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Assessment of Diabetes-Related Nutritional Knowledge and Adherence to Dietary Recommendations Among Patients with Type 2 Diabetes at Mthatha Hospital Complex, Eastern Cape, South Africa: A Facility-Based Cross-Sectional Study

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Highlights

Public health relevance—How does this work relate to a public health issue?

- Poor dietary adherence remains a major challenge among individuals with type 2 diabetes mellitus (T2DM), with nearly half of participants failing to follow recommended dietary practices, thereby compromising effective diabetes management and glycaemic control.
- By identifying nutritional knowledge gaps, limited exposure to nutrition education, and social and behavioural barriers such as family gatherings and eating outside the home, this study provides evidence to inform public health strategies aimed at improving dietary self-management among people living with T2DM.

Public health significance—Why is this work of significance to public health?

- The findings demonstrate that poor dietary adherence is closely associated with uncontrolled glycaemic status, increasing the risk of diabetes-related complications, reduced quality of life, and greater healthcare burden.
- By revealing that nutritional knowledge alone is insufficient to ensure adherence, this study highlights the importance of addressing social, behavioural, and environmental influences on dietary practices to achieve better diabetes outcomes.

Health implications—What are the key implications or messages for practitioners, policy makers and/or researchers in public health?

- This study underscores the need for strengthened, culturally sensitive, and patient-centred nutrition education programmes that equip individuals with practical dietary self-management skills and support sustained behavior change.
- For practitioners and policymakers, interventions that involve family and community support, address social influences on eating behaviour, and improve access to affordable healthy foods are essential for enhancing dietary adherence, improving glycaemic control, and reducing the long-term burden of T2DM.

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Abstract

Objective: To assess diabetes-related nutritional knowledge, dietary adherence, and factors associated with poor dietary adherence among patients with type 2 diabetes mellitus

(T2DM) attending the Mthatha Hospital Complex in the Eastern Cape, South Africa. **Methods:** A facility-based cross-sectional study was conducted between May and December 2025 among 227 patients with T2DM attending Mthatha Regional Hospital and Nelson Mandela Academic Hospital. Participants were selected using systematic sampling. Data were collected using a structured interviewer-administered questionnaire. Nutritional knowledge was assessed using items adapted from the revised General Nutrition Knowledge Questionnaire, while dietary adherence was measured using the nine-item Perceived Dietary Adherence Questionnaire (PDAQ). Binary logistic regression was performed to identify factors associated with poor dietary adherence. **Results:** The median age of participants was 61 years (IQR: 49–68), and 53.3% were female. Overall, 48.5% (95% CI: 42.0–54.9) of participants had poor dietary adherence, while 61.2% (95% CI: 54.8–67.4) demonstrated high diabetes-related nutritional knowledge. Poor dietary adherence was significantly associated with age ≤ 30 years [Adjusted Odds Ratio (AOR) = 6.36, 95% CI: 1.36–29.74)], low nutritional knowledge (AOR = 4.89, 95% CI: 2.24–10.65), gathering with friends and family (AOR = 4.75, 95% CI: 1.87–12.05), eating outside the home (AOR = 2.79, 95% CI: 1.27–6.13), and uncontrolled HbA1c levels (AOR = 2.55, 95% CI: 1.25–5.19). Attendance at nutrition education sessions was associated with lower odds of poor dietary adherence (AOR = 0.22, 95% CI: 0.05–0.97). **Conclusions:** Significant knowledge-related, social, behavioral, and environmental barriers to optimal dietary adherence persist, highlighting the need for strengthened diabetes nutrition education, patient-centered interventions, and supportive public health strategies that facilitate healthy dietary practices and improved glycaemic control.

Keywords: type 2 diabetes mellitus; dietary adherence; nutritional knowledge; nutrition education; glycaemic control; Eastern Cape; South Africa

1. Introduction

Diabetes mellitus is a metabolic disorder of multiple aetiologies characterized by persistent hyperglycaemia resulting from defects in insulin secretion, insulin action, or both [1,2]. It is a major global public health concern, affecting approximately 589 million adults worldwide in 2024, with numbers projected to rise substantially over the coming decades [3]. Type 2 diabetes mellitus (T2DM), which accounts for more than 90% of diabetes cases, is associated with significant morbidity, mortality, and healthcare costs due to its microvascular and macrovascular complications [3–8]. In South Africa, T2DM remains a growing burden, with a pooled adult prevalence of 15.25% and considerable economic and mortality implications [9,10].

Optimal glycaemic control is central to T2DM management and requires a combination of pharmacological treatment and lifestyle modification. Among lifestyle interventions, nutrition therapy is widely recognized as a cornerstone of diabetes care because of its role in improving glycaemic outcomes and reducing diabetes-related complications [11–13]. In this context, nutritional knowledge plays an important role in diabetes self-management by influencing patients' ability to make informed dietary choices and adhere to recommended eating practices [13,14]. Studies have shown that improved nutritional knowledge is associated with healthier dietary behaviours, better adherence to dietary recommendations, improved glycaemic control, and reduced cardiovascular risk factors [15–20].

Nevertheless, adherence to dietary recommendations remains a major challenge among individuals with T2DM. Studies conducted in various settings have reported substantial variation in adherence, ranging from 15.7% to 50.2% [18,21–24]. Poor dietary adherence has been associated with factors such as limited nutritional knowledge, financial constraints,

inadequate access to healthy foods, sociocultural influences, and food preferences, while access to nutrition information and social support have been identified as important facilitators of adherence [18,25–28].

In South Africa, diabetes management guidelines emphasize nutrition education as part of routine diabetes care [29–31], through initiatives such as group empowerment and training programmes [32]. However, adherence to dietary recommendations remains suboptimal and is often considered one of the most difficult aspects of diabetes self-management [28,33]. In the rural Eastern Cape, poor adherence to diabetic diets has been identified as a significant barrier to effective disease management, alongside persistently poor glycaemic control among many patients with T2DM [34–36].

At Mthatha Regional Hospital and Nelson Mandela Academic Hospital, routine nutrition education is provided to patients; however, there remains a paucity of evidence regarding the level of diabetes-related nutritional knowledge and the extent to which this knowledge translates into adherence to recommended dietary practices. Furthermore, the sociocultural and economic factors influencing dietary behaviour in this predominantly rural population remain poorly understood. This knowledge gap is particularly important given the strong evidence linking dietary adherence to improved glycaemic control and reduced diabetes-related complications [15,19,37]. Therefore, this study aimed to assess diabetes-related nutritional knowledge, adherence to dietary recommendations, and factors associated with poor adherence among patients with T2DM attending the Mthatha Hospital Complex (MHC) in the Eastern Cape, South Africa.

2. Materials and Methods

2.1. Study Design and Setting

A facility-based cross-sectional study was conducted from 13 May 2025 to 30 December 2025 at the MHC in Mthatha, Eastern Cape, South Africa. The complex comprises Mthatha Regional Hospital (MRH) and Nelson Mandela Academic Hospital (NMAH), which provide specialized and referral healthcare services to a predominantly rural population within the Eastern Cape Province. The facilities manage a large number of patients with T2DM, including those with uncontrolled diabetes and diabetes-related complications.

As part of comprehensive diabetes care, nutrition education is routinely provided by professional nurses in the internal medicine outpatient units and resident dietitians. Education is delivered through both group-based and individual counselling sessions. Group education sessions are conducted on clinic days and typically cover topics such as the definition, types, symptoms, and risk factors of diabetes; glycaemic monitoring; target blood glucose levels; medication adherence; healthy eating; weight management; and lifestyle modification. These sessions generally last 30–60 min, depending on patient attendance and discussion needs. Patients with specific nutritional concerns, poor glycaemic control, or clinician referral receive individualized nutrition counselling from a dietitian. These consultations typically last 20–45 min and include an assessment of dietary practices, barriers to adherence, household circumstances, food access and preparation, family support, and financial status. Nutrition education is tailored to each patient's context and includes meal planning, portion control, use of the plate model, food-group selection, carbohydrate management, healthy food substitutions, and practical strategies for adhering to dietary recommendations within available resources. Follow-up counselling is provided during subsequent clinic visits to reinforce dietary practices and support continuous modification of eating behaviours until optimal glycaemic control is achieved.

2.2. Study Population and Participants

The study population comprised patients diagnosed with T2DM who were receiving care at the diabetic outpatient clinics or admitted to the wards of the two hospitals. Participants included individuals aged 15 years and older who were permanent residents of the rural Eastern Cape region. Adolescents aged 15–17 years were included because T2DM occurs in this age group and such patients routinely receive diabetes care at the study sites, consistent with growing evidence of adolescent T2DM globally and in South Africa [38,39]. Patients diagnosed with other types of diabetes mellitus and those who were non-residents of the study area were excluded from the study.

2.3. Sample Size and Sampling Procedure

The sample size was calculated using Cochran's formula for estimating a single population proportion formula $n_0 = \frac{Z^2 \cdot p \cdot (1-p)}{E^2}$ (Ref. [40], based on the rate of poor dietary practice reported in another South African setting (43.7%) [41]. Where n_0 signifies the initial sample size, Z signifies the standard normal value at a 95% confidence level (1.96), p signifies the prevalence of poor dietary practice (43.7%), and E signifies the margin of error (0.05). Using these parameters, the initial sample size was calculated to be 379 participants. Since the study population was finite, a finite population correction was applied using the formula: $n' = \frac{n_0}{1+\frac{n_0}{N}}$ [42]. Where n' signifies the corrected sample size, n_0 signifies the initial sample size, and N signifies the total study population. The total population (N) was estimated at 450 participants, based on the average number of patients attending the two study sites in the previous year (250 participants from NMAH and 200 participants from MRH). Following application of the finite population correction, the minimum required sample size obtained was 206 participants. To account for nonresponse and incomplete questionnaires, a 10% contingency was added, resulting in a final estimated sample size of 227 participants. The sample was proportionally allocated between the two study sites according to their respective population sizes. Thus, 125 participants were recruited from NMAH, and 102 from MRH.

A systematic sampling technique was used to select participants. Patients attending the weekly diabetes clinic were recruited using a fixed sampling interval, with the first eligible patient selected from the clinic attendance list and every second eligible patient recruited thereafter. The average attendance per clinic day was approximately 20 patients. The same sampling procedure was applied to eligible patients with both hypertension and diabetes attending the weekly hypertension clinic. Additionally, eligible patients admitted to the wards were selected using the same systematic sampling approach.

2.4. Data Collection Tools, Procedures, and Measurements

Data were collected using a structured interviewer-administered questionnaire developed in line with the study objectives. The questionnaire was prepared in English, translated into IsiXhosa, and then backtranslated to ensure consistency. Data collection was conducted during routine clinic visits and hospital admissions, and each session lasted approximately 20–30 min. Six trained research assistants were used to collect data; three at each hospital, each distributed to the diabetes clinic day, the hypertension clinic day, and the wards. Completed questionnaires were checked for completeness before participants were released, a process that was free of coercion, with participants retaining the right to decline to answer any question. The questionnaire consisted of three sections:

2.4.1. Section A: Sociodemographic, Health, Behavioural, and Food-Related Characteristics

This section captured participants' age, gender, ethnicity, marital status, education level, employment status, monthly income, and place of residence. Health-related information included duration of diabetes, type of treatment, medication adherence, presence of comorbidities, and episodes of hypoglycaemia. The most recent HbA1c values, or levels of diabetes control, were also obtained from patients' medical records. Behavioural and food-related characteristics, including physical activity, smoking, alcohol use, frequency of nutrition education, and time since the last education session, were also assessed. Perceived barriers to dietary adherence were also assessed, including financial constraints, social gatherings, eating out, time constraints, and difficulty adapting to dietary changes.

2.4.2. Section B: Diabetes-Related Nutritional Knowledge

Diabetes-related nutritional knowledge was assessed using a questionnaire adapted from the revised General Nutrition Knowledge Questionnaire [43] and previously used in a similar study [18]. The instrument comprised nine knowledge domains, including dietary recommendations, fruit and vegetable intake, sources of nutrients, fibre content, nutrient profiles, healthy food choices, added sugars, fats, cholesterol, and glycaemic index. These domains consisted of 28 individual knowledge questions, with each correct response worth 1 point, yielding a total score ranging from 0 to 28. Participants scoring at or above the median were classified as having high nutritional knowledge, while those scoring below the median were classified as having low nutritional knowledge.

2.4.3. Section C: Adherence to Dietary Recommendations

Adherence to dietary recommendations was assessed using the nine-item Perceived Dietary Adherence Questionnaire (PDAQ), which evaluates dietary practices over the preceding seven days [44]. Each item was scored on a 7-point Likert scale, with higher scores indicating better adherence. Items reflecting unhealthy dietary behaviours, such as consumption of foods high in sugar and fat, were reverse-coded prior to analysis. The questionnaire was modified to reflect locally relevant dietary guidelines and commonly consumed foods.

2.5. Data Quality Assurance

The validity and reliability of the data collection instruments were carefully assessed before the main study. The PDAQ and revised General Nutrition Knowledge Questionnaire (GNKQ-R) have demonstrated acceptable psychometric properties in previous studies, with reported Cronbach's alpha coefficients of 0.78 and 0.93, respectively [43,44]. Furthermore, the PDAQ has been successfully utilized in diabetes-related research conducted in Ghana and Ethiopia, supporting its applicability in similar contexts [18,26]. In this study, face and content validity were established through expert review by professionals in diabetes care and nutrition. A pretest was conducted with 30 adults with T2DM attending diabetes and hypertension clinics, as well as those admitted to the wards at the two study sites, to assess the instruments' clarity, feasibility, and reliability. The pretest yielded Cronbach's alpha coefficients of 0.69 for the PDAQ and 0.82 for the GNKQ-R, indicating acceptable internal consistency. Based on the findings, revisions were made to improve questionnaire instructions, item wording, question sequencing, and grammatical accuracy before the main study commenced.

2.6. Data Management and Analysis

Collected data were entered into Microsoft Excel, cleaned, and exported to IBM SPSS Statistics version 30 (IBM Corp., Armonk, NY, USA, 2023) for analysis. Following data verification and cleaning, no missing data were identified; therefore, no imputation was required.

Descriptive and inferential statistics were used to summarise the data. All continuous variables, including PDAQ scores, were non-normally distributed and are presented as medians and interquartile ranges (IQRs). Categorical variables, including GNKQ-R parameters, were summarised using frequencies and percentages. Bivariate analyses were conducted using the Chi-square test or Fisher's exact test when the assumptions of the Chi-square test were not met. Variables that showed significant associations with dietary adherence in the bivariate analysis were entered into a binary logistic regression model to identify independent factors associated with poor dietary adherence. Self-reported medication adherence was significantly associated with PDAQ scores in the bivariate analysis; however, it was excluded from the multivariable model due to conceptual overlap with the outcome variable and its potential role in the causal pathway, which could lead to over-adjustment and biased effect estimates. In addition, its highly imbalanced category distribution could compromise the stability of regression estimates. After exclusion, model fit was assessed using the Hosmer–Lemeshow goodness-of-fit test, which indicated an adequate fit to the data ($p = 0.405$). Statistical significance was set at $p < 0.05$ for all inferential analyses.

3. Results

3.1. Characteristics of Patients with Diabetes

3.1.1. Sociodemographic Characteristics of Patients with Type 2 Diabetes Mellitus

A total of 227 participants were included in the study. The median age was 61 years (IQR: 49–68). Most participants (212; 93.4%) were aged 30 years or older. Almost all (220; 96.9%) of the participants were African. A total of 121 (53.3%) were females, and more than half, 137 (60.4%), were also married. More than half of the participants (115, 50.7%) were peri-urban dwellers, and 101 (44.5%) were rural residents. Nearly half (125, 55.1%) had below Grade 12 education, and 55 (24.2%) had completed matric. More than half (174, 76.7%) were unemployed, and 53 (23.3%) were employed. Most participants (199, 87.7%) had a monthly income greater than R2000 (Table 1).

Table 1. Sociodemographic characteristics of participants, Mthatha Hospital Complex, Eastern Cape, South Africa, 2025 ($n = 227$).

Variable	Categories	Frequency	Valid Percent
Age group (years)	≤30 years	15	6.6%
	>30 years	212	93.4%
	Median (IQR)|Min–Max	61 (49–68)	15–86
Ethnicity	African	220	96.9%
	White	1	0.4%
	Asian	1	0.4%
	Indian	3	1.3%
	Coloured	2	0.9%
Gender	Male	106	46.7%
	Female	121	53.3%
Residence	Rural	101	44.5%
	Peri-urban	115	50.7%
	Urban	11	4.8%
Marital status	Single	66	29.1%
	Cohabiting	15	6.6%
	Married	137	60.4%
	Divorced	3	1.3%
	Separated	6	2.6%

Table 1. *Cont.*

Variable	Categories	Frequency	Valid Percent
Highest level of education attained	No education	16	7.0%
	Below Grade 12	125	55.1%
	Matric	55	24.2%
	Degree/Diploma	25	11.0%
	Post-degree/Diploma	6	2.6%
Employment status	Student	10	4.4%
	Employed in the private sector	7	3.1%
	Employed in the public sector	26	11.5%
	Self-employed	20	8.8%
	Unemployed	117	51.5%
	Retired	47	20.7%
Monthly income (in rand)	<1000	15	6.6%
	1000–2000	13	5.7%
	>2000	199	87.7%

3.1.2. Health-Related Characteristics of the Participants

In this study, 154 (67.8%) participants reported a family history of diabetes mellitus. The majority of participants (155; 68.3%) had been living with diabetes for at least five years. Similarly, 155 (68.3%) participants had one or more chronic comorbidities, with hypertension being the most prevalent, affecting 146 (64.3%) participants. Almost all participants (219; 96.5%) reported adherence to their prescribed antidiabetic medications. Regarding glycaemic control, more than half of the participants (118; 52%) had uncontrolled HbA1c levels (Table 2). Supplementary Tables S1 and S2 present the distributions of selected participant characteristics by self-reported medication adherence and glycaemic control, respectively.

Table 2. Health-related characteristics of T2DM patients, Mthatha Hospital Complex, Eastern Cape, South Africa, 2025 ($n = 227$).

Variables	Categories	Frequency	Valid Percent
Family history of diabetes mellitus	Yes	154	67.8%
	No	73	32.2%
Duration of living with diabetes mellitus	Less than five years	72	31.7%
	5 years and above	155	68.3%
Diabetic treatment	Oral hypoglycaemics	152	67.0%
	Insulin	14	6.2%
	Oral hypoglycaemics and insulin	61	26.9%
Adherence to diabetic medication	Yes	219	96.5%
	No	8	3.5%
Experienced hypoglycemia last month	Less than three times	88	38.8%
	More than three times	16	7.0%
	None	123	54.2%
Presence of other medical conditions	Yes	155	68.3%
	No	72	31.7%
Hypertension	Yes	146	64.3%
	No	81	35.7%
Dyslipidemia	Yes	8	3.5%
	No	219	96.5%

Table 2. *Cont.*

Variables	Categories	Frequency	Valid Percent
Chronic kidney disease	Yes	10	4.4%
	No	217	95.6%
Retinopathy	Yes	9	4.0%
	No	218	96.0%
Heart disease	Yes	23	10.1%
	No	204	89.9%
HIV	Yes	26	11.5%
	No	201	88.5%
Level of Control of diabetes mellitus based on HbA1c (%)	Controlled	109	48.0%
	Uncontrolled	118	52.0%

3.1.3. Behavioral-Related Characteristics of Participants

Of the total participants, more than half (144; 63.4%) did not exercise, while 83 (36.6%) reported exercising. Fifty-two (22.9%) of the participants currently smoked cigarettes, and the majority, 175 (77.1%), did not smoke. Sixty (26.4%) of the participants currently consumed drinks containing alcohol, while the majority, 167 (73.6%), did not consume alcohol (Table 3).

Table 3. Behavioral-related characteristics of T2DM patients, Mthatha Hospital Complex, Eastern Cape, South Africa, 2025 ($n = 227$).

Variables		Frequency	Valid Percent
Doing exercise	Yes	83	36.6%
	No	144	63.4%
Currently smoke cigarette	Yes	52	22.9%
	No	175	77.1%
Currently consume drinks containing alcohol	Yes	60	26.4%
	No	167	73.6%

3.1.4. Food-Related Factors of Participants

The median yearly frequency of nutritional education was 2 sessions (IQR: 1–3; range: 0–12). Most participants (171; 75.3%) had received nutritional education within the past year, while 25 (11.0%) had never received any. Regarding barriers to adherence to dietary recommendations, most participants (195; 85.9%) reported that recommended diets were difficult to afford due to financial constraints and their additional cost. Similarly, 189 (83.3%) indicated that recommended diets were sometimes unavailable for purchase. More than half of the participants (130; 57.3%) reported inappropriate dietary habits, such as eating snacks between meals. Other commonly reported barriers included eating outside the home (96; 42.3%), busy schedules that made adherence difficult (87; 38.3%), struggling to adjust eating habits to recommended diets (80; 35.2%), and gatherings with friends and family (74; 32.6%) (Table 4).

Table 4. Nutrition education and lived barriers to adherence of participants, Mthatha Hospital Complex, Eastern Cape, South Africa, 2025 (n = 227).

Food-Related Variables	Frequency	Valid Percent
Yearly frequency of nutritional education		
Median (IQR)|min–max	2 (1–3)	0–12
Last nutritional education session		
Never	25	11.0%
<1 year	171	75.3%
1–4 years	22	9.7%
>4–10 years	7	3.1%
>10 years	2	0.9%
Reported barriers to adherence to dietary recommendations		
The recommended diets are difficult to afford due to financial constraints and their additional cost	195	85.9%
The recommended diet is sometimes not available for purchase	189	83.3%
Inappropriate dietary habits like eating snacks between meals	130	57.3%
Eating outside the home	96	42.3%
Busy schedules make it difficult to adhere to dietary recommendations	87	38.3%
Struggling to adjust eating habits to the recommended ones	80	35.2%
Gathering with friends and family	74	32.6%

3.2. Nutritional Knowledge of the Participants Based on the General Diabetes Nutritional Knowledge

Participants had a wide range of diabetes-related nutrition knowledge, with a median score of 16 (IQR: 14–19). More than half of the participants (139; 61.2%) had high diabetes-related nutrition knowledge (scoring at or above the median), while 88 (38.8%) had low knowledge. Most participants correctly identified recommendations for reducing sugar intake (167, 73.6%) and vegetable intake (186, 81.9%), as well as recommendations on foods related to cholesterol (184, 81.1%) and the glycemic index (164, 72.2%). However, knowledge gaps were observed, as many participants incorrectly identified processed red meat (120, 52.9%) and whole grains (153, 67.4%). Additionally, misconceptions were noted in areas such as fruit and vegetable serving sizes (217; 95.6%), dietary fiber profile in eggs (161; 70.9%), and healthy fats, with 200 (88.1%) not correctly identifying the recommended oils (Table 5). Supplementary Table S3 presents the distribution of selected participant characteristics by knowledge level.

Table 5. Nutritional knowledge of participants, Mthatha Hospital Complex, Eastern Cape, South Africa, 2025 ($n = 227$).

General Diabetes Nutritional Knowledge Items	Correctly Answered	Incorrectly Answered
	n (%)	*n* (%)
Knowledge of dietary recommendations and minimum fruit and vegetable servings by health professionals		
PLWD should be eating fruits	149 (65.6%)	78 (34.4%)
PLWD should be eating food and drinks with added sugar	167 (73.6%)	60 (26.4%)
PLWD should be eating vegetables	186 (81.9%)	41 (18.1%)
PLWD should be eating fatty foods	180 (79.3%)	47 (20.7%)
PLWD should be eating processed red meat	107 (47.1%)	120 (52.9%)
PLWD should be eating wholegrains	74 (32.6%)	153 (67.4%)
Number of servings of fruit and vegetables per day	10 (4.4%)	217 (95.6%)
Knowledge of sources of nutrients in food		
Fat for PLWD, for example olive oil, sunflower oil, soybean oil	27 (11.9%)	200 (88.1%)
Fat for PLWD, for example margarine, peanut butter, French fries	184 (81.1%)	43 (18.9%)
Fat for PLWD, for example fatty meat (like pork), coconut oil, cheese	193 (85.0%)	34 (15.0%)
Knowledge of fibre profile in food		
Oats are typically high or low in fiber	148 (65.2%)	79 (34.8%)
Banana is typically high or low in fiber	91 (40.1%)	136 (59.9%)
White rice is typically high or low in fibre	103 (45.4%)	124 (54.6%)
Eggs are typically high or low in fibre	66 (29.1%)	161 (70.9%)
Pasta is typically high or low in fibre	75 (33.0%)	152 (67.0%)
Brown rice is typically high or low in fibre	115 (50.7%)	112 (49.3%)
Knowledge of nutrient profiles in food		
Pasta is considered a starchy food	110 (48.5%)	117 (51.5%)
Potatoes are considered starchy foods	209 (92.1%)	18 (7.9%)
Nuts are considered starchy foods	71 (31.3%)	156 (68.7%)
Bananas are considered starchy foods	98 (43.2%)	129 (56.8%)
Knowledge of healthy food choices		
The healthiest and most balanced choice for a main meal in a restaurant	214 (94.3%)	13 (5.7%)
Knowledge of sugar profile in food		
Zero cola drinks are typically high or low in added sugar	92 (40.5%)	135 (59.5%)
Plain yoghurt is typically high or low in added sugar	140 (61.7%)	87 (38.3%)
Ice cream is typically high or low in added sugar	180 (79.3%)	47 (20.7%)
Tomato ketchup is typically high or low in added sugar	114 (50.2%)	113 (49.8%)
Melon typically high or low in added sugar	176 (77.5%)	51 (22.5%)
Knowledge of cholesterol and glycemic index in food		
Food more likely to raise people's blood cholesterol	184 (81.1%)	43 (18.9%)
Foods classified as having a high Glycaemic index	164 (72.2%)	63 (27.8%)
Total knowledge	Median (IQR)	16 (14–19)
Knowledge level		
High diabetes-related nutrition knowledge	n (%; 95% CI)	139 (61.2; 54.8–67.4)
Low diabetes-related nutrition knowledge	n (%; 95% CI)	88 (38.8; 32.6–45.2)

PLWD: People living with diabetes.

3.3. Dietary Practice of the Participants with Respect to the Nine Items Measuring Adherence

Slightly more than half of the participants (117; 51.5%) had good dietary adherence, defined as a score equal to or above the median, while 110 (48.5%) exhibited poor dietary adherence. The median (IQR) total dietary adherence score was 37 (33–41). The highest median (IQR) scores were observed for adherence to dietary recommendations provided by healthcare professionals [5 (3–6)] and fruit and vegetable consumption [5 (3–6)]. The lowest median (IQR) scores were recorded for the consumption of foods high in sugar [1 (0–3)] and foods high in fat [1 (1–2)] (Table 6).

Table 6. Perceived Dietary Adherence Questionnaire (PDAQ) score of participants, Mthatha Hospital Complex, Eastern Cape, South Africa, 2025 (n = 227).

Perceived Dietary Adherence Items	Median (IQR)
Number of days in the last seven days:	
That dietary recommendations given by your HCP were followed	5 (3–6)
That the number of fruits and vegetables supposed to be eaten based on recommendations from HCP was eaten	5 (3–6)
That carbohydrate-containing foods with a low glycemic Index were eaten	4 (3–5)
During which foods high in sugar, such as cakes, cookies, desserts, and candies, were eaten	1 (0–3)
During which foods high in fiber, such as oatmeal, high-fiber cereals (wheat, brown rice), and whole-grain bread, were eaten	4 (3–5)
During which carbohydrates were spaced evenly throughout the day	4 (2–5)
That fish or other foods high in omega-3 (shrimp, soybean oil) were eaten	2 (1–4)
Foods that contained or were prepared with sunflower, soybean, or olive oils were eaten	4 (2–5)
Foods high in fat (such as high-fat dairy products, fatty meat, fried foods, or deep-fried foods) were eaten	1 (1–2)
Total adherence PDAQ| Median (IQR)	37 (33–41)
	n (%; 95% CI)
Dietary adherence level	
Good dietary adherence	117 (51.5; 45.1–58.0)
Poor dietary adherence	110 (48.5; 42.0–54.9)

3.4. Factors Affecting Dietary Adherence of Patients with Diabetes

The multivariable logistic regression analysis revealed that age group, knowledge level, prior exposure to nutritional education, gathering with friends and family, eating outside the home, and level of diabetic control were significantly associated with poor dietary adherence. In this study, patients aged ≤ 30 years were 6 times more likely (adjusted Odds Ratio [AOR] = 6.364; 95% CI, 1.362 to 29.735) to have poor dietary adherence compared with those aged > 30 years. Patients with low diabetes-related nutrition knowledge were nearly five times more likely (AOR = 4.887, 95% CI 2.243 to 10.650) to have poor dietary adherence compared with those with high knowledge. Patients who received nutrition education were less likely (AOR = 0.221, 95% CI 0.050 to 0.966) to have poor dietary adherence than those who did not. Patients who reported gathering with friends and family were almost five times as likely to have poor dietary adherence (AOR = 4.752, 95% CI 1.873 to 12.054) as those who did not. Similarly, patients who ate outside the home were nearly three times as likely to have poor dietary adherence (AOR = 2.786, 95% CI 1.265 to 6.134) as those who did not. Patients with uncontrolled HbA1c were about three times as likely (AOR = 2.545, 95% CI 1.249 to 5.188) to have poor dietary adherence compared with those with controlled HbA1c (Table 7).

Table 7. Bivariate and multivariate logistic regression analysis of factors affecting dietary practice of patients with diabetes, Mthatha Hospital Complex, Eastern Cape, South Africa, 2025.

Variables with Categories	Good Adherence n (%)	Poor Adherence n (%)	COR (95% CI)	AOR (95% CI)
Age group				
>30 years	113 (53.3%)	99 (46.7%)	1	1
≤30 years	4 (26.7%)	11 (73.3%)	3.1 (1.0–10.2) *	6.4 (1.4–29.7) *
Ethnicity				
African	116 (52.7%)	104 (47.3%)	1	-
Others	1 (14.3%)	6 (85.7%)	6.7 (0.8–56.5)	-
Gender				
Female	63 (52.1%)	58 (47.9%)	1	-
Male	54 (50.9%)	52 (49.1%)	1.0 (0.6–1.8)	-
Residence				
Peri-urban/Urban	66 (52.4%)	60 (47.6%)	1	-
Rural	51 (50.5%)	50 (49.5%)	1.1 (0.6–1.8)	-
Marital status				
Single	32 (48.5%)	34 (51.5%)	1	-
Married/Cohabiting	81 (53.3%)	71 (46.7%)	0.8 (0.5–1.5)	-
Divorced/Separated	4 (44.4%)	5 (55.6%)	1.2 (0.3–4.8)	-
Highest education level				
Attended school	110 (52.1%)	101 (47.9%)	1	-
Never attended school	7 (43.8%)	9 (56.3%)	1.4 (0.5–3.9)	-
Employment status				
Unemployed	94 (54.0%)	80 (46.0%)	1	-
Employed	23 (43.4%)	30 (56.6%)	1.5 (0.8–2.8)	-
Income (rand)				
>2000	106 (53.3%)	93 (46.7%)	1	-
≤2000	11 (39.3%)	17 (60.7%)	1.8 (0.8–4.0)	-
Family history of diabetes				
No	36 (49.3%)	37 (50.7%)	1	-
Yes	81 (52.6%)	73 (47.4%)	1.1 (0.7–2.0)	-
Duration of diabetes				
<5 years	39 (54.2%)	33 (45.8%)	1	-
≥5 years	78 (50.3%)	77 (49.7%)	1.2 (0.7–2.0)	-
Adherence to medication				
No	0 (0.0%)	8 (100.0%)	1	-
Yes	117 (53.4%)	102 (46.6%)	0.0 (0.0) *	-
Other medical conditions				
No	41 (56.9%)	31 (43.1%)	1	-
Yes	76 (49.0%)	79 (51.0%)	1.4 (0.8–2.4)	-
Level of control based on HbA1c (%)				
Controlled	70 (64.2%)	39 (35.8%)	1	1
Uncontrolled	47 (39.8%)	71 (60.2%)	2.7 (1.6–4.6) **	2.5 (1.2–5.2) *
Received a nutritional education				
No	4 (16.0%)	21 (84.0%)	1	1
Yes	113 (55.9%)	89 (44.1%)	0.2 (0.1–0.5) **	0.221 (0.1–1.0) *
Financial constraints				
Yes	95 (48.7%)	100 (51.3%)	1	1
No	22 (68.8%)	10 (31.3%)	0.4 (0.2–1.0) *	0.7 (0.2–2.0)
Gathering with friends/family				
No	106 (69.3%)	47 (30.7%)	1	1
Yes	11 (14.9%)	63 (85.1%)	12.9 (6.2–26.7) **	4.8 (1.9–12.1) *
Eating outside the home				
No	87 (66.4%)	44 (33.6%)	1	1
Yes	30 (31.3%)	66 (68.8%)	4.4 (2.5–7.6) **	2.8 (1.3–6.1) *
Struggling to adjust diet				
No	85 (57.8%)	62 (42.2%)	1	1
Yes	32 (40.0%)	48 (60.0%)	2.1 (1.2–3.6) *	1.3 (0.6–2.7)
Diabetes-related nutrition knowledge level				
High	96 (69.1%)	43 (30.9%)	1	1
Low	21 (23.9%)	67 (76.1%)	7.1 (3.9–13.1) **	4.887 (2.2–10.7) **

COR: Crude odds ratio, AOR: adjusted OR, * $p < 0.05$, ** $p < 0.001$, Hosmer–Lemeshow goodness of fit = 0.405.

4. Discussion

This study assessed diabetes-related nutritional knowledge and dietary adherence, as well as the factors associated with adherence, among patients with T2DM attending the

Mthatha Hospital Complex. The findings showed that more than half of the participants (61.2%) demonstrated high diabetes-related nutritional knowledge. This finding is consistent with studies conducted in Ghana, Lebanon, and Limpopo province of South Africa, which reported relatively high levels of nutritional knowledge among individuals with diabetes [18,28,45]. In the Lebowakgomo study, 53% of participants demonstrated good nutritional knowledge and 11% had excellent knowledge, although important misconceptions regarding food variety, portion control, meal frequency, healthy fats, and fruit and vegetable intake were still evident [28]. Similarly, Wilson et al. found that 53.5% of participants had high diabetes-related nutritional knowledge [18]. In contrast, studies conducted in Ethiopia and Saudi Arabia reported lower levels of nutritional knowledge among patients with diabetes [46,47]. The relatively high level of knowledge observed in this study may be explained by the large proportion of participants who reported receiving nutritional education during the previous year. Nevertheless, important knowledge gaps remained, particularly regarding recommended serving sizes of fruits and vegetables, dietary fibre sources, and healthy fats. Similar deficiencies in practical nutrition knowledge have been reported in Ireland and global systematic reviews, despite generally acceptable overall levels of dietary awareness [48,49].

Although participants' dietary knowledge was high, only 51.5% demonstrated good adherence to dietary recommendations, while 48.5% had poor adherence. This finding suggests that adequate knowledge does not necessarily translate into optimal dietary practices. The observed gap between dietary knowledge and adherence may be explained by Social Cognitive Theory, which posits that behaviour change arises from the interaction of personal, environmental, and behavioural factors [50]. Thus, knowledge alone may be insufficient if individuals lack self-efficacy or face environmental barriers that limit their ability to adopt recommended behaviours. Similarly, the COM-B model proposes that behaviour occurs only when capability, opportunity, and motivation are present simultaneously [51,52]. Although participants demonstrated adequate dietary knowledge, reflecting capability, contextual factors may have restricted opportunities for adherence, while motivational factors may have further impeded the translation of knowledge into dietary practice.

Nevertheless, the observed adherence rate should be interpreted with caution as the instrument's reliability was below the conventionally accepted threshold. Despite this, the observed level of dietary adherence remains meaningful when considered alongside existing literature. It was comparable to the 50.7% reported by Wilson et al. in Ghana [18], lower than the rates of 57.4% and 62.8% reported among patients with T2DM in Ethiopia [53,54], but higher than the 44.6% reported in another Ethiopian study [55].

These variations may reflect differences in socioeconomic conditions, cultural dietary practices, healthcare support, and access to recommended foods across settings. In the present study, financial constraints and limited availability of recommended foods may partly explain the disconnect between dietary knowledge and adherence. Although affordability was not statistically significant in the multivariable model, most participants reported difficulty affording recommended foods. Similar findings have been reported elsewhere, where the cost and availability of healthy foods were identified as major determinants of dietary behaviour [18,23,25,26]. Likewise, Ambaw et al. found that concerns about the high cost of healthy foods significantly increased the likelihood of poor dietary practices [55]. Financial limitations may therefore compel individuals to prioritize inexpensive, energy-dense foods over nutritionally balanced diets, thereby compromising adherence to dietary recommendations. These findings support the proposition of both Social Cognitive Theory and the COM-B model that environmental constraints can impede the translation of dietary knowledge into sustained dietary adherence.

The present study further demonstrated that participants with lower nutritional knowledge were significantly more likely to exhibit poor dietary adherence than those with higher levels of knowledge. This finding is consistent with previous studies that identified nutritional knowledge as an important determinant of dietary behaviour among individuals with T2DM [18–20]. Similarly, a study conducted in Ghana found that higher diabetes-related nutritional knowledge significantly increased the likelihood of good dietary adherence among T2DM patients [18]. These findings support the proposition that greater nutritional knowledge may be associated with healthier dietary choices and better diabetes outcomes [13,14]. Consistent with this, participants with higher diabetes-related nutrition knowledge in the present study were more likely to achieve good glycaemic control (Supplementary Table S3). However, knowledge alone may not be sufficient to optimize outcomes. Health literacy, defined as the personal knowledge and competencies that enable individuals to access, understand, appraise, and use health information and services to maintain good health, may partly explain this relationship [56]. In the literature, lower health literacy has been associated with poorer glycaemic control, higher HbA1c levels, increased diabetes-related complications, and weaker self-management behaviours, whereas higher health literacy has been linked to better diabetes outcomes [57]. Therefore, health literacy may be an important factor in the relationship between nutritional knowledge, dietary practices, and diabetes outcomes.

Getting nutritional education was also significantly associated with better dietary adherence. Participants who received nutrition education were less likely to exhibit poor adherence than those who had not. This finding agrees with previous studies showing that structured nutrition education interventions improve nutritional knowledge, dietary adherence, and glycaemic outcomes among individuals with T2DM [58,59]. Likewise, nutrition education has been identified as a significant predictor of good dietary adherence [53,54], while a lack of nutrition education has been associated with poor dietary adherence [55]. Nutrition education may provide patients with the practical skills to select appropriate foods, interpret dietary advice, and integrate healthy eating behaviours into daily life [13,14]. At the study sites, nutrition education is routinely delivered through both group-based diabetes education and individualized dietary counselling, which may partly explain the observed association between nutrition education and dietary adherence. However, nutrition education and knowledge alone are unlikely to produce sustained behavioural change. The translation of knowledge into practice depends not only on the information provided but also on how it is communicated and the extent to which patients are actively engaged in their care. Effective patient-provider communication has been linked to improved diabetes-related outcomes and may enhance patient engagement and involvement in care, particularly among vulnerable populations with diabetes [60]. Furthermore, patient-centred communication characterised by empathy, support, active listening, and a collaborative approach may help address psychosocial concerns, build confidence, and mitigate fear and stress, thereby promoting adherence to treatment decisions and improving self-management goals among individuals with T2DM [61]. Therefore, the quality of communication during nutrition education may influence the extent to which nutritional knowledge is associated with dietary adherence and favourable diabetes outcomes. As these factors were not assessed in the present study, future research should investigate their influence on diabetes self-management and outcomes.

Family involvement and social support have been identified as important predictors of dietary adherence among individuals with T2DM [54], whereas limited social support has been associated with poor dietary practices [55]. Consistent with these findings, participants in the present study who frequently socialized with friends and family or ate out regularly were more likely to exhibit poor dietary adherence. Similar barriers have been reported

in previous studies, where family eating patterns, social interactions, and external food environments influenced adherence to dietary recommendations [18,27,28]. However, social interactions can be a double-edged sword, either facilitating or hindering dietary adherence, depending on the nature of family and social relationships [18]. For instance, in many African settings, particularly in rural communities, communal eating practices and cultural expectations surrounding food can make it difficult for individuals with T2DM to adhere to recommended dietary guidelines [62].

The present study also found that younger participants (≤30 years) were significantly more likely to exhibit poor dietary adherence than older participants. Similar findings have been reported among Korean adults with T2DM, where younger individuals demonstrated lower adherence to dietary guidelines and were more likely to skip breakfast, consume alcohol, smoke, and follow irregular meal patterns than older adults [63]. Likewise, Karabicak and Yuksel reported that older individuals with T2DM in Turkey tended to have better adherence to healthy dietary patterns [64]. These findings suggest that younger adults may be at greater risk of poor dietary adherence and could potentially benefit from age-specific nutrition education and behavioural interventions that address their unique lifestyle challenges and self-management needs. However, this association should be interpreted with caution, as the small number of participants aged ≤ 30 years led to wide confidence intervals and limited precision.

Importantly, poor dietary adherence was significantly associated with uncontrolled glycaemic status. Participants with uncontrolled HbA1c levels were more likely to demonstrate poor dietary adherence than those with controlled diabetes. This finding is supported by previous studies reporting an association between adherence to dietary recommendations and better glycaemic control, as well as lower risk of diabetes-related complications [15,16,37]. Dietary interventions have also been shown to improve fasting blood glucose levels, promote healthier eating patterns, and reduce cardiovascular risk factors among individuals with T2DM [17,58]. Consistent with the multifactorial nature of diabetes management, exploratory analyses (Supplementary Table S2) revealed that participants with uncontrolled diabetes were less likely to engage in regular physical activity, have high diabetes-related nutrition knowledge, and adhere to prescribed medications, and more likely to eat outside the home. The present findings therefore support the importance of dietary management, alongside behavioral, educational, and treatment-related factors in glycaemic control.

Despite the high prevalence of self-reported medication adherence in this study (96.5%), more than half of the participants (52%) had uncontrolled diabetes. Similar findings have been reported in Portugal, where high levels of medication adherence coexisted with poor cardiometabolic control [65]. Although the prevalence of uncontrolled diabetes in the present study was lower than that reported in other South African studies [35,36,66], it nevertheless highlights the complex, multifactorial nature of glycaemic control. The observed discordance may partly reflect over-reporting of adherence inherent to self-reported measures; however, it also suggests that medication adherence alone may be insufficient to achieve optimal glycaemic outcomes. Effective diabetes management requires an integrated approach that combines pharmacological treatment with sustained lifestyle modifications, particularly healthy eating and regular physical activity [67]. Further exploratory analyses revealed that more than half (50.7%) of participants who reported medication adherence still had uncontrolled glycaemic levels (Supplementary Table S1). Among these participants, favourable self-management characteristics, including good dietary adherence and high diabetes-related nutrition knowledge, coexisted with behaviours such as eating outside the home, which may have limited optimal glycaemic control. Other factors, including medication timing, treatment adequacy, and disease severity, may also have contributed to poor glycaemic control, although these were not assessed in the present study. These

findings highlight the need for routine diabetes care to integrate medication adherence with nutrition education, behavioural support, and sustained lifestyle modification to achieve optimal glycaemic outcomes.

Limitations of the Study

This study has several limitations. First, the findings may not be generalizable to all individuals living with diabetes in South Africa, as only patients with T2DM attending two hospitals in the rural Eastern Cape were included. Second, the cross-sectional study design limits the ability to determine temporal relationships and precludes causal inferences regarding the associations between dietary adherence and the factors examined. Accordingly, the observed relationships between nutrition education, diabetes-related nutritional knowledge, dietary adherence, and glycaemic control should be interpreted as associations rather than cause-and-effect relationships. Third, the use of interviewer-administered questionnaires may have introduced interviewer and social desirability biases. In addition, the self-reported assessment of nutritional knowledge and dietary adherence may have resulted in overreporting of desirable behaviours. Moreover, dietary adherence was assessed using a perception-based measure of recent dietary practices and may not accurately reflect habitual long-term behaviours. This approach is also susceptible to selective recall, which may have led to overestimation or underestimation of dietary adherence. Furthermore, information on the duration of participants' usual dietary intake was not collected; therefore, the findings should be interpreted as reflecting recent rather than sustained dietary practices.

Another limitation relates to the measurement instruments used in the study. Although the GNKQ-R and PDAQ were adapted to reflect locally relevant foods and dietary recommendations, neither instrument was formally validated in this predominantly rural setting. Some questionnaire items may not have adequately reflected local dietary knowledge and practices. For example, the item assessing sunflower, soybean, and olive oils grouped oils with differing affordability and availability, potentially limiting its ability to discriminate dietary adherence. While sunflower oil is commonly used, olive oil is often unaffordable, and soybean oil is not readily available in many rural communities. Consequently, some degree of measurement error in assessing diabetes-related nutritional knowledge and dietary adherence cannot be excluded. These findings highlight the need to develop and validate culturally and contextually appropriate instruments for assessing nutrition knowledge and dietary adherence in rural populations. Therefore, the study findings should be interpreted with caution until such instruments are available, validated, and shown to yield consistent, comparable results in similar settings.

Despite these limitations, the study provides valuable insights into diabetes-related nutritional knowledge, dietary adherence, and associated factors among patients with T2DM in a predominantly rural South African setting. The use of established assessment tools and the inclusion of participants from two major referral hospitals strengthen the credibility of the findings and provide evidence that may inform nutrition education and diabetes management interventions.

Future longitudinal and intervention studies are warranted to clarify the associations and pathways linking nutrition education, diabetes-related nutritional knowledge, dietary adherence, and glycaemic outcomes among individuals with T2DM. Further research should also explore factors influencing dietary adherence, including the interplay between diabetes-related nutritional knowledge, health literacy, and patient-provider communication, to better understand why knowledge does not always translate into optimal self-management and glycaemic outcomes in the Eastern Cape, South Africa.

5. Conclusions

The proportion of patients with T2DM who had poor dietary adherence was substantial, with nearly half of the participants not adhering adequately to recommended dietary practices. Although most participants had received nutrition education and demonstrated relatively high levels of nutritional knowledge, important knowledge gaps and social and behavioural barriers to adherence remained. Younger age, low diabetes-related nutritional knowledge, non-exposure to nutrition education, gathering with friends and family, eating outside the home, and uncontrolled glycaemic status were the main factors associated with poor dietary adherence.

The findings suggest that comprehensive, culturally sensitive, and contextually relevant nutrition education should remain an integral component of routine diabetes care, with particular emphasis on practical dietary knowledge and self-management skills. Interventions that engage family members, address social influences on eating behaviours, and support healthy food choices in social settings may help improve dietary adherence. However, given the cross-sectional nature of the study, causal relationships cannot be inferred. Nevertheless, such patient-centred approaches may contribute to improved dietary adherence, better glycaemic control, and enhanced quality of life among individuals living with T2DM in the Eastern Cape, South Africa.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/diabetology7110213/s1. Table S1: Distribution of selected participant characteristics according to self-reported medication adherence among T2DM patients, Mthatha Hospital Complex, Eastern Cape, South Africa, 2025 (N = 227); Table S2: Distribution of selected participant characteristics according to glycaemic control among T2DM patients, Mthatha Hospital Complex, Eastern Cape, South Africa, 2025 (N = 227); Table S3: Distribution of selected participant characteristics according to diabetes-related nutrition knowledge among T2DM patients, Mthatha Hospital Complex, Eastern Cape, South Africa, 2025 (N = 227).

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Informed Consent Statement: Written informed consent was obtained from all participants after providing detailed information about the study in English and IsiXhosa. For participants younger than 18 years, parental or guardian consent and participant assent were obtained. Participation was voluntary, and participants were informed of their right to withdraw at any time without affecting their care. Confidentiality and anonymity were maintained by not collecting personally identifiable information.

Data Availability Statement: Minimal de-identified datasets generated and/or analyzed during the current study are provided with this manuscript. Access to the full dataset may be granted by the corresponding author upon reasonable request.

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Abbreviations

The following abbreviations are used in this manuscript:

T2DM	Type 2 Diabetes Mellitus
GNKQ-R	Revised General Nutrition Knowledge Questionnaire
PDAQ	Perceived Dietary Adherence Questionnaire
NMAH	Nelson Mandela Academic Hospital
MRH	Mthatha Regional Hospital
MHC	Mthatha Hospital Complex

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