EXPLORING BARRIERS TO DIETARY COMPLIANCE IN TYPE 2 DIABETIC PATIENTS IN PAKISTAN: A SNAP CHAT STUDY

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ABSTRACT

Objective: The study aimed to explore the key barriers that prevent patients with type 2 diabetes mellitus (T2DM) from adhering to dietary recommendations. Understanding these challenges is crucial for improving patient compliance and ultimately enhancing diabetes management outcomes.

Methods: Between March and July 2024, we conducted a cross-sectional study at Ayub Teaching Tertiary Care Hospital in Abbottabad, Pakistan. We recruited 450 T2DM patients, aged between 18 and 80, all of whom had received dietary recommendations prior to the study.

Participants completed a 27-item questionnaire designed to assess barriers to dietary adherence.[1]They were categorized based on their age and how long they had been living with diabetes. To provide a well-rounded view of their health, we also collected BMI and other relevant lab data. The results were analyzed using Stata version 17, and we used Cronbach's alpha to measure reliability[2]. Factor analysis helped us identify the major barriers these patients faced.

Methods: Of the 450 participants, 306 (68%) were women, with an average age of 52.2 years and a mean BMI of 28.2 kg/m². The reliability of the questionnaire was strong, showing a Cronbach's alpha of 0.89. From the factor analysis, we identified eight key barriers to dietary adherence. The most prominent barrier was a lack of understanding of dietary guidelines, accounting for 13.5% of the total variance. Other significant barriers included situational difficulties (11.4%), insufficient family support (10.2%), stress-related eating habits (9.0%), dissatisfaction with the diet's monotony (7.8%), concerns over the cost and perceived ineffectiveness of recommended diets (7.1%), work-related challenges (6.0%), and hunger or feelings of weakness (4.9%). Altogether, these barriers explained 69.9% of the variance.

Conclusion: Our findings highlight the need for better education on dietary guidelines, which was the most significant barrier to adherence. Addressing these gaps with tailored education and support

systems could improve dietary compliance and positively impact the overall management of type 2 diabetes.

Keywords: Type 2 diabetes mellitus, Dietary adherence, Barriers to compliance, Non- adherence, Patient education, Psychosocial factors, Pakistan.

Introduction
Diabetes mellitus (DM) has emerged as one of the most daunting health challenges in modern times. According to the World Health Organization (WHO), more than half a billion people worldwide are living with diabetes, and projections suggest this number will continue to rise. Of the various types, type 2 diabetes mellitus (T2DM) accounts for about 90% of cases, making it the most common form of the disease[3]. Alarmingly, nearly half of those affected by T2DM are unaware of their condition, which adds to the difficulty in managing it effectively.

In Pakistan, diabetes has become increasingly prevalent, with over 33 million people affected by the condition. The country ranks among the top in the world for diabetes cases, a statistic largely driven by rapid urbanization and lifestyle shifts. Many people now lead more sedentary lives, compounded by dietary changes that favor calorie-dense, nutrient-poor foods.

Although T2DM is a manageable condition, early intervention and lifestyle adjustments are essential. The WHO advocates for a balanced approach to diabetes management, which includes regular physical activity, maintaining a healthy weight, and consuming a nutritious diet[4].

Tobacco avoidance and cutting down on unhealthy fats and sugars are also key elements. Similarly, the American Diabetes Association (ADA) promotes a diet rich in fiber, whole grains, vegetables, and legumes, while limiting high-sugar foods.

Yet, despite clear evidence on the benefits of dietary management, many patients struggle to stick to these guidelines. Globally, there are common challenges like the high cost of healthier foods, limited communication with healthcare providers, and patients' lack of understanding of diabetes management[5].

In Pakistan, cultural and psychological barriers further complicate dietary adherence. Many patients do not have access to personalized, easy-to-follow dietary advice, even though the prevalence of diabetes continues to grow.

International studies, particularly from low- and middle-income countries, have found that dietary adherence remains low, often due to socioeconomic factors and lack of resources. In Pakistan, although similar trends are expected, research specific to the barriers faced by T2DM patients remains sparse[6].

This study aims to fill that gap by identifying the primary barriers to dietary adherence among T2DM patients in Pakistan, with the goal of informing future interventions and healthcare policies that can better support patients in managing their condition.

Materials and Methods
This cross-sectional study was conducted between March 1, 2024, and July 30, 2024, in the General Medicine Unit of Ayub Teaching Tertiary Care Hospital, part of the Medical Teaching Institution (MTI) in Abbottabad, Khyber Pakhtunkhwa, Pakistan. Prior to data collection, ethical approval was secured from the MTI Ethical Review Committee. The primary objective was to explore the barriers hindering dietary adherence among patients diagnosed with type 2 diabetes mellitus (T2DM).

The sample size was calculated using the OpenEpi calculator, based on a 79% prevalence rate for "lack of knowledge" as a key barrier. We used a 5% margin of error and a 95% confidence interval, inflating the sample size by 20% to account for potential non-responders or incomplete data. The final sample size was reached through a non-probability convenience sampling method.

Inclusion and Exclusion Criteria

Eligible participants were adults aged 18 to 80 years, all with a confirmed diagnosis of T2DM and having previously received dietary counseling from their healthcare providers. Patients were excluded if they had endocrine disorders, thyroid issues, pregnancy, or significant systemic comorbidities that could interfere with their ability to follow dietary or physical activity guidelines, in order to minimize confounding factors.

Data Collection

After obtaining informed consent, data were collected via structured, interview-based questionnaires. Information recorded included demographics such as age, gender, occupation, place of residence, family history of diabetes, and diabetes-related complications.

Anthropometric measurements, including height, weight, body mass index (BMI), and waist circumference (WC), were taken following standard protocols. BMI was categorized using the World Health Organization (WHO) cut-offs specific to the Asian population: underweight (<18.5 kg/m²), normal (18.5–22.9 kg/m²), overweight (23.0–27.4 kg/m²), and obese (≥27.5 kg/m²).

Additionally, laboratory results for fasting blood glucose (FBG) and glycated hemoglobin (HbA1c) were documented. All patients were on oral anti-diabetic medications and had received dietary advice as part of their ongoing treatment.

Assessment of Barriers

To assess barriers to dietary adherence, we used a validated 27-item questionnaire that had been pretested with 20 participants meeting the inclusion criteria. These pretest responses were excluded from the final analysis. Responses were measured using a 5-point Likert scale (ranging from 1 = strongly disagree to 5 = strongly agree), with higher scores indicating more significant barriers.

Statistical Analysis

Data analysis was conducted using Stata version 17. Descriptive statistics, including means and standard deviations (SD) for continuous variables, and frequencies and percentages for categorical variables, were used to summarize the data. The questionnaire's internal consistency was evaluated using Cronbach's alpha, which showed high reliability ($\alpha = 0.89$).

To identify key barriers to dietary adherence, we applied factor analysis using principal component analysis (PCA). The data's suitability for factor analysis was confirmed with Bartlett's test of sphericity ($p < 0.001$). Factors with an eigenvalue greater than 1 were retained, and varimax rotation was applied to enhance interpretation. Factor loadings of 0.45 or higher were deemed significant. The barriers were then grouped into common factors, with factor scores calculated as the mean of the items for each barrier. Polychoric correlation was employed to account for the ordinal nature of the responses. A p-value of ≤ 0.05 was considered statistically significant.

Results

Among the 450 participants recruited for the study, 306 (68%) were female, while 144 (32%) were male. The overall mean age of the participants was 52.2 ± 11.2 years, and the average body mass index (BMI) was 28.2 ± 4.5 kg/m².

A significant portion of the participants, 290 (64.4%), identified as housewives. The mean duration of living with type 2 diabetes mellitus (T2DM) was 8.3 ± 7.2 years. A family history of diabetes in first-degree relatives was reported by 315 participants (70%). Regarding diabetes-related complications, 160 (35.5%) reported eye impairment, 98 (21.8%) had foot-related complications, and 95 (21.1%) experienced nerve damage.
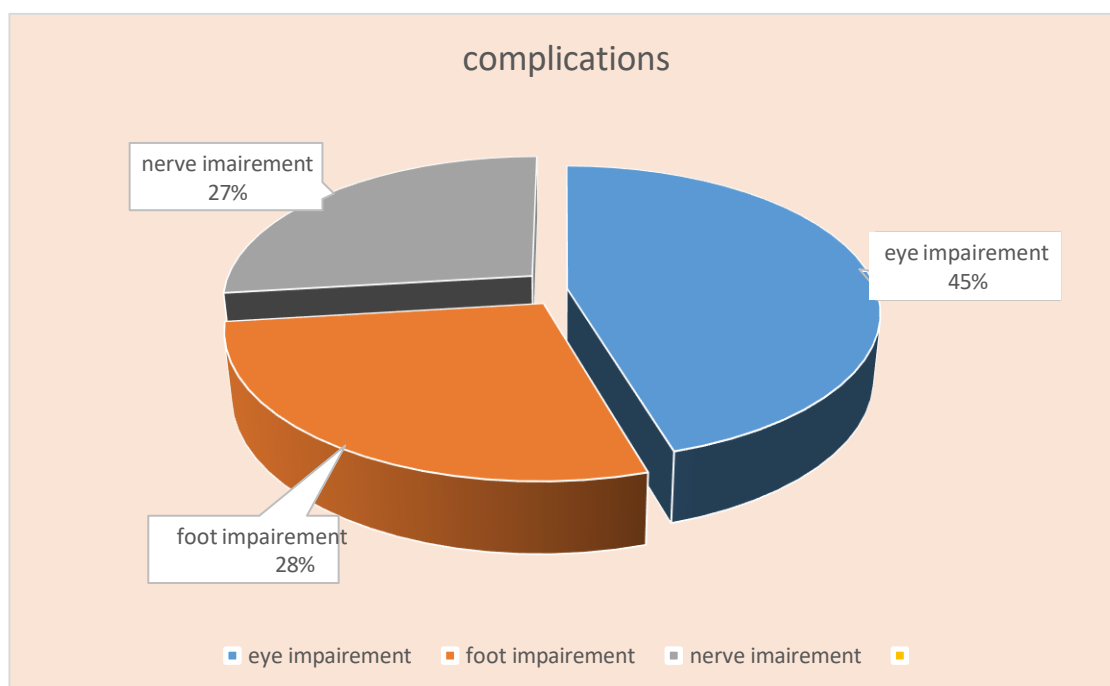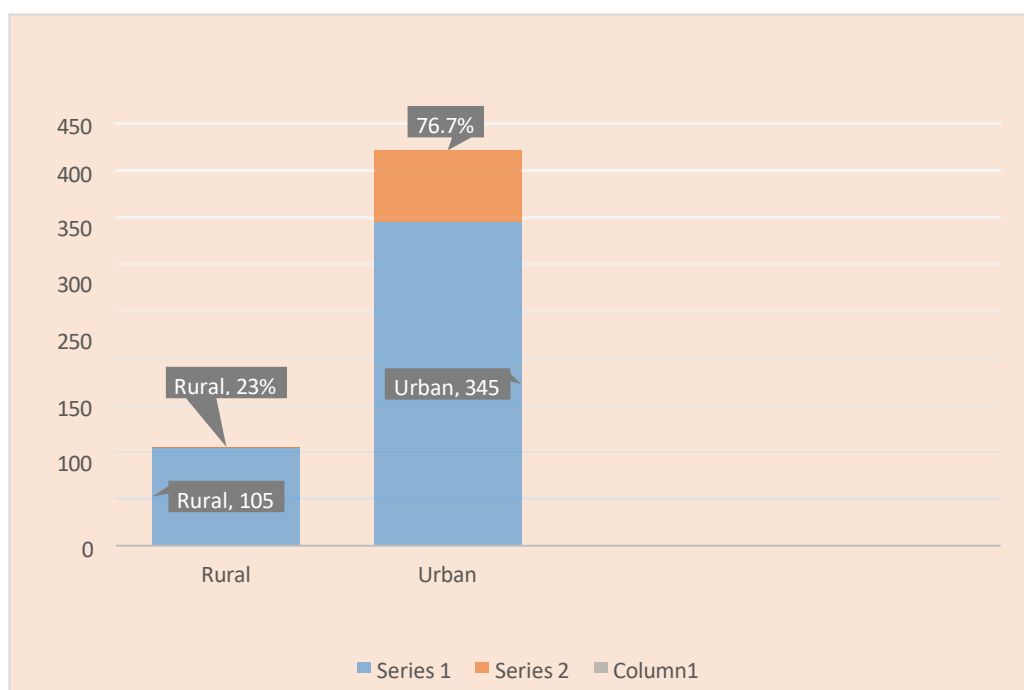
Table 1: Socio-demographic Characteristics (n=450)

Characteristics	Mean ± SD
Age in years	52.2 ± 11.2
BMI in kg/m²	28.2 ± 4.5
FBS in mg/dL	173.6 ± 65.7
HbA1c in %	8.8 ± 2.1
DM Duration in years	8.3 ± 7.2

The Kaiser-Meyer-Olkin (KMO) value for sampling adequacy was 0.84, indicating the data was suitable for factor analysis. Principal component analysis (PCA) identified eight distinct factors, each representing a different barrier to dietary adherence. The weighted mean of the factor loadings for the items corresponding to each barrier was calculated to determine their scores. The three most common

barriers were significantly loaded on 6 items (with loadings ranging from 0.87 to 0.56), 4 items (ranging from 0.85 to 0.61), and 5 items (ranging from 0.76 to 0.49), respectively. The fourth and sixth barriers were loaded with 3 items each (with ranges of 0.82 to 0.61 and 0.73 to 0.58, respectively). Meanwhile, the fifth, seventh, and eighth barriers were each loaded with 2 items (ranging from 0.88 to 0.65, 0.81 to 0.53, and 0.74 to 0.48, respectively). Item number 18 did not load onto any of the identified factors and was excluded from further analysis. Repeating the factor analysis without this item did not alter the overall results (refer to Table 3).

The internal consistency of the questionnaire was verified with a Cronbach's alpha of 0.89, indicating strong reliability. The factor analysis revealed eight key barriers to dietary adherence, which were as follows:

1. **Lack of knowledge about dietary guidelines** (explaining 13.5% of the variance)
2. **Situational challenges** (11.4% variance explained)
3. **Lack of family support** (10.2%)
4. **Stress-related eating behaviors** (9.0%)
5. **Monotonous and unappealing diet** (7.8%)
6. **High cost and perceived ineffectiveness of the recommended diet** (7.1%)
7. **Unfavorable work conditions or disliking the diet** (6.0%)
8. **Feelings of hunger and weakness** (4.9%)

These eight factors collectively explained 69.9% of the total variance, offering valuable insight into the challenges faced by T2DM patients in adhering to dietary recommendations.

Characteristics	n (%)450
DM in First-Degree Relatives	
Yes	315 (70%)
No	135 (30%)

Table 2: Patients' Responses for Perceived Barriers to Dietary Adherence

Item	Disagree/Strongly Disagree (%)	Neutral (%)	Agree/Strongly Agree (%)
1. I don't feel full with the dietary food recommended.	39.1	10.9	50.0
2. Following the recommended diet usually makes me feel hungry and weak.	32.4	13.5	54.2
3. I think the recommended diet is expensive.	51.3	25.0	23.7
4. I don't enjoy the diet recommended to me.	40.4	19.6	40.1
5. I find the recommended diet monotonous and boring.	45.2	17.3	37.5
6. I can't follow the diet when on a trip.	41.7	13.5	44.9
7. At parties, I am unable to fully follow the recommended diet.	37.5	15.7	46.8
8. Eating food from outside (restaurant, etc.) makes it difficult to follow the recommended diet.	43.6	15.4	41.0
9. A stressful family environment makes it difficult to follow the recommended diet.	49.0	13.5	37.5
10. Stress at work makes it difficult to follow the recommended diet.	47.4	12.5	40.1
11. The recommended diet is very different from my previous diet.	25.3	14.1	60.6
12. When anxious or angry, it is difficult for me to follow the recommended diet.	48.7	12.2	39.1

13. I feel hopeless about continuing the recommended diet because I don't see effective results.	45.2	15.7	39.1
14. I can't eat the recommended foods because of other family members.	65.4	12.5	22.1
15. It is difficult to follow the diet when I am with others.	49.0	11.9	39.1
16. I am not supported and encouraged by family and friends to follow my recommended diet.	77.9	9.9	12.2
17. Dietary recommendations are not clear.	52.9	18.3	28.8
18. I can't resist temptation to eat unhealthy food and foods that are not recommended.	42.3	14.1	43.6
19. Due to work conditions, I can't adhere to the recommended diet.	57.1	15.1	27.9
20. I prefer to enjoy the food I eat rather than dieting.	51.3	17.3	31.4
21. Because other people cook for me, I can't follow the recommended diet.	74.7	11.5	13.8
22. I can't follow the diet schedule.	52.9	24.0	23.1
23. I can't follow the number and quantity of the recommended diet.	40.7	23.4	35.9
24. I don't know what other foods I can use instead of those recommended in the diet.	45.8	19.2	34.9
25. Generally, I don't know what food to eat.	57.4	17.0	25.6
26. I don't know the quantity of food I should eat.	47.1	14.1	38.8
27. I have not received adequate information from my doctor or nutritionist on the recommended diet.	51.9	7.7	40.4

Table-3: Extracted factors for perceived barriers to dietary adherence.

z	Mean ± SD	% of Variance	Cronbach's Alpha
Lack of knowledge about dietary guidelines	3.2 ± 1.0	13.5	0.88
Situational challenges	2.9 ± 1.1	11.4	0.88
Lack of family support	3.6 ± 0.8	10.2	0.77
Stress-related eating behaviors	3.1 ± 1.1	9.0	0.82
Monotonous and unappealing diet	3.0 ± 1.2	7.8	0.90
High cost and perceived ineffectiveness	2.9 ± 0.9	7.1	0.57
Unfavorable work conditions/dislike of diet	3.3 ± 0.9	6.0	0.48
Feelings of hunger and weakness	2.7 ± 1.1	4.9	0.59

● **Total Variance Explained**: 69.9%
● **Overall Cronbach's Alpha**: 0.89

Discussion

Pakistan is currently facing a pressing healthcare challenge due to the rising rates of Type 2 Diabetes Mellitus (T2DM) and its associated complications, including skin, nerve, kidney, and eye issues, along with foot problems and cardiovascular diseases[8]. While dietary changes play a crucial role in

managing T2DM, many barriers hinder patients from adhering to these recommendations. Identifying these barriers is essential for developing effective interventions that cater to the unique needs of T2DM patients in Pakistan.

Our study found that a significant barrier to dietary adherence is a lack of knowledge about dietary guidelines. This aligns with previous research by Funnell et al. (2008), which highlighted that insufficient understanding of diet plans and food choices can lead to poor adherence and glycemic control[9]. Similarly, Funnell and colleagues (2007) noted that patients often struggle with comprehending dietary advice, resulting in difficulties in following through and ultimately leading to disease progression. To tackle this barrier, it is vital to provide clear, practical, and flexible dietary recommendations, accompanied by regular follow-up support to enhance understanding and adherence (Bower et al., 2010).

Situational challenges were the second most frequently reported obstacle. Many participants indicated that special occasions—such as holidays, weekends, and social gatherings—made it difficult to adhere to their dietary plans. This observation is supported by findings from Al- Muhanna et al. (2013), who noted that cultural and social events significantly affect dietary adherence among diabetic patients[10]. The cultural importance of food and the social pressures during celebrations present unique challenges in South Asian contexts (Zhang et al., 2015; Khan et al., 2018). Therefore, dietary interventions should consider these cultural dynamics and offer strategies to help manage adherence during these events.

The role of social support from family, friends, and community was another critical factor identified in our study. Our findings are consistent with Karter et al. (2000), who discovered that strong social support is linked to better adherence to dietary and lifestyle interventions. Enhanced support from social networks can lead to improved management of T2DM and a reduction in complications[11]. Similarly, Bodenheimer et al. (2002) emphasized that support systems play a vital role in improving patient outcomes, highlighting the need for healthcare providers to engage these networks in patient education and management.

Our study also revealed that stressful family and work environments pose significant barriers to dietary adherence. This finding aligns with Mendenhall et al. (2011), who showed that psychological stress negatively impacts dietary adherence and diabetes management. The long work hours and challenging family dynamics reported by our participants reflect a broader trend noted by Gonzalez et al. (2010), emphasizing how stress, depression, and psychosocial factors affect dietary habits. It is crucial to integrate stress management and psychological support into diabetes education programs to enhance adherence (Powers et al., 2015).

Participants also reported that monotonous and unappealing diets deterred them from following their meal plans. This resonates with Pender et al. (2002), who found that a lack of variety in diets can lead to decreased adherence due to feelings of deprivation. Kaiser et al. (2013) further highlighted the importance of offering diverse and enjoyable food options within dietary guidelines to keep patients engaged. Therefore, nutrition therapy should focus on providing a range of healthy food options that cater to individual preferences and needs (Henderson et al., 2014).

Economic factors emerged as a significant barrier, with many participants expressing concerns about the cost of recommended diets, which often differed greatly from their usual foods. This observation is consistent with Norris et al. (2006), who identified the high expense of diabetic diets as a major barrier, particularly for those from lower socioeconomic backgrounds. The rising costs of healthy foods, noted in our study, echo findings from Jenkins et al. (2014), underscoring the necessity for cost-effective dietary recommendations and affordable, nutritious options.

Healthcare providers and dietitians should prioritize developing practical dietary plans that are both

sustainable and accessible.

While this study provides valuable insights, it has some limitations. Its cross-sectional design restricts our ability to assess changes in dietary adherence over time. Additionally, reliance on self-reported data may introduce bias, and the findings may not be generalizable beyond our study population. Future research should aim to explore longitudinal changes in dietary adherence and investigate barriers across different geographic regions.

In conclusion, improving dietary adherence among T2DM patients in Pakistan necessitates a comprehensive approach that addresses psychological, sociocultural, and economic factors. Tailoring dietary recommendations to incorporate familiar foods, practical alternatives, and simplified cooking methods, while considering cost constraints, can significantly enhance patient compliance. Furthermore, incorporating motivational techniques and personalized counseling can further support dietary adherence and help mitigate complications associated with T2DM. Collaboration between policymakers and healthcare providers is essential to develop and implement effective, culturally relevant dietary guidelines and support systems for diabetic patients.

Conclusion

Our study identified a lack of knowledge as the primary barrier to adhering to dietary recommendations for Type 2 Diabetes Mellitus (T2DM). This finding highlights the urgent need for comprehensive educational interventions aimed at enhancing patient understanding of dietary guidelines. By addressing this knowledge gap with clear, accessible, and culturally relevant educational materials, we can significantly improve dietary adherence and overall diabetes management.

In addition to education, it is vital to implement strategies that address situational and socioeconomic barriers. Providing cost-effective dietary options and support for managing social and familial influences can play a crucial role in enhancing adherence. By focusing on these key areas, healthcare providers can better empower T2DM patients to adopt optimal dietary practices and manage their condition more effectively.

Authors Contribution

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Final Approval of version: Ahmad Zeb4, Waqar Ahmad[1]

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