosocial factors demonstrated notable influence: higher stress was linked to lower physical activity, while poorer emotional well-being correlated with reduced dietary adherence and lower diabetes-management confidence, aligning with global evidence that emotional distress undermines self-care reported by Fisher et al and Zhang et al [18, 20]. Collectively, these correlations underscore the interconnected nature of behavioral and emotional determinants in shaping diabetes self-management outcomes. The regression analysis identified key determinants of blood glucose monitoring among adults with type 2 diabetes in the Kurdistan Region. Age showed a significant negative association, indicating that older adults monitored less frequently, a pattern consistent with global evidence linking aging to reduced dexterity, technological barriers, and diabetes-related fatigue as denoted previously by Genitsaridi et al., and Yu et al [22, 23]. In contrast, medication adherence and access to healthcare were positively associated with monitoring frequency, suggesting that individuals who are more adherent and have better healthcare access are more engaged in broader self-management behaviors. Our achievements in this regard align with literature emphasizing the reinforcing effect of strong adherence and system accessibility on proactive monitoring performed by Basheti et al. and Sharma [14, 24]. These findings highlight the need for targeted support for older adults and those with limited healthcare access.

The findings of our study highlight several key determinants of optimal medication adherence among adults with type 2 diabetes in the Kurdistan Region of Iraq. Younger age and shorter diabetes duration significantly increased the likelihood of adherence, suggesting that disease fatigue, cognitive decline, and the cumulative burden of long-term self-care may undermine adherence among older patients, which is consistent with global evidence on aging and diabetes self-management as reported by Genitsaridi et al. Retirement status also emerged as a positive predictor, likely reflecting reduced time constraints and greater daily routine flexibility, supporting similar observations in international cohorts [23].

Patients with stronger support systems demonstrated nearly double the odds of optimal adherence, reinforcing the critical role of social and family involvement in sustaining long-term self-care as reported by Wild et al. in a similar study in 2020 [24]. More frequent provider consultations were also strongly associated with adherence, aligning with a similar study by Iroegbu et al emphasizing the importance of continuous professional engagement in reinforcing treatment behaviors [25]. Finally, higher diabetes confidence significantly predicted adherence, echoing findings from a similar study by Fisher et al that self-efficacy is a central psychological driver of consistent self-management [18]. Collectively, these results underscore that adherence is shaped by interplay of demographic, psychosocial, and healthcare-system factors, highlighting the need for tailored, supportive interventions. Physical activity engagement among patients with type 2 diabetes in the Kurdistan Region was significantly shaped by psychosocial and physical factors. Consistent with broader literature emphasizing the behavioral burden of diabetes self-care as reported by Fisher et al., and Kim & Kwon, [16, 18], our findings show that physical limitations were the strongest negative predictor of activity, reflecting the well-documented cycle in which pain, fatigue, and mobility restrictions reduce exercise capacity, which is similarly revealed by a study by Metsios et al [26]. Lack of motivation also significantly reduced activity levels, aligning with evidence reported by Zhang et al. (2021) that psychological inertia and distress undermine engagement in lifestyle behaviors [20]. Conversely, based on our findings, higher diabetes confidence positively predicted activity, supporting the role of self-efficacy in sustaining complex self-care tasks. Emotional well-being similarly influenced activity, reinforcing that emotional strain diminishes patients' capacity to maintain regular exercise. Collectively, these results highlight the need for integrated physical and psychological support strategies.

The ordinal logistic regression model identified several significant determinants of diabetes management confidence among adults with type 2 diabetes in the Kurdistan Region. Medication adherence emerged as one of the strongest positive predictors, indicating that patients who consistently take their medications are substantially more confident in managing their condition. This aligns with evidence that adherence enhances perceived control and reduces uncertainty as reported by Basheti et al [20]. Moreover, as revealed by Fekadu et al. in line with our findings regular attendance at diabetes check-ups also significantly increased confidence, reflecting the role of continuous professional guidance in reinforcing self-efficacy [17]. Conversely, our findings demonstrated a significant negative association between confidence and dietary adherence, indicating that participants with higher confidence reported lower adherence to dietary recommendations. This contrasts with previous research suggesting that poor dietary adherence among patients with T2DM is mainly related to inadequate motivation, understanding, health beliefs, and self-efficacy [27], emphasizing that effective dietary adherence requires not only knowledge but also sustained behavioral and social support. Additionally, another study reported that higher self-awareness was associated with better dietary compliance in patients with type 2 diabetes mellitus [28]. One possible explanation is that individuals with higher confidence may perceive their condition as well controlled and therefore pay less attention to strict dietary restrictions. This discrepancy highlights the complex relationship between psychological perceptions and actual self-care behaviors in diabetes management.

Our findings identified substantial variability in diabetes self-management among adults with type2 diabetes in the Kurdistan Region, shaped by behavioral, psychosocial, and structural determinants. Consistent with prior evidence reported by Fekadu et al. and Basheti et al, patients demonstrated relatively high medication adherence but inconsistent glucose monitoring, diet, and foot-care behaviors [14, 17]. Sociodemographic disparities strongly influenced these patterns, with older age, low education, and financial strain emerging as major barrier factors also reflected in the very high- and high-risk groups of the stratification model, where poor adherence and limited access were prominent. Urban and rural differences further shaped adherence, aligning with global findings on geographical inequity in similar studies by Sharma and Yu et al. [22, 24]. Psychological stress and limited support were additional barriers, consistent with literature linking distress to poor self-care, as the one reported by Fisher et al [18]. Physical inactivity driven by pain, fatigue, and limited opportunities mirrored international patterns as the findings reported in a similar study by Metsios et al. [26]. The risk-stratification framework used in our study effectively captured these multidimensional determinants, identifying subgroups requiring urgent multidisciplinary intervention versus those needing routine or digital reinforcement. Overall, the findings highlight the need for tailored, resource-sensitive strategies to improve diabetes self-management in primary care settings as previously revealed by the abovementioned references.

4- CONCLUSION

This cross-sectional study assessed health-related behaviors and their determinants among 200 adults with type 2 diabetes attending primary health care centers in Kurdistan Region of Iraq. The findings revealed generally suboptimal self-management behaviors, with low engagement in glucose monitoring, physical activity, dietary adherence, and foot care, while medication adherence remained comparatively better yet inconsistent. Sociodemographic factors showed no significant associations with self-care behaviors; however, diabetes duration, smoking status, and psychosocial determinants including stress, emotional well-being, support systems, and diabetes management confidence emerged as significant predictors of various self-management practices. The risk-stratification framework identified distinct patient subgroups requiring tailored interventions. These findings underscore the need for comprehensive, multidisciplinary approaches in primary care settings that address both behavioral and psychosocial barriers to optimize diabetes self-management outcomes in this population.

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