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Adherence to Dietary Recommendations among Type 2 Diabetic Patients in a Tertiary Level Hospital in Barishal

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Abstract: ***Background:*** Type 2 diabetes mellitus (T2DM) is a global public health challenge, with dietary adherence being crucial for effective management and glycemic control. Despite its importance, maintaining recommended dietary practices is often hindered by socioeconomic, cultural, and educational barriers, particularly in low-resource settings like Bangladesh. This study aimed to explore the adherence levels and influencing factors to enable the targeted interventions to improve patient outcomes and reduce diabetes-related complications in resource-constrained environments. ***Method*:** This study assessed dietary adherence among Type 2 diabetic patients at two hospitals in Barishal, Bangladesh, using a cross-sectional design. Data from 214 participants were collected via structured questionnaires and analyzed using SPSS. Ethical approval, informed consent, and validated tools ensured the study's reliability, focusing on socio-demographics, medical history, and perceived dietary adherence. ***Results*:** The results revealed that the Four-Item Morisky Medication Adherence Scale (MMAS) indicated low medication adherence among participants (M = 3.62, SD = 0.722). Similarly, the mean score for perceived dietary adherence (M = 1.88, SD = 0.47) suggested that participants rarely to occasionally followed dietary recommendations, reflecting low adherence. Significant differences in dietary adherence were observed based on monthly family income ($r = 0.48$, $p < 0.001$), gender ($t = 2.23$, $p = 0.02$), education level ($F = 3.03$, $p = 0.01$), occupation ($F = 3.26$, $p = 0.007$), income expenditure ($F = 3.29$, $p = 0.02$), and stress control methods ($F = 2.43$, $p = 0.04$).***Conclusion*:** Effective dietary education should incorporate activities that foster a more positive outlook toward managing the disease. This can be achieved through personalized counseling tailored to the patient's needs and emphasizing the importance of regular blood glucose monitoring.

Keywords: Diabetes, Type 2 diabetic patient, Dietary adherence, Dietary recommendation.

Research Paper

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INTRODUCTION

Diabetes mellitus (DM), particularly Type 2 diabetes mellitus (T2DM), is a rapidly growing public health concern worldwide, contributing significantly to morbidity, mortality, and economic burden. Nutritional regulation remains a cornerstone of diabetes management, as effective adherence to dietary recommendations plays a vital role in glycemic control and the overall well-being of individuals with T2DM. Studies have demonstrated that improving dietary practices alone can reduce glycosylated hemoglobin (HbA1c) by 1-2%, particularly in the early stages of diabetes (Mohammed & Sharew, 2019). However, adherence to dietary guidelines is often one of the most challenging aspects of diabetes self-management. Many patients fail to maintain proper dietary habits due to a multitude of factors, including lack of awareness, socioeconomic constraints, and the difficulties associated with altering long-standing dietary behaviors (Ahola & Groop, 2013). Despite advancements in pharmacological treatments, lifestyle modification, including dietary adherence, remains fundamental for the prevention of diabetes-related complications and the enhancement of patients' quality of life.

Globally, the burden of diabetes has increased at an alarming rate. According to the World Health Organization (2016), over 422 million people were living with diabetes worldwide, and projections indicate that this figure will rise to 642 million by 2040 (International Diabetes Federation, 2015). The distribution of diabetes is notably unequal, with over 70% of cases occurring in low- and middle-income countries where healthcare infrastructure and public awareness programs remain inadequate. In Bangladesh, diabetes has emerged as a significant public health issue, driven by rapid urbanization, lifestyle changes, and dietary shifts (Chowdhury *et al.*, 2021). Recent estimates suggest that over 13.7 million people in Bangladesh will be living with diabetes by 2045 (Cho *et al.*, 2018). This increasing prevalence underscores the urgent need to prioritize adherence to dietary recommendations as a cost-effective and sustainable approach to managing diabetes in resource-limited settings like Bangladesh.

The impact of dietary adherence on the management of T2DM is well-documented in literature. Maintaining a balanced diet rich in whole grains, vegetables, fruits, lean proteins, and healthy fats has been associated with better glycemic control and reduced risk of diabetes-related complications (Franz *et al.*, 2017). Conversely, poor adherence to dietary recommendations often leads to poor glycemic control, necessitating the intensification of pharmacological therapies, which can increase healthcare costs and patients' physical and psychological burdens (Khattab *et al.*, 2010). Studies conducted in various settings, including Ethiopia, India, and Indonesia, have consistently highlighted low levels of dietary adherence among patients with T2DM (Berhe *et al.*, 2012; Hailu *et al.*, 2012; Peyrot *et al.*, 2005). In Ethiopia, for instance, only 25.7% of participants adhered to recommended dietary practices, with socioeconomic constraints, lack of education, and limited access to dietary counseling identified as key barriers (Hailu *et al.*, 2012). Similar trends have been observed in Bangladesh, where cultural dietary practices, low income, and lack of awareness about the importance of nutrition exacerbate the challenge of dietary adherence among diabetic patients (Biswas *et al.*, 2016; Chowdhury *et al.*, 2021).

The factors influencing adherence to dietary recommendations among individuals with T2DM are multifaceted, encompassing both individual and systemic barriers. Socioeconomic status, education, access to healthcare services, and cultural beliefs significantly influence dietary behaviors (Nagelkerk *et al.*, 2006; Mohammed *et al.*, 2020). In low-resource settings like Bangladesh, many patients struggle to afford healthy diets that meet recommended guidelines. Additionally, a lack of communication and education provided by healthcare professionals often leaves patients unaware of the benefits of adhering to dietary recommendations. Family support, the affordability of nutritious food, and patients' motivation to control their condition are also critical determinants of dietary adherence (Baral *et al.*, 2022). Addressing these barriers requires a collaborative approach involving patients, healthcare providers, and policymakers to promote awareness, improve access to dietary counseling, and develop culturally appropriate nutritional interventions tailored to the needs of the population.

Given the high prevalence of T2DM in Bangladesh and the documented challenges associated with dietary adherence, there is an urgent need for research to assess the extent to which diabetic patients adhere to dietary recommendations and to identify the factors influencing their adherence. Tertiary-level hospitals in regions like Barishal play a pivotal role in providing specialized care for diabetic patients. However, the level of adherence to dietary guidelines among patients attending such healthcare facilities remains largely unexplored. Understanding the challenges and barriers to dietary adherence in this population is essential for designing targeted interventions that can improve diabetes management outcomes. This study, therefore, aimed to investigate the adherence to dietary recommendations among Type 2 diabetic patients in tertiary-level hospitals in Barishal, Bangladesh, and to identify the associated factors influencing adherence. The findings of this study are assumed to provide valuable insights for healthcare professionals and policymakers to develop effective strategies for improving dietary adherence and enhancing the overall quality of life for individuals with T2DM in Bangladesh.

METHODS

This study employed a cross-sectional design to assess the level of perceived adherence to dietary recommendations among type 2 diabetic patients at selected hospitals in Barishal, Bangladesh. The research was conducted at two prominent healthcare facilities: Sher-E-Bangla Medical College Hospital (SBMCH) and Advocate Hemayet Uddin Ahmed Diabetic and General Hospital. SBMCH, the largest tertiary-level teaching and referral hospital in Barishal, serves a diverse population of patients from across the city and surrounding regions. Advocate Hemayet Uddin Ahmed Diabetic and General Hospital, a specialized diabetic care center, attracts a significant number of diabetic patients daily. The selection of these hospitals ensured feasibility and representativeness, capturing a broad spectrum of type 2 diabetic patients. The study took place between March and May 2024, during which indoor and outdoor patients receiving care at these hospitals were recruited for participation. The inclusion criteria included adults aged 20 years or older, diagnosed with type 2 diabetes mellitus (T2DM) for at least six months, physically fit to engage in interviews, and willing to provide informed consent. A convenient sampling technique was used to enroll 214 participants, which accounted for a 15% margin to mitigate non-response and missing data. The sample size was calculated using the World Health Organization (WHO) formula, based on a prevalence rate of 13.75% reported in earlier studies (Chowdhury *et al.*, 2022).

Data were collected using an interviewer-administered structured questionnaire divided into three key segments. Segment I gathered socio-demographic information, including age, gender, marital status, education level, occupation, monthly income, residency type, family structure, and family history of diabetes mellitus. Segment II assessed participants' medical history, including blood pressure (systolic and diastolic), height, weight (to calculate body mass index), duration of diabetes diagnosis, comorbidities, current blood glucose levels, stress management methods, and adherence to prescribed medications. Medication adherence was measured using the four-item Morisky Medication Adherence Scale (MMAS), which categorizes adherence into high, medium, and low levels based on yes/no responses. Segment III utilized the Perceived Dietary Adherence Questionnaire (PDAQ), a validated tool developed by Asaad *et al.*, (2015) to measure participants' perceptions of dietary adherence. The PDAQ includes nine questions rated on a seven-point Likert scale, with scores ranging from 0 ("never") to 6 ("every time"), where higher scores indicate better adherence. The tool has demonstrated good reliability, with an intra-class correlation coefficient of 0.78.

Prior to data collection, ethical approval was obtained from the Institutional Review Board (IRB) of Sher-E-Bangla Medical College, Barishal. Formal permissions were secured from the respective hospital authorities, and informed written consent was collected from all participants, ensuring their voluntary participation. Face-to-face interviews were conducted by the researcher, who clarified questions as needed to facilitate accurate responses. Privacy, confidentiality, and anonymity were strictly maintained by assigning code numbers to participants. Upon completion of data collection, the data were cleaned, verified for consistency, and analyzed using SPSS version 23. Univariate analyses, including frequencies, percentages, means, and standard deviations, were performed to describe participants' characteristics. Bivariate analyses, such as t-tests, ANOVA, and correlation tests, were applied to examine relationships between socio-demographic factors and dietary adherence levels among type 2 diabetic patients. This systematic approach ensured the validity, reliability, and robustness of the study findings.

RESULTS

In the table 1, the study of 214 type 2 diabetic patients reveals that the mean age of participants was 53.34 years (SD ± 8.59), ranging from 30 to 85 years, highlighting a predominantly middle-aged group. The average total family income was 29,448.60 BDT (SD ± 27,232.48), with significant variation across participants. Gender distribution was nearly equal, with 51.9% female and 48.1% male. Most participants were Muslim (70.6%), and the majority were married (69.6%), followed by widows (15.9%) and single individuals (14.5%). Educational attainment was low, with over half (51.4%) completing only primary education, and a small proportion reaching graduate (3.3%) or post-graduate (5.1%) levels. Unemployment was high at 47.7%, while 14% were retired, and smaller groups worked in government (13.1%) and private jobs (12.1%**)**. A significant majority resided in rural areas (68.1%), and 64% belonged to nuclear families. Approximately 35% reported a family history of hypertension. The crowding index averaged 2.13 (SD ± 0.72), indicating moderate household density. Financially, over half of the participants (53.7%) could just meet routine expenses, while 13.1% were in debt, and only 11.7% managed to save or invest money.

Table 1: Distribution of Socio-demographic Characteristics of the type 2 diabetic patients (N = 214)

Variables	**Categories**	**n**	**%**	**Mean ± SD**
Age (years)	Min = 30 & Max = 85			53.34±8.59
Total family income (Bangladeshi Taka)	Min = 8000 & Max = 200000			29448.60±27232.48
Gender	Male	103	48.1	
	Female	111	51.9	
Religion	Muslim	151	70.6	
	Non-Muslim	63	29.4	
Marital status	Single	31	14.5	
	Married	149	69.6	
	Widow	34	15.9	
Education	Primary	110	51.4	
	SSC	59	27.6	
	HSC	27	12.6	
	Graduate	7	3.3	
	Post-graduate	11	5.1	
Occupation	Govt. job	28	13.1	
	Private job	26	12.1	
	Businessman	22	10.3	
	Retired	30	14	
	Student	6	2.8	
	Unemployment	102	47.7	
Living status	Rural	147	68.1	

	Urban	66	30.9	
Type of family	Nuclear family	137	64	
	Extended family	77	36	
Family history of hypertension	Yes	75	35	
	No	139	65	
Crowing index	Min = 1 & Max = 5			2.13±0.72
Income expenditure	In debt (inadequate)	28	13.1	
	Just meet routine expenses (adequate)	115	53.7	
	Meet routine expenses and emergencies	46	21.5	
	Able to save or invest money	25	11.7	

The health status of the participants, as presented in Table 2, reveals significant insights into their physical condition, comorbidities, stress management, and medication adherence. Regarding BMI, the majority (68.7%) fell within the normal range (15.56–24.9, Mean ± SD: 24.11±3.35), while 31.3% were classified as obese (25–39.9), indicating a notable portion with excess weight. The average duration of diagnosis was 4.63 years (SD ± 3.62), ranging between 1 and 15 years, showing variability in the participants' experience with the condition. In terms of comorbidities, 32.7% reported hypertension, while 67.3% had no other associated conditions.

For stress control, prayer emerged as the most common method, practiced by 44.9% of participants, followed by taking rest (34.6%), talking with family or friends (15.9%), and listening to music (4.7%). Medication adherence, assessed using the Four-item Morisky Medication Adherence Scale (MMAS), showed high adherence rates overall. Most participants reported not forgetting to take their medicine (89.7%) or having problems remembering (82.2%). Additionally, 95.8% did not stop taking their medication when feeling better, and 93% continued their medication even if feeling worse, resulting in a mean MMAS score of 3.62±0.722, indicating good adherence.

Table 2: Distribution of Health Indicators, Stress Management, and Medication Adherence Among Type 2 Diabetic Patients

S/no.	Questions	Categories	N	%	Mean±SD
1.	BMI (Body mass Index)	15.56 – 24.9 Normal	147	68.7	24.11±3.35
		25 – 39.9(Obese)	67	31.3	
2.	Duration of Diagnosis	Min = 1 and Max = 15			4.63±3.62
3.	Comorbidity	No comorbidity	144	67.3	
		Hypertension	70	32.7	
4.	Way of stress control	Prayer	96	44.9	
		Listening to music	10	4.7	
		Taking rest	74	34.6	
		Talking with family or friends	34	15.9	
5.	Four-item Morisky Medication Adherence Scale (MMAS)				
a.	Do you ever forget to take your (name of health condition) medicine?	Yes	22	10.3	0.90±0.30
		No	192	89.7	
b.	Do you ever have problems remembering to take your (name of health condition) medication?	Yes	38	17.8	0.83±0.39
		No	176	82.2	
c.	When you feel better, do you sometimes stop taking your (name of health condition) medicine?	Yes	9	4.2	0.96±0.20
		No	205	95.8	
d.	Sometimes if you feel worse when you take your (name of health condition) medicine, do you stop taking it?	Yes	15	7	0.93±0.26
		No	199	93	
Total score of Four-item MMAS		**3.62±0.722**			

The perceived dietary adherence of the participants reveals notable variability in compliance with recommended dietary practices in the table 3. The overall mean score for perceived dietary adherence was 16.96±4.23, with a mean of 1.88±0.47 across all items, suggesting generally low adherence. For specific items, only 3.10±1.62 participants reported following a healthful eating plan to a moderate extent. Adherence was particularly low for eating the recommended number of fruits and vegetables (2.50±1.13) and consuming foods with low glycemic index (1.94±0.88). Similarly, spacing carbohydrates evenly throughout the day (1.87±1.20) and eating fish or foods high in omega-3 fats (1.61±0.95) were also poorly adhered to by most participants. Foods low in fat (1.15±0.95) and prepared with oils such as canola, walnut, olive, or flax oils (1.19±0.99) had the lowest mean scores, indicating minimal compliance. Additionally, consumption of foods high in fiber (2.35±1.44) and low in sugar (1.25±0.89) were also inadequate.

Table 3. Distribution of the Perceived Dietary Adherence of the participants (N=214)

S/no	Items	Never (0) n (%)	rarely (1) n (%)	occasionally (2) n (%)	Sometimes (3) n (%)	Frequently (4) n (%)	Usually (5) n (%)	Always (6) n (%)	Mean±SD
1.	Following a healthful eating plan.	2(0.9)	26(12.1)	74(34.6)	42(19.6)	6(2.8)	44(20.6)	20(9.3)	3.10±1.62
2.	Eating the number of fruit and vegetable servings you are supposed to eat.	2(0.9)	20(9.3)	114(53.3)	51(23.8)	6(2.8)	16(7.5)	5(2.3)	2.50±1.13
3.	Eating carbohydrate-containing foods with a low Glycemic Index.	2(0.9)	62(29)	115(53.2)	21(9.8)	10(4.7)	4(1.9)		1.94±0.88
4.	Eating foods low in sugar.	33(15.4)	114(53.3)	55(25.7)	8(3.7)		4(1.9)		1.25±0.89
5.	Eating foods high in fiber such as oatmeal, high fiber cereals, and wholegrain breads.	8(3.7)	62(29)	58(27.1)	55(25.7)	4(1.9)	19(8.9)	8(3.7)	2.35±1.44
6.	Spacing carbohydrates evenly throughout the day.	6(2.8)	96(44.9)	67(31.3)	26(12.1)	8(3.7)	6(2.8)	5(2.3)	1.87±1.20
7.	Eating fish or other foods high in omega-3 fats.	11(5.1)	100(46.7)	81(37.9)	12(5.6)	4(1.9)	6(2.8)		1.61±0.95
8.	Eating foods that contained or was prepared with canola, walnut, olive, or flax oils.	56(26.2)	85(39.7)	56(26.2)	13(6.1)	2(0.9)	2(0.9)		1.19±0.99
9.	Eating foods low in fat.	60(28)	78(36.4)	63(29.4)	11(5.1)		2(0.9)		1.15±0.95
Total mean of Perceived Dietary Adherence									**16.96±4.23**
Mean of total mean of Perceived Dietary Adherence									**1.88±0.47**

The relationship between socio-demographic and health-related characteristics and adherence to dietary recommendations among type 2 diabetic patients reveals significant associations with several variables in the table 4. Total family income showed a strong positive correlation with dietary adherence (r=0.48, p=0.000), indicating that higher income was associated with better adherence. Gender also showed significance, with males (17.62±3.84) adhering more than females (16.34±4.48, p=0.02). Educational status demonstrated a significant trend (p=0.02), as adherence improved with higher education levels, peaking among graduates (19.71±3.15) and postgraduates (19.18±3.54). Similarly, occupation was a determining factor (p=0.007), with individuals in government jobs (17.86±2.86) and retirees (18.93±4.93) showing better adherence compared to students and the unemployed. Income expenditure patterns significantly influenced adherence (p=0.02), with participants who could save or invest money (18.96±4.22) adhering better than those in debt (16.18±4.07). For stress control methods, participants who listened to music (17.89±5.39) or took rest (17.49±2.96) had better adherence compared to those relying on prayer (16.64±5.37, p=0.03). However, no significant relationships were found with age, living status, type of family, BMI, duration of diagnosis, comorbidities, or family history of hypertension.

Table 4. The relationship among socio-demographic and health related characteristics with adherence to dietary recommendations among type 2 diabetic patients

Variables	Categories	Adherence to dietary recommendations	
		Mean ± SD	**t/F/r(P)**
Age (years)	Min = 30 & Max = 85		-0.11(0.10)
Total family income (Bangladeshi Taka)	Min = 8000 & Max= 200000		0.48(0.000)*
Gender	Male	17.62±3.84	2.23(0.02)*
	Female	16.34±4.48	
Religion	Muslim	17.13±4.47	0.94(0.35)
	Non-Muslim	16.54±3.57	
Marital status	Single	16.35±3.12	0.69(0.49)
	Married	17.18±3.89	
	Widow	16.96±6.15	
Education	Primary	16.45±4.39	3.03(0.02)*
	SSC	16.47±4.42	
	HSC	18.44±2.62	
	Graduate	19.71±3.15	
	Post-graduate	19.18±3.54	
Occupation	Govt. job	17.86±2.86	3.26(0.007)*
	Private job	18.12±4.99	
	Businessman	15.95±3.43	
	Retired	18.93±4.93	
	Student	16.00±5.59	
	Unemployment	16.11±3.94	
Living status	Rural	17.09±4.52	0.72(0.47)
	Urban	16.64±2.92	
Type of family	Nuclear family	17.04±3.83	0.28(0.78)
	Extended family	16.87±4.91	
Family history of hypertension	Yes	17.38±4.86	0.97(0.33)
	No	16.72±3.88	
Crowing index			0.80(0.24)
Income expenditure	In debt (inadequate)	16.18±4.07	3.29(0.02)*
	Just meet routine expenses (adequate)	16.43±4.15	
	Meet routine expenses and emergencies	17.65±3.54	
	Able to save or invest money	18.96±4.22	
BMI	Normal BMI	16.74±3.34	-0.82(0.41)
	Obese	17.38±5.85	
Duration of Diagnosis	Min = 1 and Max = 15	16.94±4.31	-0.08(0.23)
Comorbidities	No comorbidity	16.99±4.07	-0.06(0.95)
	comorbidities	16.04±3.14	
Way of stress control	Prayer	16.64±5.37	2.96(0.03)*
	Listening to music	17.89±5.39	
	Taking rest	17.49±2.96	
	Talking with family or friends	16.94±4.31	

DISCUSSION

The current paper aimed to explore the level of adherence on dietary recommendation among type 2 diabetic patients in the selected tertiary level hospitals in Barishal, Bangladesh. This chapter provides a detailed discussion of the key findings, focusing on the socio-demographic characteristics of the participants, identifying the health indicators, stress management, and medication adherence, measuring the perceived dietary adherence and exploring the relationship between socio-demographic factors and adherence on dietary recommendation among type 2 diabetic patients.

The socio-demographic characteristics of type 2 diabetic patients in the current study are broadly consistent with findings from other studies but reveal notable differences in some aspects. The average age of participants (M = 53.34, SD = 8.59, range 30–85 years) aligns with Abdelsalam et al. (2022), where the mean age was 52.00 ± 7.69 years. However, gender distribution varied, with females comprising 80% of participants in this study, compared to 52% in the Egyptian study, highlighting potential cultural or regional differences.

Residency patterns differed significantly, as 68.1% of participants in the current study lived in rural areas, compared to 65% residing in urban areas in the Egyptian study. Educational attainment was similar, with most participants in both studies having undergraduate education. Crowing index and living conditions were also comparable, indicating overcrowding as a common factor.

Income expenditure revealed that 53.7% of participants in the current study could just meet routine expenses, similar to the 57.5% reported in the Egyptian study. However, fewer participants in the Egyptian study (2.5%) could save or invest money compared to 11.7% in the current study.

Marital status was consistent, with 69.6% of participants in the current study married, similar to the 68% reported by Ayele *et al.*, (2018). However, occupational status varied significantly, with higher unemployment in the current study (47.7%) compared to the Ethiopian study (25.6%).

Finally, the prevalence of a family history of diabetes was comparable across studies, but hypertension history differed slightly, with 65% of participants in the current study reporting no hypertension compared to 72% in the Ethiopian study. These findings underscore the importance of considering socio-demographic contexts in diabetes management strategies.

The health status of participants in the current study provides insights into their physical condition, duration of diabetes diagnosis, comorbidities, and medication adherence, with findings that align with or diverge from other studies in notable ways. The mean BMI of participants in this study was 24.11 (SD = 3.35), with 68.7% categorized as having a normal body weight. This result contrasts with findings from a study conducted in Indonesia (Khusna *et al.*, 2023), where the mean BMI was 25.8 (SD = 4.48) and only 36.6% of participants were classified as having a normal body weight. These differences suggest that participants in the current study generally had better weight management, potentially due to varying lifestyle factors, cultural influences, or healthcare interventions.

The average duration of diabetes diagnosis among participants in the current study was 4.63 years (SD = 3.62), which is somewhat shorter than the 7.3 years (SD = 6.85) reported in the Indonesian study. This variation may reflect differences in participant recruitment or earlier detection and management practices in the current study setting. Comorbidity prevalence also showed notable differences. In the current study, 67.3% of participants reported no comorbidities, which is significantly higher than the 46% reported in the Indonesian study. This indicates a relatively healthier population in the current study. Similar findings were reported by Ayele *et al.*, (2018) in Ethiopia, where 59.7% of participants had no comorbidities, reinforcing the trend of lower comorbidity prevalence in the current study.

Medication adherence, assessed using the Four-Item Morisky Medication Adherence Scale (MMAS), showed a mean score of 3.62 (SD = 0.722), indicating low adherence levels. This aligns with findings from Al-Haj Mohd *et al.*, (2016) in the United Arab Emirates, where low medication adherence was similarly reported. The consistency across these studies suggests a broader challenge in ensuring adherence to prescribed treatments among type 2 diabetic patients. Overall, the findings emphasize the need for tailored interventions to address differences in health status and medication adherence, taking into account regional and cultural contexts.

In regards to the perceived dietary adherence of type 2 diabetic participants, this study reveals significant challenges in following dietary recommendations. With a mean perceived adherence score of 1.88 (SD = 0.47), participants reported infrequent or occasional adherence to prescribed dietary guidelines. Over half (56.1%) of the participants demonstrated poor adherence, underscoring the need for targeted interventions to improve dietary practices among this population. The findings align with studies in other regions that also report poor dietary adherence among type 2 diabetic patients. For instance, Abdelsalam *et al.*, (2022) found that 97.5% of participants in an Egyptian study failed to meet satisfactory dietary adherence levels. Notably, participants in the Egyptian study consumed high-fat and high-sugar foods more frequently, with mean weekly scores of 4.70 (SD = 2.23) and 4.16 (SD = 2.19), respectively. Similarly, participants in a study by Ayele *et al.*, (2018) exhibited high consumption of sugary foods, with a mean score of 5.49 (SD = 1.20) times per week. These findings indicate a global trend of low adherence to dietary recommendations, particularly concerning the consumption of unhealthy foods.

The current study identified specific areas where adherence was particularly low. For example, the lowest adherence was observed for the item "Eating foods low in fat," with a mean score of 1.15 (SD = 0.95), whereas the highest adherence was associated with "Following a healthful eating plan," with a mean score of 3.10 (SD = 1.62). This pattern suggests that while participants may attempt to follow general dietary advice, they struggle with specific and more restrictive recommendations, such as reducing fat intake. Similar trends were noted in studies by Khusna *et al.*, (2023), where poor adherence was reported for consuming omega-3-rich foods, high-fiber foods, and low-sugar options. Cultural and regional dietary practices may play a significant role in shaping adherence patterns. For instance, the consumption of foods prepared with olive oil was notably low in the Egyptian study (mean scores of 0.21 ± 0.47 and 0.48 ± 0.55 times per week), reflecting limited availability or cultural preferences. Likewise, in the current study, adherence to reducing fat intake was poor, which may be influenced by traditional dietary habits or lack of access to healthier food options.

This study evaluated the relationship between socio-demographic and health-related characteristics and adherence to dietary recommendations among patients with Type 2 diabetes. A significant relationship was observed between monthly family income and adherence to dietary recommendations ($r = 0.48$, $p = 0.000$). This finding suggests that individuals with higher family incomes tend to adhere more strictly to dietary guidelines. Higher income levels may provide greater access to nutritious food options, health education, and healthcare services, all of which can facilitate better diabetes management. This aligns with the findings of Ayele et al. (2018), who reported that higher income levels were associated with improved adherence to dietary recommendations in Ethiopian patients with Type 2 diabetes.

The study also found that gender ($t = 2.23$, $p = 0.02$) played a role, with male participants exhibiting better adherence to dietary recommendations compared to female participants. This result is consistent with previous research suggesting gender differences in health-related behaviors, which may be influenced by cultural, social, and familial roles that differ between men and women.

Regarding education level ($F = 3.03$, $p = 0.01$), participants with graduate and post-graduate degrees were more likely to follow dietary guidelines than those with undergraduate degrees. Education likely enhances individuals' understanding of the importance of dietary adherence in managing Type 2 diabetes, leading to better compliance with dietary recommendations. This is in agreement with Ayele et al. (2018), who identified education as a key factor influencing adherence.

The relationship between occupation and dietary adherence ($F = 3.26$, $p = 0.007$) revealed that retired individuals practiced better dietary behaviors than those who were employed. This could be due to retired individuals having more time to focus on health management and dietary habits, whereas employed individuals may face time constraints that hinder their ability to plan and prepare healthy meals.

In terms of income expenditure ($F = 3.29$, $p = 0.02$), individuals who had the ability to save or invest money were more likely to follow dietary guidelines than those who did not. Financial stability likely allows individuals to prioritize healthier food choices and invest in their health, supporting previous findings that financial resources play a significant role in managing chronic diseases like Type 2 diabetes.

A key finding from this study was the role of stress management ($F = 2.43$, $p = 0.04$) in influencing dietary adherence. Participants who engaged in stress-reducing practices, such as relaxation techniques or mindfulness, were more likely to adhere to their dietary plans. This finding supports the idea that effective stress management can improve overall well-being and make it easier for individuals to maintain healthy lifestyle choices, including dietary adherence.

These findings are in line with a study by Khusna *et al.*, (2023), which found that adherence to dietary recommendations among Type 2 diabetes patients was associated with comorbidities and the length of diagnosis. However, our study did not observe significant links between these variables, suggesting that other socio-demographic and health-related factors, such as income and occupation, may play a more dominant role in dietary adherence than clinical factors like comorbidities.

CONCLUSION

This study highlights the significant challenge of dietary adherence among Type 2 diabetes mellitus (T2DM) patients, with the findings indicating a very low level of compliance. The mean score for perceived dietary adherence signifying that most participants rarely or seldom followed the dietary recommendations. Over half of the participants reported not adhering to the prescribed dietary guidelines. The key barriers identified included co-morbidities, low monthly income, lack of prior exposure to dietary instruction, insufficient knowledge, and the inability to afford the recommended foods.

Despite some foods being well-conformed to dietary prescriptions, such as those high in omega-3 fatty acids, high-fiber foods, and low-sugar items, patients still struggled with incorporating certain healthy foods, such as fish, high-fiber diets, and olive or organic oils for frying. This indicates the need for targeted education and counseling, particularly focusing on these food groups. Healthcare professionals, including nurses, should make it a priority to provide tailored dietary education and motivate patients to include these foods in their daily meals, offering practical substitutes when necessary.

The study also found that individuals without additional comorbidities demonstrated a much higher level of dietary adherence. This underscores the importance of supporting T2DM patients, especially those with coexisting conditions, to adopt a healthy diet. To address these challenges, healthcare providers must proactively identify and remove obstacles to dietary adherence, while policymakers should ensure the availability of practical dietary guidelines for T2DM patients, particularly in underserved areas. In conclusion, enhancing dietary adherence in T2DM patients requires a multifaceted approach, including patient education, better access to affordable healthy foods, and comprehensive healthcare support.

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