ORIGINAL ARTICLE

Barriers to dietary adherence among Vietnamese type 2 diabetes mellitus patients: a hospital-based cross-sectional study in Haiphong

Ha Thuy Thi Tran[1,2], Duc Minh Cap[1], Linh Thuy Nguyen[1], Thanh Van Nguyen[2,3]

[1]Faculty of Public Health, Haiphong University of Medicine and Pharmacy, Haiphong, Vietnam
[2]Haiphong Medical University Hospital, Haiphong, Vietnam
[3]Department of Family Medicine, Haiphong University of Medicine and Pharmacy, Haiphong,Vietnam

Corresponding Author: Duc Minh Cap **Email:** cmduc@hpmu.edu.vn

Received: 3 January 2024 **Revised:** 3 March 2024 **Accepted:** 6 March 2024 **Available online:** May 2024
DOI: 10.55131/jphd/2024/220204

ABSTRACT

Dietary adherence (DA) among patients with Type 2 Diabetes Mellitus (T2DM) is crucial for improving clinical parameters and enhancing patients' quality of life. This cross-sectional study aimed to describe the prevalence of DA and its barriers among T2DM patients at the outpatient clinic of Haiphong Medical University Hospital, Vietnam. Simple random sampling was employed to select patients, and data were collected through face-to-face interviews. DA was assessed using the Perceived Dietary Adherence Questionnaire (PDAQ). Out of 410 patients, the percentage of males and females was 39.8% and 60.2%, respectively, with an average age of 66.08 ± 8.72. Only 16.3% of patients adhered to the diet. Multivariate regression analysis revealed that factors such as medication adherence (AOR = 3.44, 95%CI: 1.50–7.93), good glycemic control (AOR = 2.13, 95%CI: 1.17–3.87), and patients receiving monthly dietary counseling (AOR = 3.01, 95%CI: 1.63–5.55) were statistically significantly related to DA. This study highlights the alarmingly low percentage of patients complying with their prescribed diet. Clinicians should consider these significantly associated factors when advising patients on dietary adherence.

Key words:
dietary; adherence; type 2 diabetes mellitus; Vietnam.

Citation:
Ha Thuy Thi Tran, Duc Minh Cap, Linh Thuy Nguyen, Thanh Van Nguyen. Barriers to dietary adherence among Vietnamese type 2 diabetes mellitus patients: a hospital-based cross-sectional study in Haiphong. J Public Hlth Dev. 2024;22(2):39-53 (https://doi.org/10.55131/jphd/2024/220204)

INTRODUCTION

The "Diabetes" epidemic is projected to become one of the most significant pandemics in human history.[1] According to the International Diabetes Federation (IDF), in 2021, approximately 537 million adults aged 20–79 worldwide will have diabetes, with Type 2 Diabetes Mellitus (T2DM) being the most prevalent, accounting for over 90% of all cases.[2] In Vietnam, the estimated incidence of diabetes in adults is 7.1%, affecting nearly 5 million individuals. More than 55% of patients with diabetes now have complications, with 34% experiencing cardiovascular complications, 39.5% experiencing eye and neurological complications, and 24% experiencing kidney complications.[3]

According to the World Health Organization (WHO), diabetes can be treated, and complications prevented with a proper diet, physical activity, and medication.[4] The American Diabetes Association (ADA) recommends choosing carbohydrate foods from fruits, vegetables, whole grains, legumes, and low-fat dairy while controlling carbohydrate intake, increasing fiber consumption, and limiting saturated fatty acid, trans fatty acid, and cholesterol intake.[5] Nutritional therapy is vital in disease prevention and treatment. It confers health benefits reflected in improved T2DM-specific clinical parameters and enhanced quality of life. Research shows that nutritional therapy in T2DM patients can help reduce the HbA1c index by 1%–2%.[7] Additionally, adherence to recommended diets has been proven to reduce the risk of cardiovascular disease in T2DM patients.[8]

Despite understanding the importance of diet in controlling diabetes, adherence remains low.[9] Research by Savvas Katsaridis et al. in Greece revealed a compliance rate of 41.2% with ADA dietary recommendations.[10] In Eastern Ethiopia, a cross-sectional hospital-based study involving 307 patients found that 62.5% did not adhere to the recommended diet. Barriers to adherence included a lack of dietary education (83.38%) and financial constraints preventing access to healthy foods (71.33%).[11] Selvam J et al. studied 284 patients with T2DM in Tamil Nadu, India. The study showed that high, medium, and low DA were 4.2%, 73.2%, and 22.5%, respectively. Factors influencing DA included diabetes duration, body mass index (BMI), comorbidities, diabetes complications, and exercise.[12] Jijeebisha Baral et al. studied 204 T2DM patients in Nepal and found that only 15.7% of participants complied well with the recommended diet. The study also revealed that factors related to DA included living alone, patients' ability to afford the recommended diet, participation in physical activities, and medication adherence.[13] A systematic review study in South Asia reported that the rate of patient adherence to the diet was approximately 48%.[14] Abate TW et al. demonstrated that the overall rate of DA in patients with T2DM was 41.05%, with education level, monthly income, and dietary knowledge emerging as statistically significant factors influencing DA.[15] Research conducted at Universiti Sains Malaysia Hospital indicated that only 16.4% of T2DM patients adhered to the diet prescribed by nutritionists. Among the seven dietary self-care behaviors examined, consuming fiber-rich foods such as vegetables and oats exhibited the highest compliance rate (54.1%), while consuming five or more servings of fruits and vegetables daily had the lowest compliance rate (23.0%).[16]

At Haiphong Medical University Hospital, where this study was conducted, data on dietary adherence (DA) in patients with Type 2 Diabetes Mellitus (T2DM) are still limited. Therefore, this study aims to describe the proportion of T2DM patients complying with their prescribed diet and determine whether barriers to non-

compliance originate from medical staff or the patients themselves. This information will aid in identifying appropriate intervention solutions. The study results will also assist nutritionists, clinicians, and administrators in managing and treating T2DM from a nutritional perspective.

METHODS

Study location and participants

The research was conducted at Hai Phong Medical University Hospital, situated in Hai Phong City, a port city in the Northern Coastal region of Vietnam, approximately 120 km northeast of Hanoi, the capital. The hospital provides a wide range of services, including approximately 300 beds for inpatient care and various outpatient clinics, including those dedicated to non-communicable diseases. The study included T2DM patients undergoing outpatient treatment at Hai Phong Medical University Hospital. Specifically, we selected patients receiving outpatient treatment at the hospital for at least three months. Exclusions comprised patients with acute illnesses, those unable to answer interview questions, and individuals who did not consent to participate in the study.

Study design and sample size

We conducted a cross-sectional study from September 2023 to December 2023. The sample size was calculated based on the formula for estimating the sample size for a proportion: $N = Z^2_{(1\alpha/2)} \times P(1 - P)/d^2$. In this formula, Z = level of confidence (for a level of confidence of 95%, Z = 1.96); P = estimated percentage of patients with T2DM who adhere to the diet (we used P = 0.5 to maximize the sample size); and d = the margin of error, d = 0.05. The calculated minimum study sample size was determined to be 384 patients. It was expected that 20% of patients would refuse to participate in the study, resulting in a projected number of refusals (N = 96). Thus, the total target sample size was set at 480 patients.

At the time of the study, 1514 patients were undergoing outpatient treatment management. To select the sample, we employed the simple random sampling method using the RANDBETWEEN (1; 1514) function in Microsoft Excel, resulting in the selection of 480 patients for interviews. The actual rate of patients refusing to participate in the study was approximately 14.6% (N = 70). Therefore, the study was conducted with a final sample size of 410 patients.

Instrument

Dependent variables: The Perceived Dietary Adherence Questionnaire (PDAQ) was utilized to evaluate the DA of patients diagnosed with T2DM. This questionnaire, developed by Asaad et al. in 2015,[17] has been widely employed by researchers globally to assess DA among T2DM patients across various nations.[13, 18–20] The PDAQ comprises nine items, each rated on a 7-point Likert scale, to recall dietary intake over the preceding seven days. The original food items in the questionnaire were adjusted to accommodate local dietary patterns. Higher scores on most items indicate greater adherence, except for item 4 and item 9, which pertain to unhealthy dietary choices (such as high-sugar or fatty foods). For these particular items, higher scores indicate lower adherence. Consequently, to compute the total PDAQ score, the scores for these two items were reversed. Patients were categorized as exhibiting good DA if they adhered to a healthy diet for at least four days per week.

Independent variables: These variables pertain to barriers to DA. We categorized them into two groups: factors associated with patients (demographic

factors, anthropometric indicators, disease-related factors, factors linked to diet, regular physical activity, and preference for sugar-sweetened beverages) and factors associated with medical staff (diet counseling for patients).

Demographic factors: Age, gender (male, female), education level (secondary school and lower, high school and higher), occupation (housewife, freelancer, farmer, worker, businessperson, civil servant), marital status (married, divorced, widowed), living area (urban, rural), living status (living with family, living alone), patient monthly average income (in Vietnamese dong - VND).

Anthropometric indicators: Height, waist circumference, hip circumference, and weight were measured. We calculated BMI (kg/m2) and classified it into three categories: Underweight (BMI < 18.5 kg/m2), normal (BMI: 18.5–24.9 kg/m2), and overweight/obesity (BMI: ≥ 25.0 kg/m2).[21] Waist circumference indicates abdominal obesity when it is > 94 cm for men and > 80 cm for women. An abnormal waist-hip ratio (indicative of abdominal obesity) occurs when it is > 0.9 for men and > 0.85 for women.[22]

Factors related to the disease: Family history of diabetes (yes, no), treatment duration of the patient (< 5 years, 5–10 years, > 10 years), disease duration (< 5 years, 5–10 years, > 10 years), adherence to regular follow-up (yes, no), co-morbidity (yes, no), type of diabetes treatment (oral hypoglycemic drug, insulin), HbA1c level (%), complications of diabetes (yes, no), and medication adherence (yes, no). For HbA1c assessment, the nurse collected the patient's blood in the morning after an overnight fast of at least 8 hours. The blood sample was then sent to the Laboratory Department of Hai Phong Medical University Hospital for HbA1c testing. The HbA1c index was measured using the Celltac ES automatic analyzer manufactured by Nihon Kohden in Japan. Patients were considered to have good glycemic control if their HbA1c level was < 7%.[23]

Medication adherence: We employed the General Medication Adherence Scale (GMAS) questionnaire to evaluate medication adherence. The questionnaire was translated and standardized for implementation among T2DM patients in Ho Chi Minh City, Vietnam, in 2020, yielding a Cronbach's alpha coefficient of 0.871 for all questions.[24] The questionnaire consisted of 11 questions, each rated on a 4-point Likert scale: Always (0 points), often (1 point), sometimes (2 points), never (3 points). Medication adherence scores ranged from 0 to 33 points, and patients were considered to have achieved medication adherence if they obtained a score ≥ 27.

Dietary factors, physical activity: Family support to comply with the diet (yes, no), feeling of lack of knowledge/lack of diet education (yes, no), lack of belief in the diet's role in controlling blood glucose (yes, no), difficulty in adhering to the recommended diet during social or work events (yes, no), sugar-sweetened beverage preference (not at all like, dislike, neutral, like, like very much), and regular physical activity (exercise 5–7 days/week, at least 30 minutes/day).

Factors related to the medical staff: Patients receive monthly dietary counseling (yes, no), remember the recommended diet by the medical staff (yes, no), find the recommended diet affordable (yes, no), find it time-consuming to cook the recommended diet (yes, no).

The questionnaire was collaboratively designed by nutritionists from Hai Phong University of Medicine and Pharmacy and doctors directly involved in patient care at the outpatient clinic of Hai Phong Medical University Hospital. Information was gathered through direct patient interviews using a structured questionnaire, anthropometric indicators were measured, and data were extracted from medical records. Investigators

reviewed completed questionnaires daily to ensure there was no missing data.

Statistical analysis

Data entry was conducted using EpiData software version 3.1 (The EpiData Association, Odense, Denmark), with statistical analyses performed utilizing SPSS version 25.0 (Statistical Package for the Social Sciences). Categorical variables were described using frequency and percentage (%), while continuous variables were represented by mean and standard deviation (SD). The chi-square test was utilized to compare the percentage of patients' adherence to dietary factors and associated variables. Univariate and multivariate logistic regression analyses were employed to investigate barriers influencing DA. Only variables with a p-value < 0.25 in the univariate logistic regression analyses were included in the multivariate logistic regression analyses. Statistical significance was defined as $p < 0.05$.

Ethical approval

The research protocol was approved by the Scientific Council of Hai Phong University of Medicine and Pharmacy. Prior to collecting research data, the investigator briefed the patients on the study's objectives. Participation in the research was voluntary, and only patients who consented were included. Those who declined faced no repercussions in their hospital treatment. Patient information was strictly confidential.

RESULTS

Patient demographic information is presented in Table 1. The mean age of the patients was 66.08 ± 8.72 years. The proportion of female patients was 60.2%; 67.1% had a high school education or higher, and 96.8% lived in urban areas and resided with their families. The average monthly income of the patients was 5.14 ± 2.87 million VND. The proportion of patients classified as overweight/obese according to BMI was 22.2%. The percentages of patients with abdominal obesity, determined by waist circumference and waist-hip ratio, were 73.7% and 82%, respectively.

Table 1. The socio-demographic characteristics of the patients (N = 410)

Variables	Frequency	%
Age (years)		
< 50	17	4.1
50 - 59	54	13.2
60 - 69	210	51.2
70 - 79	102	24.9
≥ 80	27	6.6
Mean ± SD (Min - Max)	66.08 ± 8.72 (34 - 85)	
Gender		
Male	163	39.8
Female	247	60.2
Education level		
Secondary school and lower	135	32.9
High school and higher	275	67.1

Variables	Frequency	%
Occupation		
Housewife	43	10.5
Freelancer	118	28.8
Farmer	10	2.4
Worker	111	27.1
Business	36	8.8
Civil servants	92	22.4
Marital status		
Married	366	89.3
Divorced/Separated/Widowed	44	10.7
Resindence		
Urban	397	96.8
Rural	13	3.2
Living status		
Living with family	397	96.8
Living alone	13	3.2
Monthly average income in VND		
< 5 million	217	52.9
5 - 10 million	174	42.4
> 10 million	19	4.7
Mean ± SD (Min - Max)	5.14 ± 2.87 (1 - 20)	
Body Mass Index (BMI - kg/m^2)		
Underweight (< 18.5)	11	2.7
Normal (18.5 - 24.9)	308	75.1
Overweight/obesity (≥ 25.0)	91	22.2
Waist circumference		
Abdominally obese	302	73.7
No abdominal obesity	108	26.3
Waist-hip ratio		
Abdominally obese	336	82.0
No abdominal obesity	74	18.0

The clinical characteristics of the patients are summarized in Table 2. Among the participants, 24.6% had a family history of T2DM. The average disease duration was 8.65 ± 6.02 years, while the average treatment duration was 7.11 ± 4.66 years. The majority of patients (93.2%) reported having regular follow-up examinations. Among the patients, 53.4% had comorbidities, 65.4% were adherent to medication, and 39.3% achieved good glycemic control. Additionally, 16.8% of patients were found to have complications from diabetes

.

Table 2. Clinical characteristics of the patients (N = 410)

Variables	Frequency	%
Family history of type 2 diabetes		
Yes	101	24.6
No	309	75.4
Disease duration (in year)		
< 5 years	107	26.1
5 - 10 years	194	47.3
> 10 years	109	26.6
Mean ± SD (Min - Max)	8.65 ± 6.02 (3 months - 40 years)	
Treatment duration		
< 5 years	134	32.7
5 - 10 years	206	50.2
> 10 years	70	17.1
Mean ± SD (Min - Max)	7.11 ± 4.66 (3 months - 24 years)	
Adherence to regular follow-up		
Yes	382	93.2
No	28	6.8
Co-morbidity		
Yes	219	53.4
No	191	46.6
Type of diabetes treatment		
Oral hypoglycemic drug/insulin	337	82.2
Oral hypoglycemic drug and insulin	73	17.8
Medication adherence		
Yes	268	65.4
No	142	34.6
Glycemic control		
Good	161	39.3
Poor	249	60.7
Complications of diabetes		
Yes	69	16.8
No	341	83.2

Table 3 presents barriers influencing patients' DA. The findings reveal that 4.4% of patients do not believe diet can effectively control blood sugar. Moreover, 32.4% of patients reported not receiving support from their families to comply with the diet. Approximately 51.7% of patients expressed a lack of knowledge/lack of education about the recommended diet. Only 44.9% of patients reported receiving monthly dietary consultations. Additionally, 32.7% of patients could not recall the recommended diet provided by the medical staff, while 29.3% cited financial constraints preventing them from affording the recommended diet. Furthermore, 47.3% of patients reported that following the recommended diet required excessive cooking time. Work and social events were also identified as challenging factors for adhering to the diet, with 58.3% of patients finding it difficult. It is worth noting that 24.6% of patients preferred sugar-sweetened beverages. Lastly, only 67.1% of patients reported engaging in regular physical activity.

Table 3. Barriers Influencing Adherence to the Recommended Diet of Patients

Variables	Frequency	%
Don't believe diet can control blood glucose		
Yes	18	4.4
No	392	95.6
Family support to comply with the diet		
Yes	277	67.6
No	133	32.4
The feeling of lack of knowledge/lack of diet education		
Yes	212	51.7
No	198	48.3
Patients receive monthly dietary counseling		
Yes	184	44.9
No	226	55.1
Remember the recommended diet by the medical staff		
Yes	276	67.3
No	134	32.7
Affordability to the recommended diet		
Yes	290	70.7
No	120	29.3
It takes too long to cook the recommended diet		
Yes	194	47.3
No	216	52.7
The difficulty of adhering to recommendation diet during social or work events		
Yes	239	58.3
No	171	41.7
Sugar-sweetened beverage preference[a]		
Yes	101	24.6
No	309	75.4
Regular physical activity		
Yes	275	67.1
No	135	32.9

Notes: [a]Answers of "Like" and "Like very much" have been merged into "Yes", answers of "Completely dislike", "Dislike" or "Neutral" have been merged into "No".

Table 4 presents the patient's level of DA. Patients consumed fiber-rich foods, such as green vegetables, cucumbers, cereals, etc., over the past seven days for an average of 6.41 days. However, consumption of carbohydrate-containing foods with a low glycemic index (whole grains, brown rice, rye bread, boiled potatoes, beans, etc.) and foods containing or prepared with canola, walnut, olive, or flax oils was relatively low, with averages of 2.79 and 2.35 days, respectively. The rate of patient adherence to the diet was 16.3%.

Table 4. Perceived Dietary Adherence Questionnaire (PDAQ) score for patients

Item	Mean ± SD (days/week)
On how many of the last SEVEN DAYS have you followed a healthful eating plan?	3.76 ± 1.68
On how many of the last SEVEN DAYS did you eat the number of fruit and vegetable servings you are supposed to eat based on guidelines?	6.28 ± 1.28
On how many of the last SEVEN DAYS did you eat carbohydrate-containing foods with a low Glycemic Index? (Example: whole grains, brown rice, black bread, boiled potatoes, beans,...)	2.79 ± 2.13
On how many of the last SEVEN DAYS did you eat foods high in sugar, such as white rice, potatoes, roasted sweet potatoes, candy, jam, soft drinks, jackfruit, papaya, mango, longan, lychee..., etc.?	4.42 ± 2.19
On how many of the last SEVEN DAYS did you eat foods high in fiber such as vegetables, cucumbers, cereals,…?	6.42 ± 1.04
On how many of the last SEVEN DAYS did you space carbohydrates evenly throughout the day?	5.15 ± 1.52
On how many of the last SEVEN DAYS did you eat fish or other foods high in omega-3 fats?	3.67 ± 1.35
On how many of the last SEVEN DAYS did you eat foods that contained or were prepared with canola, walnut, olive, or flax oils?	2.35 ± 2.09
On how many of the last SEVEN DAYS did you eat foods high in fat (such as high-fat dairy products, fatty meat, fried foods, animal organs…)?	2.16 ± 1.28
The average dietary adherence score	37.85 ± 7.08
Overall adherence	**n (%)**
Good	67 (16.3)
Poor	344 (83.7)

Table 5 presents factors related to patient DA. A multivariable logistic regression analysis revealed several factors associated with DA. These factors include medication adherence (AOR = 3.44, 95%CI: 1.50–7.93), good glycemic control (AOR = 2.13, 95%CI: 1.17–3.87), and patients receiving monthly dietary advice (AOR = 3.01, 95%CI: 1.63–5.55).

Table 5. Factors associated with the level of dietary adherence: Univariate and multivariate logistic regression analysis (n,%)

Variables	Adherence (n,%)		Univariate	Multivariate
	Poor	Good	OR (95%CI)	AOR (95%CI)
Gender				
Male	141 (86.5)	22 (13.5)	1	1
Female	202 (81.8)	45 (18.2)	1.43 (0.82-2.48)	1.10 (0.59-2.05)
Education level				
Secondary school and lower	104 (77.0)	31 (23.0)	1	1
High school and higher	239 (86.9)	36 (13.1)	0.51 (0.30-0.86)	0.64 (0.35-1.19)

Variables	Adherence (n,%)		Univariate	Multivariate
	Poor	Good	OR (95%CI)	AOR (95%CI)
Resindence				
Urban	334 (84.1)	63 (15.9)	1	1
Rural	9 (69.2)	4 (30.8)	2.34 (0.70-7.89)	1.44 (0.38-5.55)
Family history of diabetes				
Yes	80 (79.2)	21 (20.8)	1	1
No	263 (85.1)	46 (14.9)	0.67 (0.38-1.18)	0.73 (0.38-1.38)
Type of treatment				
Oral hypoglycemic drug/insulin	277 (82.2)	60 (17.8)	1	1
Oral hypoglycemic drug and insulin	66 (90.4)	7 (9.6)	0.49 (0.21-1.12)	0.54 (0.22-1.32)
Medication adherence				
No	134 (94.4)	8 (5.6)	1	
Yes	209 (80.7)	59 (22.0)	**4.73*** (2.19-10.21)**	**3.44** (1.50-7.93)**
Glycemic control				
Poor	217 (87.1)	28 (12.9)	1	1
Good	126 (78.3)	39 (21.7)	**2.40** (1.41-4.09)**	**2.13* (1.17-3.87)**
Regular physical activity				
No	118 (87.4)	17 (12.6)	1	1
Yes	225 (81.8)	50 (18.2)	1.54 (0.85-2.79)	0.92 (0.45-1.85)
The feeling of lack of knowledge/lack of diet education				
Yes	159 (80.3)	39 (19.7)	1	1
No	184 (86.8)	28 (13.2)	0.62 (0.37-1.05)	1.15 (0.59-2.22)
Patients receive monthly dietary counseling				
No	204 (90.3)	22 (9.7)	1	1
Yes	139 (75.5)	45 (24.5)	**3.0*** (1.73-5.22)**	**3.01*** (1.63-5.55)**
Remember the recommended diet by the medical staff				
No	125 (93.3)	9 (6.7)	**1**	1
Yes	218 (79.0)	58 (21.0)	**3.70*** (1.77-7.71)**	1.46 (0.60-3.56)
Affordability to the recommended diet				
No	113 (94.2)	7 (5.8)	1	1
Yes	230 (79.3)	60 (20.7)	**4.21*** (1.87-9.51)**	2.08 (0.80-5.42)
It takes too long to cook recommended diet				
Yes	172 (88.7)	22 (11.3)	1	1
No	171 (79.2)	45 (20.8)	**2.06**(1.19-3.57)**	1.29 (0.63-2.63)

Abbreviation: *OR: Odds Ratio, AOR: Adjusted Odds Ratio, CI: Confidence Interval*

Notes: *Bolded numbers are significant at p < 0.05* (*<0.05, **<0.01, ***<0.001)

DISCUSSION

A hospital-based cross-sectional study carried out at Hai Phong Medical University Hospital, involving 410 T2DM patients, revealed that only approximately one-sixth of the patients adhered to the prescribed diet. The study aimed to analyze factors associated with DA, focusing explicitly on patient-related factors, including demographics, disease-related aspects, treatment compliance, physical activity, dietary habits, and medical staff consultation. The analysis showed significant associations between DA and factors such as medication adherence,

achieving good glycemic control, and the frequency of monthly dietary counseling provided to patients.

A healthy diet is fundamental to preventing and controlling diabetes.[25] Nutritional therapy is integral to disease management and educating patients on diabetes self-management.[26] However, our study showed that only 16.3% of patients adhered to the diet. This finding is consistent with the results reporting compliance rates of a previous study conducted at University Sains Malaysia Hospital.[16] This similarity may be due to similar sociocultural environments. Our results were higher than those of Mumu SJ et al. in Bangladesh[27] and Klinovszky A et al. in Hungary[28]. However, it is lower than that reported in studies conducted in Brazil[29], Delhi[30], Ethiopia[31], Iran[32], and Singapore[33]. Compared to the studies above, the lower rate of dietary adherence among patients in our study may be attributed to differences in the setting and socio-demographic characteristics of the patients across different locations. In Vietnam, for instance, eating together in groups with family members can pose challenges for patients adhering to their prescribed diets. Variations in the instruments used to measure dietary adherence could also contribute to the observed differences. Our study utilized the PDAQ, while studies conducted in Brazil and Delhi used the Summary of Diabetes Self-Care Activities (SDSCA) questionnaire. The survey in Ethiopia assessed dietary adherence over two weeks using a fourteen-item scale, whereas the study in Iran utilized the Mediterranean Diet Adherence Score (MEDAS) questionnaire. Meanwhile, the Singapore study measured adherence to dietary guidelines using the Alternate Healthy Eating Index (AHEI-2010).

The research demonstrated a statistically significant relationship between medication adherence and dietary adherence (DA). Patients who adhered to their medication were 3.44 times more likely to adhere to their diet compared to those who did not adhere to medication. A similar finding was reported in a study conducted by Baral et al. in Nepal, where patients who were compliant with their medication were 3.5 times more likely to be compliant with their diet than those who were non-compliant with their medication.[13] Therefore, counseling on medication adherence is also crucial. In our study, we utilized the HbA1c index to assess the outcomes of patients' glycemic control, as HbA1c is widely recognized as the gold standard for evaluating the effectiveness of diabetes treatment.[34] We found that patients who achieved good glycemic control were 2.13 times more likely to adhere to their diet than those with poor glycemic control. This finding aligns with a study conducted in Eastern Ethiopia, where patients with good glycemic control were 3.56 times more likely to adhere to their diet than those with poor glycemic control.[11] This study additionally revealed that patients receiving monthly dietary counseling were more likely to adhere to their prescribed diet. These findings align with a study by Mohammed MK et al., which reported that patients receiving nutrition education were nearly three times more likely to adhere to recommended nutritional practices than those not receiving diet education.[35] Research conducted by Ayele AA et al. supports the notion that a lack of knowledge/education about diet is a significant factor contributing to poor DA.[18] This can be explained by the fact that patients who receive counseling can enhance their awareness regarding selecting appropriate foods and better understand the consequences of dietary non-compliance. Therefore, diet counseling should be

implemented monthly at each follow-up visit.

LIMITATIONS AND STRENGTHS OF THE STUDY

This study has some limitations. Firstly, it is essential to acknowledge that our study's assessment of DA relied on self-reported data rather than direct observation. This interview method, which involved a set of questions, is subjective and dependent on the patient's memory. Secondly, we utilized the PDAQ developed by Asaad et al. in 2015 to measure DA. Although this questionnaire has been used by various researchers worldwide, including our adaptation of certain foods to align with local culture, it is worth noting that it has not been standardized in Vietnam. Consequently, errors may be unavoidable. Furthermore, it is essential to highlight that our study did not assess DA or knowledge related to T2DM. Additionally, as a cross-sectional study, we cannot establish a causal relationship between predictors and outcomes. Despite these limitations, the research findings can provide clinics and medical staff with a scientific foundation for developing interventions to improve the DA of patients. Ultimately, the goal is to achieve optimal blood sugar control and reduce complications associated with the disease.

CONCLUSION

Our study reveals a significant issue of low dietary adherence among patients with Type 2 Diabetes. Factors such as adherence to medication, achieving good glycemic control, and receiving monthly dietary counseling were statistically associated with dietary adherence. Non-compliance with the prescribed diet stands as the primary cause of complications in Type 2 Diabetes patients. Consequently, proactive measures are imperative for medical professionals to devise effective solutions.

ACKNOWLEDGMENTS

We thank all patients participating in this research and the nurses at the Outpatient Clinic of the Haiphong Medical University Hospital for their invaluable contributions to data collection.

FUNDING

No funding or sponsorship was given for this study or publication of this paper.

CONFLICTS OF INTERESTS

The authors declare no conflict of interest in this study.

AUTHORS' CONTRIBUTION

CMD was responsible for the conceptualization; CMD, TTTH, NVT, and NTL conducted research; CMD analyzed data; CMD and TTTH wrote the manuscript. CMD was primarily responsible for the final content. All authors read and approved the final manuscript.

REFERENCES

1. Zimmet PZ. Diabetes and its drivers: the largest epidemic in human history? Clin Diabetes Endocrinol. 2017;3:1. doi: 10.1186/s40842-016-0039-3.
2. IDF Diabetes Atlas 2021. IDF Atlas 10th edition [Internet]. [cited 2023 Aug 15]. Available from: https://diabetesatlas.org/atlas/tenth-edition/.
3. Vietnam Mistry of Health. Khoảng 5 triệu người Việt đang mắc căn bệnh gây nhiều biến chứng về tim mạch, thần kinh, cắt cụt chi... [Internet]. [cited 2023 Aug 20]. Available from: https://moh.gov.vn/tin-noi-bat/-

/asset_publisher/3Yst7YhbkA5j/content/khoang-5-trieu-nguoi-viet-ang-mac-can-benh-gay-nhieu-bien-chung-ve-tim-mach-than-kinh-cat-cut-chi-.
4. World Health Organization. Diabetes [Internet]. [cited 2023 Sept 9]. Available from: https://www.who.int/news-room/fact-sheets/detail/diabetes.
5. American Diabetes Association. Nutrition Recommendations and Interventions for Diabetes: A position statement of the American Diabetes Association. Diabetes Care. 2008;31(Supplement_1):S61-S78.
6. Al-Salmi N, Cook P, D'Souza MS. Diet Adherence among Adults with Type 2 Diabetes Mellitus: A Concept Analysis. Oman Med J. 2022;37(2):e361. doi: 10.5001/omj.2021.69.
7. Pastors JG, Warshaw H, Daly A, Franz M, Kulkarni K. The Evidence for the Effectiveness of Medical Nutrition Therapy in Diabetes Management. Diabetes Care. 2002;25(3):608-13. doi: 10.2337/diacare.25.3.608.
8. Wu SL, Peng LY, Chen YM, Zeng FF, Zhuo SY, Li YB, et al. Greater Adherence to Dietary Guidelines Associated with Reduced Risk of Cardiovascular Diseases in Chinese Patients with Type 2 Diabetes. Nutrients. 2022;14(9):1713. doi: 10.3390/nu14091713.
9. Ranasinghe P, Pigera AS, Ishara MH, Jayasekara LM, Jayawardena R, Katulanda P. Knowledge and perceptions about diet and physical activity among Sri Lankan adults with diabetes mellitus: a qualitative study. BMC Public Health. 2015;15:1160. doi: 10.1186/s12889-015-2518-3.
10. Katsaridis S, Grammatikopoulou MG, Gkiouras K, Tzimos C, Papageorgiou ST, Markaki AG, et al. Low Reported Adherence to the 2019 American Diabetes Association Nutrition Recommendations among Patients with Type 2 Diabetes Mellitus, Indicating the Need for Improved Nutrition Education and Diet Care. Nutrients. 2020;12(11):3516. doi: 10.3390/nu12113516.
11. Mohammed AS, Adem F, Tadiwos Y, Woldekidan NA, Degu A. Level of Adherence to the Dietary Recommendation and Glycemic Control Among Patients with Type 2 Diabetes Mellitus in Eastern Ethiopia: A Cross-Sectional Study. Diabetes Metab Syndr Obes. 2020;13:2605-12. doi: 10.2147/DMSO.S256738.
12. Selvam J, Thangaraj P, Hemalatha K, Subbian P. Diet adherence and factors associated with nonadherence among Type 2 diabetics at an urban health center in Tamil Nadu, India. International Journal of Academic Medicine. 2023;9(2).
13. Baral J, Karki KB, Thapa P, Timalsina A, Bhandari R, Bhandari R, et al. Adherence to Dietary Recommendation and Its Associated Factors among People with Type 2 Diabetes: A Cross-Sectional Study in Nepal. J Diabetes Res. 2022;2022:6136059. doi: 10.1155/2022/6136059.
14. Paudel G, Vandelanotte C, Dahal PK, Biswas T, Yadav UN, Sugishita T, et al. Self-care behaviours among people with type 2 diabetes mellitus in South Asia: A systematic review and meta-analysis. J Glob Health. 2022;12:04056. doi: 10.7189/jogh.12.04056.
15. Abate TW, Tareke M, Abate S, Tegenaw A, Birhanu M, Yirga A, et al. Level of dietary adherence and determinants among type 2 diabetes population in Ethiopian: A systemic review with meta-analysis. PLOS ONE. 2022;17(10):e0271378. doi: 10.1371/journal.pone.0271378.
16. Tan SL, Juliana S, H. S. Dietary compliance and its association with glycemic control among poorly

controlled type 2 diabetic outpatients in Hospital Universiti Sains Malaysia. Malays J Nutr. 2011;17(3):287-99.
17. Asaad G, Sadegian M, Lau R, Xu Y, Soria-Contreras DC, Bell RC, et al. The Reliability and Validity of the Perceived Dietary Adherence Questionnaire for People with Type 2 Diabetes. Nutrients. 2015;7(7):5484-96.
18. Ayele AA, Emiru YK, Tiruneh SA, Ayele BA, Gebremariam AD, Tegegn HG. Level of adherence to dietary recommendations and barriers among type 2 diabetic patients: a cross-sectional study in an Ethiopian hospital. Clin Diabetes Endocrinol. 2018;4:21. doi: 10.1186/s40842-018-0070-7.
19. Doglikuu BD, Abubakari A, Yaseri M, Shakibazadeh E, Djazayery A, Mirzaei K. Association of household socioeconomic status, neighborhood support system and adherence to dietary recommendation among persons with T2DM, a facility-based cross-sectional study in Ghana. BMC Public Health. 2021;21(1):911. doi: 10.1186/s12889-021-10963-x.
20. Khusna RB, Pangastuti HS, Wicaksana AL. Dietary adherence and the associated factors among Indonesian patients with type 2 diabetes: what should we be concerned about? Frontiers of Nursing. 2023;10(4):427-35.
21. WHO Consultation on Obesity (1999: Geneva S, World Health Organization. Obesity: Preventing and managing the global epidemic: Report of a WHO consultation [Internet]. [cited 2023 Sept 10]. Available from: https://apps.who.int/iris/handle/10665/42330.
22. World Health Organization. Waist circumference and waist-hip ratio: Report of a WHO expert consultation [Internet]. [cited 2023 Sept 10]. Available from: https://www.who.int/publications/i/item/9789241501491.
23. Cosentino F, Grant PJ, Aboyans V, Bailey CJ, Ceriello A, Delgado V, et al. 2019 ESC Guidelines on diabetes, pre-diabetes, and cardiovascular diseases developed in collaboration with the EASD. Eur Heart J. 2020;41(2):255-323. doi: 10.1093/eurheartj/ehz486.
24. Nguyen TH, Truong HV, Vi MT, Taxis K, Nguyen T, Nguyen KT. Vietnamese Version of the General Medication Adherence Scale (GMAS): Translation, Adaptation, and Validation. Healthcare (Basel). 2021; 9(11):1471. doi: 10.3390/healthcare 9111471.
25. Bekele H, Asefa A, Getachew B, Belete AM. Barriers and Strategies to Lifestyle and Dietary Pattern Interventions for Prevention and Management of TYPE-2 Diabetes in Africa, Systematic Review. J Diabetes Res. 2020;2020:7948712. doi: 10.1155/2020/7948712.
26. Evert AB, Dennison M, Gardner CD, Garvey WT, Lau KHK, MacLeod J, et al. Nutrition Therapy for Adults With Diabetes or Prediabetes: A Consensus Report. Diabetes Care. 2019;42(5): 731-54. doi: 10.2337/dci19-0014.
27. Mumu SJ, Saleh F, Ara F, Afnan F, Ali L. Non-adherence to life-style modification and its factors among type 2 diabetic patients. Indian J Public Health. 2014;58(1):40-4. doi: 10.4103/0019-557X.128165.
28. Klinovszky A, Kiss IM, Papp-Zipernovszky O, Lengyel C, Buzás N. Associations of different adherences in patients with type 2 diabetes mellitus. Patient Prefer Adherence. 2019; 13:395–407. doi: 10.2147/PPA. S187080.
29. Marinho FS, Moram CBM, Rodrigues PC, Leite NC, Salles GF, Cardoso CRL. Treatment Adherence and Its Associated Factors in Patients with Type 2 Diabetes: Results from the Rio de Janeiro Type 2 Diabetes Cohort Study. J Diabetes Res.

2018;2018:8970196. doi: 10.1155/2018/8970196.
30. Basu S, Garg S, Sharma N, Singh MM, Garg S. Adherence to self-care practices, glycemic status and influencing factors in diabetes patients in a tertiary care hospital in Delhi. World J Diabetes. 2018;9(5):72-9. doi: 10.4239/wjd.v9.i5.72.
31. Tirfessa D, Abebe M, Darega J, Aboma M. Dietary practice and associated factors among type 2 diabetic patients attending chronic follow-up in public hospitals, central Ethiopia, 2022. BMC Health Serv Res. 2023;23:1273. doi: 10.1186/s12913-023-10293-1.
32. Mirahmadizadeh A, Khorshidsavar H, Seif M, Sharifi MH. Adherence to Medication, Diet and Physical Activity and the Associated Factors Amongst Patients with Type 2 Diabetes. Diabetes Ther. 2020;11(2):479-94. doi: 10.1007/s13300-019-00750-8.
33. Han CY, Chan CGB, Lim SL, Zheng X, Woon ZW, Chan YT, et al. Diabetes-related nutrition knowledge and dietary adherence in patients with Type 2 diabetes mellitus: A mixed-methods exploratory study. Proceedings of Singapore Healthcare. 2020;29(2):81-90.
34. Landgraf R. [HbA1c--the gold standard in the assessment of diabetes treatment?]. Dtsch Med Wochenschr. 2006;131(Suppl 8):S243-6.
35. Mohammed MA, Sharew NT. Adherence to dietary recommendation and associated factors among diabetic patients in Ethiopian teaching hospitals. Pan Afr Med J. 2019;33:260. doi: 10.11604/pamj.2019.33.260.14463.