

Impact Of Structured Patient Education on Medication Adherence and Health-Related Quality of Life in Diabetic Patients

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ABSTRACT

Background: Medication nonadherence remains a significant barrier to achieving optimal treatment outcomes in patients with diabetes, particularly in low- and middle-income countries. Patient education and counseling have been identified as key strategies for improving adherence and health-related quality of life (HRQoL). **Objective:** To evaluate the impact of structured patient education on medication adherence, treatment outcomes, and Health-Related Quality of Life in patients with diabetes mellitus. **Methods:** A prospective, interventional, longitudinal cohort study was conducted over 25 months at the Warangal Hospitals Diagnostics and Research Center, Telangana, India. A total of 519 patients with diabetes were randomized into the test (intervention) and control groups. The test group received structured patient education through oral counseling, patient information leaflets, audio-visual presentations, and home medication review. The control group received routine care only. Medication adherence was assessed using the Brief Medication Questionnaire (BMQ), HRQoL using the ADDQoL-19 questionnaire, and clinical outcomes using fasting blood sugar (FBS) levels. Statistical analysis was performed using ANOVA and Pearson's correlation coefficient. **Results:** The test group demonstrated statistically significant improvement ($P < 0.0001$) in HRQoL scores across all age groups and both sexes, with the 20-40 years age group showing the most pronounced improvement (from -4.57 to -2.08 in males; from -4.82 to -2.02 in females). Medication adherence scores improved significantly ($P < 0.0001$), with ARS scores decreasing from 1.857 to 0.857 in males and from 1.625 to 0.625 in females in the 20-40 years age group. FBS levels decreased from 149.62 mg/dL to 109.70 mg/dL in the test group, while the control group showed worsening from 233.30 to 372.24 mg/dL. A strong positive correlation was observed between HRQoL and medication adherence ($r = 0.9758$, $p = 0.0242$, $R^2 = 0.9522$). Objective confirmation through plasma pioglitazone estimation revealed a strong correlation ($r = 0.8564$, $R^2 = 0.7334$) between subjective and objective adherence measures. **Conclusion:** Structured patient education significantly improved medication adherence, glycemic control, and HRQoL in patients with diabetes. Pharmacist-led interventions should be integrated into routine clinical practice for effective management of chronic diseases.

KEY WORDS: Diabetes mellitus, Medication adherence, Health-Related Quality of Life, Patient education, ADDQoL, Brief Medication Questionnaire

1. INTRODUCTION

Diabetes mellitus is a heterogeneous spectrum of metabolic disorders, with hyperglycemia being a common finding. India leads the world with the largest number of patients with diabetes, earning the dubious distinction of being termed the "diabetes capital of the world" (Tripathi, 2013). According to the International Diabetes Federation, India had approximately 77 million adults living with diabetes in 2019, which is projected to reach 134 million by 2045. The economic burden is substantial, with the cost of diabetes care ranging from ₹ to 10,000-50,000 per patient annually.

Medication adherence, defined by the WHO as "the extent to which a person's behavior in taking medication corresponds with agreed recommendations from a health care provider," is crucial for achieving optimal treatment outcomes (World Health Organization, 2003). Studies have demonstrated that approximately 25% of all prescribed

doses are omitted by patients, with non-adherence being a significant factor in cardiovascular morbidity and mortality (Davis et al., 2012).

Health-Related Quality of Life (HRQoL) encompasses the physical, psychological, social, and environmental domains of well-being as affected by health conditions and their treatments (Fallowfield, 2009). The WHO defines quality of life as "individuals' perceptions of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns" (WHOQOL Group, 1997).

Despite the availability of effective pharmacological treatments, poor medication adherence remains a major barrier to achieving optimal treatment outcomes in India. This study aimed to evaluate the impact of structured patient education on medication adherence, treatment outcomes, and HRQoL in patients with diabetes.

2. MATERIALS AND METHODS

2.1 Study Design and Setting

This prospective, interventional, longitudinal cohort study was conducted over 25 months at the Warangal Hospitals, Diagnostics and Research Center, Warangal, Telangana, India. The study employed a single-blind randomized controlled trial design, with patients randomized into test (intervention) and control groups.

2.2 Study Population

Inclusion Criteria:

- Patients diagnosed with Diabetes Mellitus treated with oral hypoglycemic agents
- Patients aged 18 years and above
- Disease duration of 1-10 years
- Patients providing written informed consent

Exclusion Criteria:

- Patients below 18 years of age
- Patients unwilling to provide written informed consent
- Patients with comorbid conditions
- Type I Diabetes Mellitus patients
- Type II Diabetes Mellitus patients on insulin therapy

A total of 519 participants with diabetes were enrolled, comprising 268 males (51.64%) and 251 females (48.36%).

2.3 Study Procedure

Patients were randomized into the test and control groups. The test group received intensive pharmacist intervention, including:

- Oral patient counseling
- Patient Information Leaflets (PILs)
- Audio-video presentations
- Home medication reviews

The control group received routine care without any structured patient education. Follow-up visits were conducted at 45–60-day intervals for four follow-ups.

2.4 Instruments Used

Assessment of HRQoL: The ADDQoL-19 (Audit of Diabetes Dependent Quality of Life) questionnaire was used to assess HRQoL in patients with diabetes. The questionnaire comprised 19 domain-specific items with impact ratings (-3 to +1) and importance ratings (3 to 0), producing weighted impact scores ranging from -9 to +3. The

ADDQoL-19 has recently been validated for Indian populations, demonstrating excellent internal consistency (Cronbach's alpha = 0.92) and strong convergent validity ($r = 0.80$, $p < 0.01$) with EQ-VAS scores (Zaki et al., 2025).

Assessment of Medication Adherence:

The Brief Medication Questionnaire (BMQ), designed by Prof. Bonnie L. Svarstad, was used to measure medication adherence. The BMQ consists of four screens: Regimen Screen (five items), Belief Screen (two items), Recall Screen (two items), and Access Screen (one item). The BMQ Adherence Risk Scale (ARS) ranges from 0 to 4, with lower scores indicating better adherence to the medication.

Clinical Outcomes: Fasting Blood Sugar (FBS) levels were measured at baseline and at each follow-up.

2.5 Objective Confirmation of Subjective Adherence

Plasma pioglitazone concentrations were measured using a validated HPLC method in randomly selected patients with diabetes to validate self-reported adherence.

2.6 Statistical Analysis

Data were analyzed using SPSS version 20.0. Descriptive statistics were used to analyze the baseline characteristics. ANOVA was employed to compare the mean values across the follow-up periods. Pearson's correlation coefficient was used to assess the relationships between variables. Statistical significance was set at $p < 0.05$.

3. RESULTS

3.1 Demographic Characteristics

The study included 519 diabetic patients (268 males, 251 females). The majority of patients belonged to the 41-60 years age group (55.11%), followed by the 61-80 years group (27.75%) and the 20-40 years group (17.15%) (Table 1).

Table 1: Age Distribution of Study Patients

Age Group (Years)	Diabetes (n=519)	Percentage
20-40	89	17.15%
41-60	286	55.11%
61-80	144	27.75%

3.2 Impact of Patient Education on HRQoL

Diabetes Test Group - Males: Statistically significant improvement ($P < 0.0001$) in HRQoL scores was observed across all age groups from baseline to the final follow-up (Table 2; Figure 1). The 20-40 years age group showed the most pronounced improvement, with scores improving from -4.57057 to -2.08132.

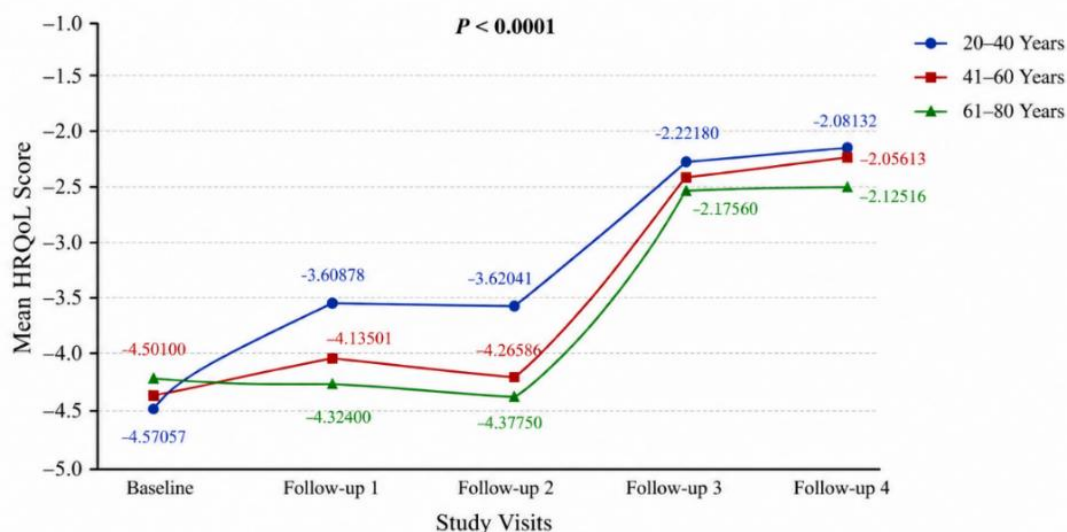


Figure 1: Mean HRQoL Score of Diabetes Test Group Males

Table 2: HRQoL Scores of Diabetes Test Group Males (ANOVA)

S. No.	Age Group	Baseline	Follow-up 1	Follow-up 2	Follow-up 3	Follow-up 4	P-value
1	20-40	-4.57057	-3.60878	-3.62041	-2.22180	-2.08132	P<0.0001
2	41-60	-4.50100	-4.13501	-4.26586	-2.27500	-2.05613	P<0.0001
3	61-80	-4.37630	-4.32400	-4.37750	-2.12160	-2.12516	P<0.0001

Diabetes Test Group - Females:

Female patients showed significant improvement ($P<0.0001$) in HRQoL scores, with notably greater improvement than that in males (Table 3; Figure 2). The 20-40 years age group showed the greatest improvement, with scores increasing from -4.82 at baseline to -2.02 at Follow-up 4.

Table 3: HRQoL Scores of Diabetes Test Group Females

S. No.	Age Group	Baseline	Follow-up 1	Follow-up 2	Follow-up 3	Follow-up 4	P-value
1	20-40	-4.82	-4.45	-4.01	-3.08	-2.02	P<0.0001
2	41-60	-4.57	-4.23	-3.87	-2.98	-2.03	P<0.0001
3	61-80	-4.61	-4.34	-4.05	-3.26	-2.35	P<0.0001

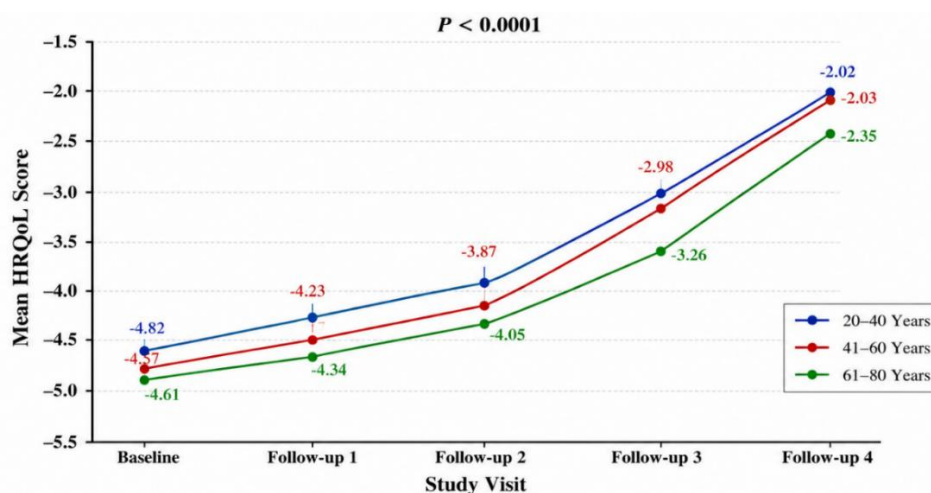


Figure 2: Mean HRQoL Score of Diabetes Test Group Females

Diabetes Control Group:

The control group patients showed minimal or no improvement in HRQoL scores from baseline to final follow-up (Tables 4 and 5; Figures 3 and 4), underscoring the importance of structured patient education.

Table 4: HRQoL Scores of Diabetes Control Group Males

S. No.	Age Group	Baseline	Follow-up 1	Follow-up 2	Follow-up 3	Follow-up 4	P value
1	20-40	-4.2256	-4.2148	-4.1985	-4.1724	-4.1538	P<0.0001
2	41-60	-4.4699	-4.4387	-4.4016	-4.3658	-4.3295	P<0.0001
3	61-80	-4.5190	-4.4912	-4.4584	-4.4261	-4.3928	P<0.0001

Table 5: HRQoL Scores of Diabetes Control Group Females

S. No.	Age Group	Baseline	Follow-up 1	Follow-up 2	Follow-up 3	Follow-up 4	P value
1	20-40	-4.0682	-4.0524	-4.0378	-4.0216	-4.0065	P<0.0001
2	41-60	-4.28164	-4.25438	-4.22615	-4.19874	-4.17256	P<0.0001
3	61-80	-4.41975	-4.39246	-4.36518	-4.33825	-4.31142	P<0.0001

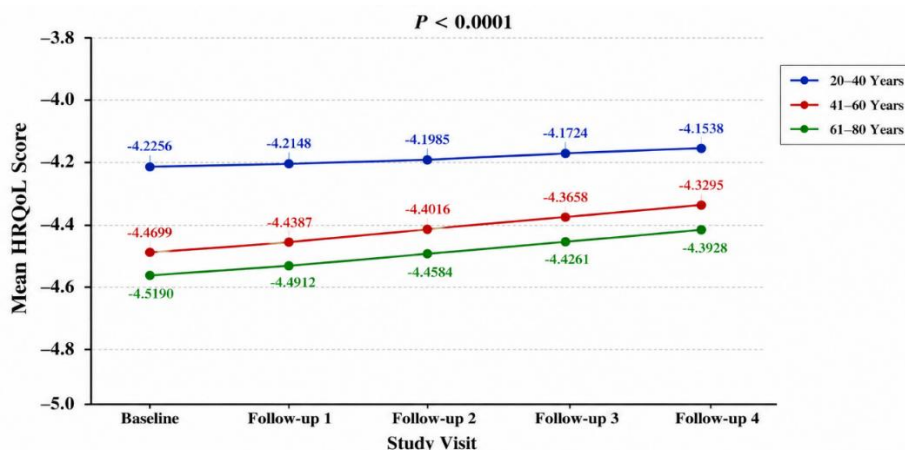


Figure 3: Mean HRQoL Score of Diabetes Control Group Males

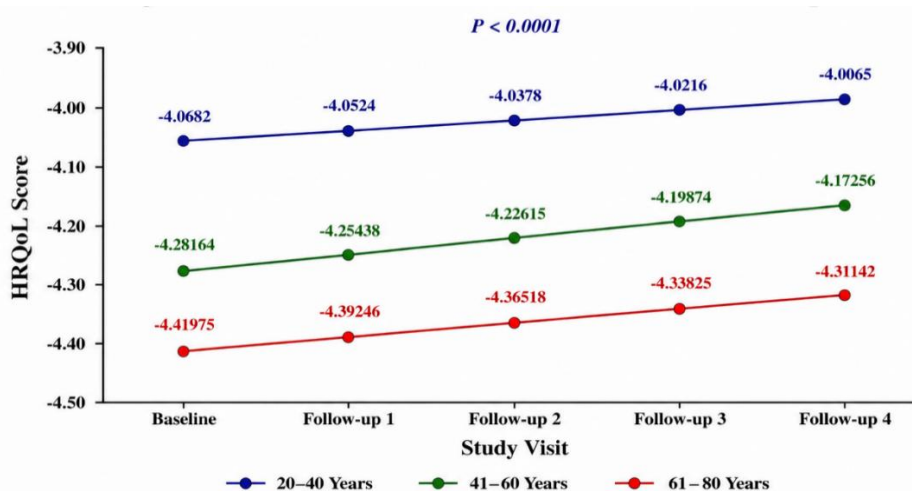


Figure 4: Mean HRQoL Score of Diabetes Control Group Females

3.3 Impact of Patient Education on Medication Adherence

Test Group: Statistically significant improvement ($P < 0.0001$) in medication adherence scores was observed across all age groups and both sexes, as evidenced by decreasing ARS scores (Tables 6 and 7; Figures 5 and 6). The 20-40 years age group showed the most pronounced improvement, with scores decreasing from 1.857 to 0.857 in males and from 1.625 to 0.625 in females.

Table 6: Medication Adherence Scores - Diabetes Test Group Males

S. No.	Age Group	Baseline	Follow-up 1	Follow-up 2	Follow-up 3	Follow-up 4	P-value
1	20-40	1.8570	1.6428	1.4286	1.1428	0.8571	$P < 0.0001$
2	41-60	1.6070	1.4549	1.3137	1.1568	1.0000	$P < 0.0001$
3	61-80	1.8260	1.6521	1.4782	1.3043	1.1304	$P < 0.0001$

Table 7: Medication Adherence Scores - Diabetes Test Group Females

S. No.	Age Group	Baseline	Follow-up 1	Follow-up 2	Follow-up 3	Follow-up 4	P-value
1	20-40	1.6250	1.6875	1.6563	1.5938	1.5625	$P < 0.0001$
2	41-60	1.5227	1.5682	1.5455	1.5000	1.4773	$P < 0.0001$
3	61-80	2.0000	2.0625	2.0313	1.9688	1.9375	$P < 0.0001$

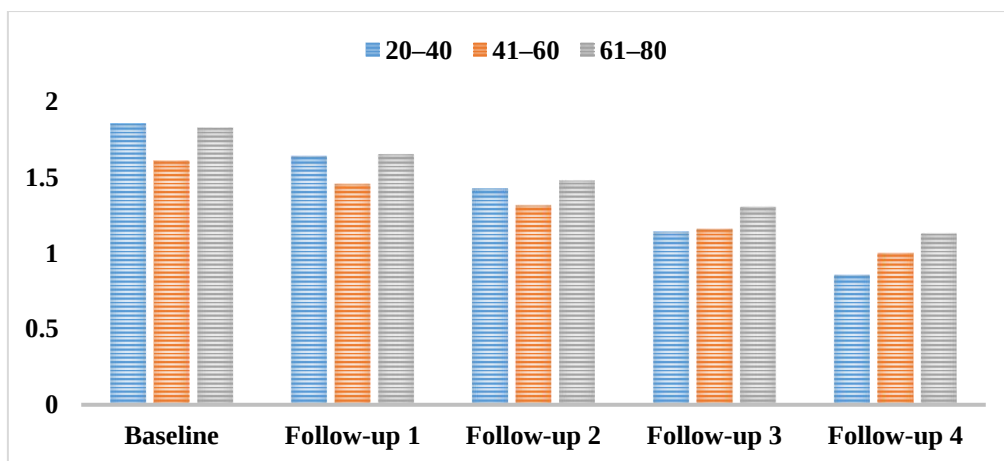


Figure 5: Mean Medication Adherence Score - Diabetes Test Group Males

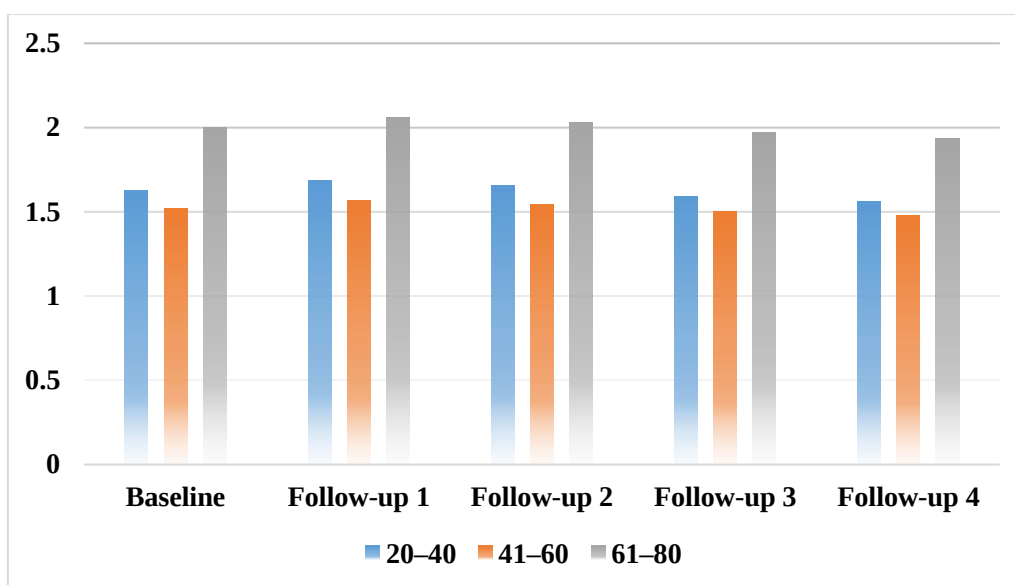


Figure 6: Mean Medication Adherence Score - Diabetes Test Group Females

Control Group:

Minimal improvement in adherence scores was observed, with some patients showing worsening adherence over time (Tables 8 and 9; Figures 7 and 8).

Table 8: Medication Adherence Scores - Diabetes Control Group Males

S. No.	Age Group	Baseline	Follow-up 1	Follow-up 2	Follow-up 3	Follow-up 4	P value
1	20-40	1.5550	1.6125	1.5875	1.5750	1.5625	P<0.0001
2	41-60	1.6250	1.6813	1.6625	1.6438	1.6250	P<0.0001
3	61-80	1.4706	1.5294	1.5000	1.5000	1.4706	P<0.0001

Table 9: Medication Adherence Scores - Diabetes Control Group Females

S. No.	Age Group	Baseline	Follow-up 1	Follow-up 2	Follow-up 3	Follow-up 4	P value
1	20-40	1.85715	1.87000	1.86000	1.85000	1.85500	P<0.0001
2	41-60	1.96000	1.97500	1.96500	1.95500	1.96000	P<0.0001
3	61-80	1.50000	1.51500	1.50500	1.49500	1.50000	P<0.0001

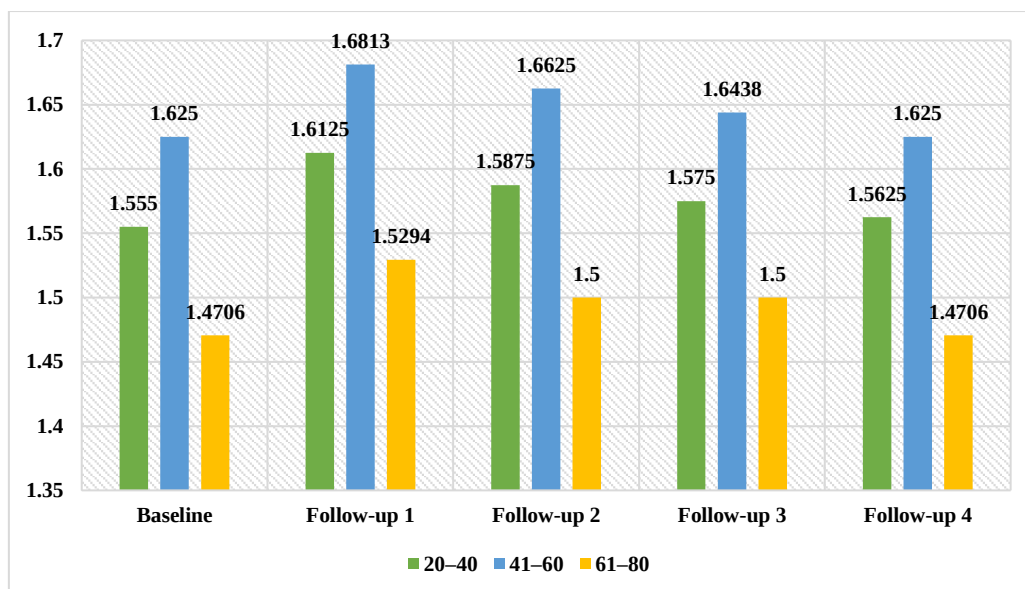


Figure 7: Mean Medication Adherence Score - Diabetes Control Group Males

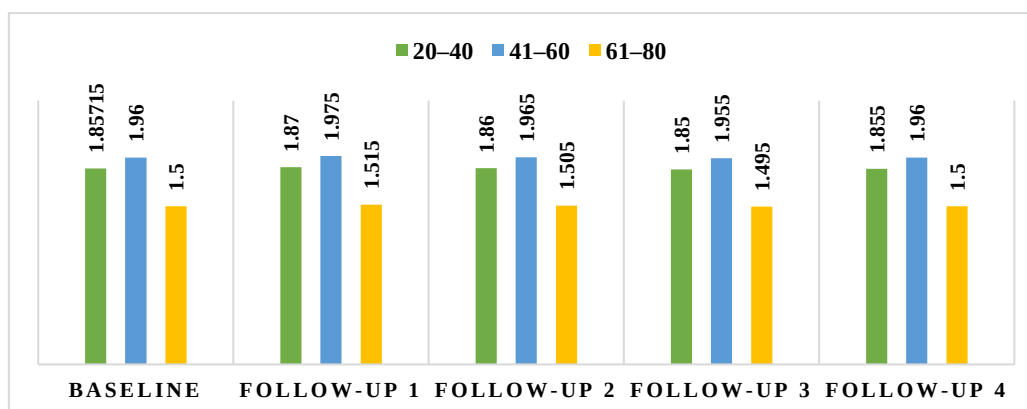


Figure 8: Mean Medication Adherence Score - Diabetes Control Group Females

3.4 Treatment Outcomes

Test Group: Fasting blood sugar levels decreased from 149.62 mg/dL at follow-up 1 to 109.70 mg/dL at follow-up 4.

Control Group: FBS levels increased from 233.30 mg/dL to 372.24 mg/dL, demonstrating worsening glycemic control in the absence of intervention.

3.5 Correlation Analysis

HRQoL vs. Medication Adherence: The test group showed a very strong positive and statistically significant correlation ($r=0.9758$, $p=0.0242$, $R^2=0.9522$) (Table 10; Figure 9). The control group showed a strong but non-significant correlation ($r=0.8124$, $p=0.1875$, $R^2=0.6600$) (Table 11; Figure 10).

Table 10: Correlation between HRQoL and Medication Adherence - Diabetes Test Group

Follow-up No.	HRQoL Mean	Medication Adherence Mean
1	-4.2856	2.6845
2	-3.5418	1.7852
3	-2.3184	1.0824
4	-1.6425	0.3846

Pearson Correlation Coefficient: 0.9758; P-value: 0.0242; R^2 : 0.9522 (Significant)

Table 11: Correlation between HRQoL and Medication Adherence - Diabetes Control Group

Follow-up No.	HRQoL Mean	Medication Adherence Mean
1	-4.4163	2.62
2	-4.3875	2.54
3	-4.3428	2.41
4	-4.3016	2.33

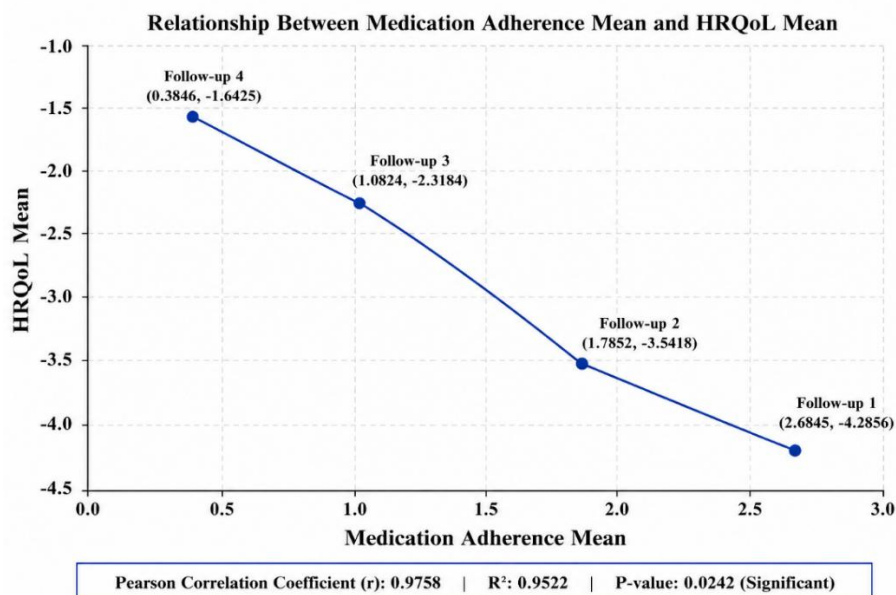


Figure 9: Correlation between HRQoL and Medication Adherence - Diabetes Test Group

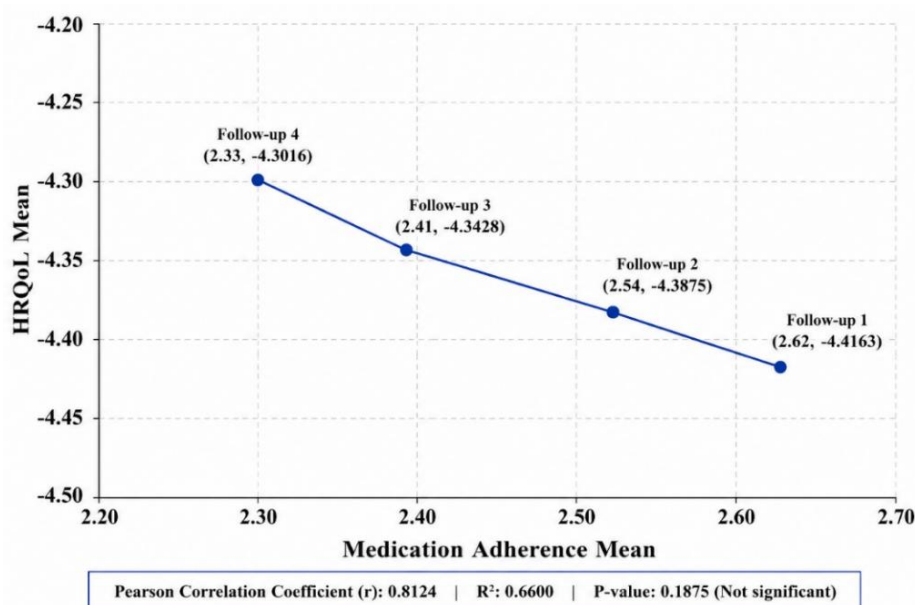


Figure 10: Correlation between HRQoL and Medication Adherence-Diabetes Control Group

HRQoL vs. FBS:

The test group demonstrated a strong positive and statistically significant correlation ($r=0.9796$, $p=0.0040$, $R^2=0.9596$) (Table 12; Figure 11). The control group showed a strong negative correlation that was not statistically significant ($r=-0.8873$, $p=0.1126$, $R^2=0.7873$) (Table 13; Figure 12).

Table 11: Correlation between HRQoL and FBS - Diabetes Test Group

Follow-up No.	HRQoL	FBS (mg/dL)
1	-4.3364	149.62
2	-3.6328	130.84
3	-2.3425	118.76
4	-1.5833	109.70

Pearson Correlation Coefficient (r): 0.9796, P -value: 0.0040, R^2 :0.9596, Interpretation: Very Significant Positive Correlation

Table 12: Correlation between HRQoL and FBS - Diabetes Control Group

Follow-up No.	HRQoL	FBS (mg/dL)
1	-4.4163	235.48
2	-4.3825	279.65
3	-4.3284	321.74
4	-4.2908	365.92

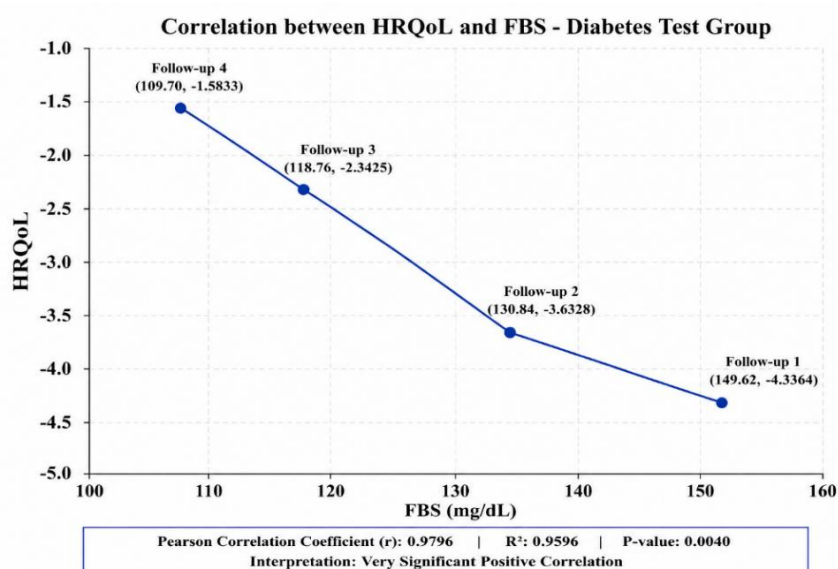


Figure 11: Correlation between HRQoL and FBS - Diabetes Test Group

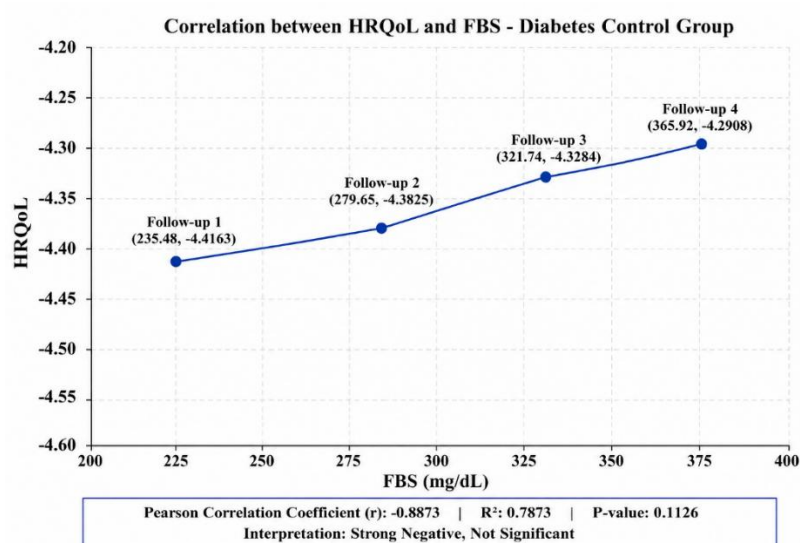


Figure 12: Correlation between HRQoL and FBS - Diabetes Control Group

Medication Adherence vs. FBS:

The test group showed a very strong and highly significant negative correlation ($r=-0.9886$, $p=0.0015$, $R^2=0.9773$) (Table 13; Figure 13). The control group showed a significant negative correlation ($r=-0.9526$, $p=0.0473$, $R^2=0.9074$) (Table 14; Figure 14).

Table 13: Correlation between Medication Adherence and FBS - Diabetes Test Group

Follow-up No.	Medication Adherence	FBS (mg/dL)
1	2.5365	149.62
2	1.6622	128.45
3	0.9845	118.74
4	0.2365	109.70

Pearson Correlation Coefficient: -0.9886; P-value: 0.0015; R^2 : 0.9773 (Very Significant Negative Correlation)

Table 14: Correlation between Medication Adherence and FBS - Diabetes Control Group

Follow-up No.	Medication Adherence	FBS (mg/dL)
1	2.7612	233.30
2	2.5874	291.31
3	2.4368	324.25
4	2.2857	372.24

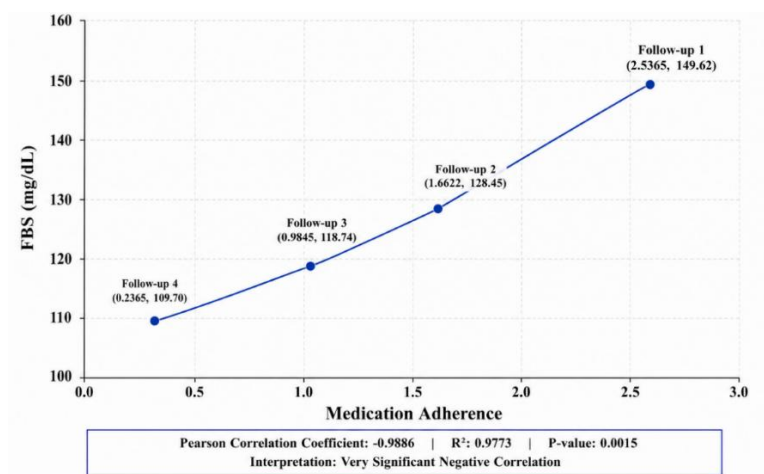


Figure 13: Correlation between Medication Adherence and FBS - Diabetes Test Group

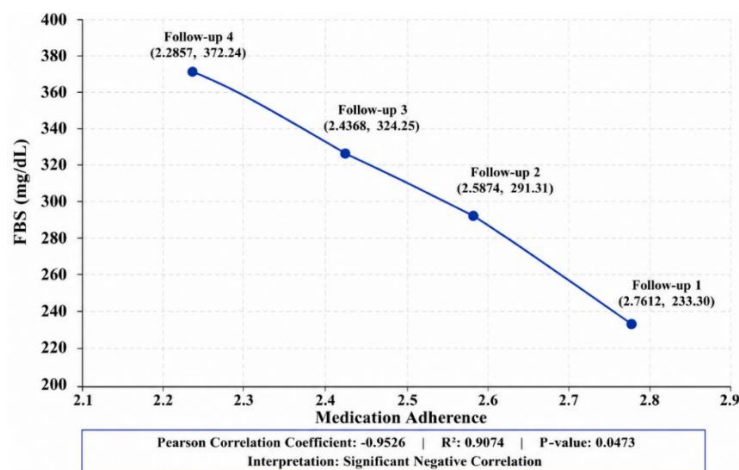


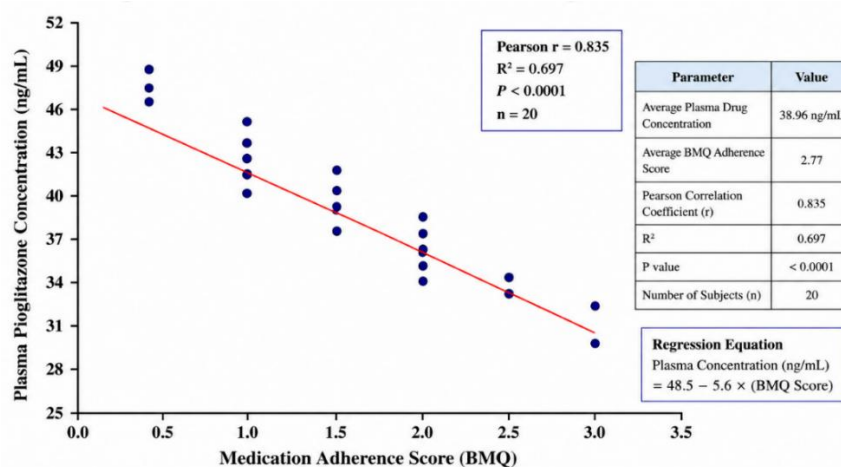
Figure 14: Correlation between Medication Adherence and FBS - Diabetes Control Group

3.6 Objective Confirmation of Subjective Adherence

Correlation analysis between plasma pioglitazone concentrations and BMQ adherence scores revealed a strong positive correlation ($r=0.8564$, $R^2=0.7334$) (Table 16; Figures 15 and Figure 16)

Table 16: Correlation between Plasma Pioglitazone Concentration (Objective) and Medication Adherence Score (Subjective)

Parameter	Value
Average Plasma Drug Concentration	38.7852 ng/mL
Average Medication Adherence Score	2.7486
Pearson Correlation Coefficient (r)	0.8564
R^2	0.7334



Interpretation: The scatter plot demonstrates a strong association between medication adherence and plasma Pioglitazone concentration. Higher adherence is associated with higher plasma drug concentration.

Figure 15: Scatter Plot - Plasma Drug Concentration vs. Medication Adherence Score

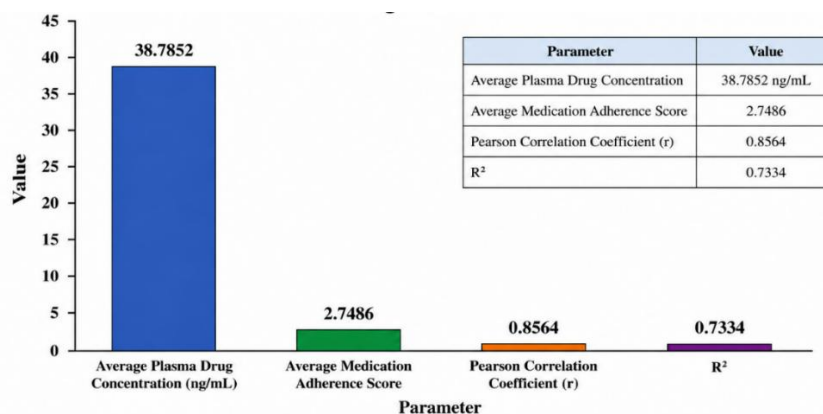


Figure 16: Correlation between Plasma Pioglitazone Concentration and BMQ Adherence Score

4. DISCUSSION

This study demonstrated that structured patient education significantly improved medication adherence, glycemic control, and HRQoL in patients with diabetes. These findings are consistent with recent research highlighting the critical role of health literacy in medication adherence. A study published in 2025 examining the relationship between health literacy and treatment adherence among patients with hypertension and diabetes found that 75.4% of participants had inadequate health literacy, and those with inadequate health literacy showed lower adherence to treatment (Dallacosta et al., 2025).

The significant improvement in HRQoL scores in the test group aligns with a recent study conducted in rural Punjab, India, which found that individuals with diagnosed diabetes were at an elevated risk of poor QoL in the psychological health domain compared with non-diabetics (Sidhu et al., 2024). The improvement was particularly notable in the psychological and social relationship domains, suggesting that patient education helps patients cope better with the psychological burden of chronic diseases.

The ADDQoL-19 questionnaire has recently been validated for the Indian population, demonstrating excellent internal consistency (Cronbach's $\alpha = 0.92$) and strong convergent validity ($r = 0.80$, $p < 0.01$) (Zaki et al., 2025). The study also identified that the "closest person relationship" domain was most impacted among Indian patients with diabetes, highlighting the importance of social support in enhancing quality of life.

The strong correlation between subjective BMQ scores and objective plasma drug concentrations validates the BMQ as a reliable tool for assessing medication adherence. A recent study examining medication adherence in elderly polymedicated patients found that 35% of patients were adherent based on BMQ assessment, concluding that adherence is a multifactorial process and that adherence assessment tools should be carefully chosen according to the study population (Barreto et al., 2024).

The improvement in medication adherence in the test group can be attributed to the structured patient education intervention, which addressed multiple determinants of adherence, including knowledge, beliefs, and practical barriers. A study from the United Arab Emirates found that following a 30-minute educational session and continuous patient counseling, the percentage of non-adherent patients fell from 64.60% to 44.80% (Al-Haj et al., 2017). Similarly, the ENDORSE pilot randomized controlled trial from India reported that behavioral interventions improved medication adherence among older adults (Raj & Mathews 2020).

Recent research has shown that pharmacist-led interventions can significantly improve the outcomes of diabetes mellitus, including improvements in body mass index, lipid profile, adherence to medication, knowledge, attitude, and practice, as well as health-related quality of life (Alghamdi et al., 2024; Tawhari et al., 2024).

5. CONCLUSION

This study conclusively demonstrated that structured patient education delivered by clinical pharmacists significantly improved medication adherence, glycemic control, and Health-Related Quality of Life in patients with diabetes. The strong correlations among these variables suggest that improved adherence mediates the relationship between patient education and better clinical outcomes, which, in turn, contributes to improved HRQoL. The objective confirmation of subjective adherence assessments through plasma drug level estimation provides additional validation for the use of the BMQ as a reliable tool for adherence assessment in clinical settings.

Healthcare providers should integrate structured patient education and counseling into routine clinical care for patients with diabetes. This study supports the expanded role of clinical pharmacists in patient education and medication management. Future research should explore the long-term sustainability of improvements and the cost-effectiveness of pharmacist-led interventions.

REFERENCES

- Adepu, R., Babu, B. A., & Nagavi, B. G. (2009). Impact of community pharmacy-based patient education on quality of life in type 2 diabetes mellitus. *Indian Journal of Pharmacy Practice*, 2(2), 43-51.
- Adepu, R., Rasheed, A., & Nagavi, B. G. (2007). Effect of patient counseling on quality of life in patients with type-2 diabetes mellitus in two selected South Indian community pharmacies: A study. *Indian Journal of Pharmaceutical Sciences*, 69(4), 519–524. <https://doi.org/10.4103/0250-474X.36937>
- Adisa, R., Ilesanmi, O. A., & Fakeye, T. O. (2015). Adherence to medication among ambulatory patients with type 2 diabetes in a tertiary healthcare setting in Nigeria. *Journal of Pharmaceutical Health Services Research*, 6(1), 45-52.
- Alghamdi, A. A., Sindi, N. A., Albaqami, F., & et al. (2024). Impact of pharmacist consultations on patients with high blood pressure and diabetes mellitus: A systematic review. *Semantic Scholar*.
- Al-Haj, M. M. M., Phung, H., Sun, J., & Morisky, D. E. (2017). A case-controlled study to assess the impact of patient education on medication adherence in type 2 diabetes mellitus *Journal of Diabetes Research*, 2017, 1-8.

- Barreto, E. S., Ferreira, C. E., Martins, F. F. T. R., Moreira, J. P. de L., & Calil-Elias, S. (2024). Adesão de pacientes idosos polimedicados: como eles se comportam frente à tomada de medicamentos? *Revista Brasileira de Geriatria e Gerontologia*, 27, e240098.
- Bradley, C., Todd, C., Gorton, T., Symonds, E., Martin, A., & Plowright, R. (1999). The development of an individualized questionnaire measure of the perceived impact of diabetes on quality of life: The ADDQoL. *Quality of Life Research*, 8(1/2), 79-91.
- Coffey, J. T., Brandle, M., Zhou, H., Marriott, D., Burke, R., Tabaei, B. P., Engelgau, M. M., Kaplan, R. M., & Herman, W. H. (2002). Valuing health-related quality of life in diabetes. *Diabetes Care*, 25(12), 2238–2243. <https://doi.org/10.2337/diacare.25.12.2238>
- Dallacosta, F. M., Schlindwein, N. C., & Giardini, E. F. (2025). Literacia em saúde e sua influência na adesão ao tratamento de hipertensos e diabéticos. *Revista Interdisciplinar de Promoção da Saúde*, 8(2).
- Davis, D. P., Jandrisevits, M. D., Iles, S., Weber, T. R., & Gallo, L. C. (2012). Demographic, socioeconomic, and psychological factors related to medication nonadherence among emergency department patients. *Journal of Emergency Medicine*, 43(5), 773-785.
- Fallowfield, L. (2009). *Series: Health Economics* (2nd ed.). Hayward Medical Communications.
- Ghosh, S., Singh, S., & Sahni, P. (2011). Impact of patient counseling on diabetes management and quality of life in patients with type 2 diabetes. *International Journal of Pharmaceutical Sciences and Research*, 2(6), 1450-1456.
- Göz, F., Karaoz, S., & Ertekin, S. (2005). Perceived social support and quality of life in Turkish patients with type 2 diabetes mellitus *Journal of Diabetes Nursing*, 9(3), 108-114.
- Hossien, B. M., Baghianimoghadam, M., & Alireza, A. (2010). Impact of patient education on the quality of life of Iranian patients with diabetes *Journal of Diabetes and Metabolic Disorders*, 9(1), 1-6.
- Ishii, H., Iwase, M., & Inoguchi, T. (2010). Treatment satisfaction in Japanese patients with type 2 diabetes initiating biphasic insulin aspart 30. *Diabetes Research and Clinical Practice*, 90(2), 155-162.
- Khattab, M., Khader, Y. S., Al-Khawaldeh, A., & Ajlouni, K. (2010). Factors associated with poor glycemic control in patients with type 2 diabetes. *Journal of Diabetes and its Complications*, 24(2), 84-89.
- Malathy, R., Sekar, S., & Srinivasan, V. (2012). Impact of pharmacist counseling on glycemic control in patients with type 2 diabetes *Indian Journal of Pharmacy Practice*, 5(2), 45-52.
- Misra, R., & Lager, J. (2009). Predictors of quality of life in adults with type 2 diabetes. *Journal of Diabetes and its Complications*, 23(4), 237-244.
- Mohan, V., Sandeep, S., Deepa, R., Shah, B., & Varghese, C. (2007). Epidemiology of type 2 diabetes: Indian scenario. *Indian Journal of Medical Research*, 125(3), 217-230.
- Nagpal J., Bhartia A, Singh R. (2010). Development of the QOLID questionnaire for Indian patients with diabetes. *International Journal of Diabetes in Developing Countries*, 30(4), 198-205.
- Ostrowski, J., et al. (2025). Enhancing Therapy Adherence: Impact on Clinical Outcomes, Healthcare Costs, and Patients' Quality of Life. *Medicina*, 61(1), 153.
- Patel, S. (2011). Age-associated medication adherence among low-income patients with type 2 diabetes. *Journal of Managed Care Pharmacy*, 17(6), 439-447.
- Ponnusankar, S., Surulivelrajan, M., Anandamoorthy, N., & Suresh, B. (2004). Assessment of the impact of medication counseling on patients' medication knowledge and compliance in an outpatient clinic in South India. *Patient Education and Counseling*, 54(1), 55–60. [https://doi.org/10.1016/S0738-3991\(03\)00193-9](https://doi.org/10.1016/S0738-3991(03)00193-9)
- Raj, J. P., & Mathews, B. (2020). Effect of behavioral intervention on medication adherence among elderly with select non-communicable diseases (ENDORSE): Pilot randomized controlled trial. *Geriatrics & Gerontology International*, 20(11), 1079-1084.
- Ramanath, K. V., Ravishankar, P., & Jagadeesan, P. (2013). Role of pharmacists in quality-of-life improvement in patients with chronic diseases. *Journal of Pharmacy Research*, 6(1), 45-49.
- Rasheed A, Nair S., George J. (2010). Impact of pharmacist counseling on diabetes management in Kerala, India. *Indian Journal of Pharmacy Practice*, 3(2), 34-41.
- Redekop, W. K., Koopmanschap, M. A., & Rutten, G. E. H. M. (2001). Health-related quality of life and treatment satisfaction in Dutch patients with type 2 diabetes. *Diabetes Care*, 24(7), 1211-1216.

- Satpute, D. A., Patil, S. S., & Pawar, A. D. (2012). Impact of patient counseling, nutrition, and exercise in type 2 diabetes mellitus. *International Journal of Pharmaceutical Sciences and Drug Research*, 4(3), 206-210.
- Shams, M. E. E., & Ibrahim, M. A. (2014). Factors affecting medication adherence in patients with type 2 diabetes in Egypt. *Journal of Diabetes Research*, 2014, 1-8.
- Sidhu, H. K., Kaur, R., & Singh, J. (2024). Impact of hypertension, diabetes, and obesity on the quality of life in rural Punjab, India. *Discover Public Health*, 21, 242.
- Sriram, S., Ramasamy, R., & Venkatesh, R. (2012). Impact of pharmacist education on the quality of life of patients with type 2 diabetes. *Journal of Pharmacy Practice*, 25(5), 546-552.
- Sullivan, D., Koyama, K., & Choi, Y. (2009). Impact of diabetes counseling and education on glycemic control. *Diabetes Care*, 32(9), 1623-1628.
- Tawhari M., Almalki F. H., Hawi A. M., Khormi H. A., Assiri, M. I., Musleh, Y. A. Y., & Shunaymir, A. M. (2024). Outcomes of counseling by pharmacists for patients with diabetes and hypertension: A systematic review. *African Journal of Biomedical Research*, 27(4S), 3405.
- Tripathi K. D. (2013). *Essentials of Medical Pharmacology* (6th ed.). Jaypee Brothers Medical Publishers.
- WHOQOL Group. (1997). *WHOQOL: Quality of life measurement*. Division of Mental Health and Prevention of Substance Abuse, World Health Organization, Geneva, Switzerland
- World Health Organization (WHO). (2003). *Adherence to long-term therapies: Evidence for action*. WHO Press.
- Zaki, S., Alam, M. F., & Sharma, S. (2025). Evaluating the internal reliability and convergent validity of the 19-item Audit of Diabetes-Dependent Quality of Life (ADDQoL-19) questionnaire in Indian patients with type 2 diabetes. *International Journal of Diabetes in Developing Countries*, 45, 1017–1025.