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Evaluating Medication Adherence in Type-2 Diabetes: A Study of Drug Therapy Using the Medication Adherence Report Scale (MARS).

Rubeena Kauser[1], Shankaraiah Puligilla[1]*

[1]Department of Pharmacy, Chaitanya – Deemed to be University, Himayathnagar, Moinabad, R.R. Dist. Telangana, India.

Email ID : drspuligilla@gmail.com

***Corresponding author:**

Dr. Shankariah Puligilla,

M.Pharm, Ph.D.Professor, Department of Pharmacy, Chaitanya – Deemed to be University, Himayathnagar, Moinabad, R.R. Dist. Telangana, India.

Email ID : drspuligilla@gmail.com

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ABSTRACT

Objective: This study sought to evaluate the medication adherence and improvements in the diabetic patients using different combination therapies.

Materials and method: This cross-sectional study included 193 T2D patients aged 18-80 years, receiving treatment for at least six months. The Medication Adherence Rating Scale (MARS) was used to assess medication adherence. Multiple regression and descriptive statistics were used to evaluate the data and find adherence predictors.

Results: According to the statistics, dual therapy showed the greatest improvement in medication adherence, followed by triple therapy. The single therapy showed the least improvement in medication adherence, at 25%. There is a better adherence score for both triple therapy and dual therapy, as the research shows that the mean difference for triple therapy is the biggest, followed by dual therapy.

Conclusion: The differing effectiveness of therapy approaches suggests that both physiological and behavioral outcomes should be considered when choosing a treatment to optimize patient care. The study's findings support the application of patient-centered, multifaceted diabetic treatment approaches that consider the complex interplay between clinical efficacy and adherence behaviors.

Keywords: *Diabetes patients, medication adherence, MARS scale, single therapy, dual therapy and combinations*..

INTRODUCTION

Diabetes mellitus is among the most prevalent conditions affecting the metabolism. Clinical manifestations include alterations in protein and lipid metabolism as well as symptomatic glucose intolerance that results in hyperglycemia. Over time, these metabolic disorders increase the risk of cancer along with this complications such retinopathy, cardiovascular disease, nephropathy, and neuropathy.[1] Some diabetics, especially those with early-stage type 2 diabetes, do not exhibit any symptoms. However, weight loss, blurred vision, polyuria, polydipsia, and polyphagia are some of the symptoms that certain diabetic patients with extreme hyperglycemia may encounter, especially in children with complete insulin insufficiency. Regarding etiology, clinical manifestations, and genetics, diabetes encompasses a broad category of diseases. [2] A health care professional defined medication adherence as "the degree to which the person's behavior corresponds with the agreed recommendations." To put it simply, it is the active, voluntary participation of the patient in adopting a behavior that is acceptable in regards to achieve the desired therapeutic outcomes. Noncompliance with medicine leads to adverse consequences and increased costs.[3] However, achieving optimal glycemic control which lowers the risk of diabetic complications and death—requires people to effectively take charge of their own health, stick to established treatment plans, and use available anti-diabetic medications rationally. [4] Medication adherence rates for diabetes range from 36% to 93% globally. Following prescription drug regimens is essential for achieving metabolic control since noncompliance with lipid-lowering or blood glucose-lowering medications is connected to elevated levels of cholesterol and HbA1C, respectively. Studies have shown that people with type-2 diabetes who take more co-medications are less likely to follow their treatment

regimens. A decline in HbA1c demonstrated to be favorably correlated with adherence to anti-diabetic medications. The HbA1c increased by 0.14 to 0.16% for every 10% improvement in adherence. [5] Those who are with diabetes that failed should take their prescription drugs as advised had poor glycemic

control, which raised their risk of acquiring chronic complications, as well as their hospitalization and mortality rate.[6] Non-adherence is caused by a number of circumstances, such as out-of-pocket costs, literacy, ignorance, and insufficient support from family or the community. Additional barriers to drug adherence in older adults include poly-pharmacy and several illnesses. Furthermore, the previously mentioned elements are connected. Medication compliance is complicated by cultural norms and the disparity in healthcare professionals between rural and urban areas. Non-adherence is also influenced by forgetfulness caused by mental illness.[7] In order to develop successful intervention programs to enhance Examining the connection between these characteristics and medication adherence in individuals with type 2 diabetes is essential.[8]

For diabetes to be effectively managed, medication adherence must be accurately assessed. Although different approaches have been documented in the literature, there is no gold standard for this kind of evaluation. [9]

MATERIALS AND METHODS

Study setting

In the Shadan Institute of Medical Sciences' Department of General Medicine and Endocrinology in Hyderabad, Telangana, India, A study of observation was conducted in a hospital. The outpatient department was used to recruit adult patients (above 18 years of age or older) who suffered from a type 2 diabetes diagnosis for at least six months period. [10]

Sample size

Utilizing OpenEpi software version 3.01, with an absolute precision of 5.5% and power of 80%, the sample size of 200 was determined at 95% confidence based on a recent facility-based cross-sectional study [5] in the Indian population that reported a non-adherence of 32.7% (95% CI 27.2 - 38.6). This was done with the assumption that an estimated 31.2% of the population would not be proactively taking anti-diabetic medications. [11]

Study criteria:

Inclusion Criteria

Our study sample includes Patients with Type-II Diabetes mellitus of age group: 18-80 years. The use of oral hypoglycemic drugs was being taken by every patient for three months or longer. We also consider in account the Patient with ADD combined therapy. [12]

Exclusion Criteria

Patients who have specific conditions, like cancer or other co-morbidities, are not permitted to participate in our study, and those who are unwilling to cooperate are also exempt from participation. Exclusion of subjects is also made on the basis of exceptions like alcoholic patients. [13]

Sampling method

Each alternate patient who met the qualifying requirements and attended the OP was chosen. Before being enrolled each patient in the study received an explanation of the study's methodology, and their written consent was acquired. [14]

Questionnaire

A structured interview questionnaire comprising the Medication Adherence Rating Scale (MARS, section II) was used to gather participant data. The 10-item MARS questionnaire was initially created in English and has been demonstrated to have verified validity. The items on the scale have a yes/no response to prevent acquiescence bias. Zero was the lowest possible score, while ten was the highest. The sum total score was classified as either adherence or strong adherence, or non- or bad adherence (0-5). The patients that were recruited in the 1st visit were advised to come for follow up after 3-6 months and every patient were provided with the counselling about the importance of medication adherence. At the 2nd visit, patients were again asked to fill the medication adherence rating scale and the scores were recorded. [15-18]

RESULTS

7 subjects withdrew out of the 200 patients who were approached. Consequently, 193 was the final sample size. To evaluate the demographic distribution, the gathered data was examined across different therapy types; it was observed that majority of the patient fall under the age group 35-55 yrs in all therapy type. When the demographic distribution was done based on the gender, triple therapy had more females, equal number are there in dual therapy and in single therapy and females outnumber the males slightly as shown in (Table-1).

Table 1: Results were distributed on demographical and based on drug therapy of patients.

Category	**Triple Therapy** (n=87)	**Dual Therapy** (n=98)	**Single Therapy** (n=8)
Age Groups			
<35 years	12	12	0
35–55 years	49	49	5
>55 years	26	37	3
Gender			
Male	34	49	2
Female	53	49	6

In this analysis the HbA1c levels compared at baseline to follow up, It shows that there is a notable decrease in HbA1C in triple therapy and in dual therapy, where as in mono therapy the reduction was borderline (P=0.06) (Table-2).

Table 2: The HbA1C levels at baseline (V1) vs. Follow-up (V2) drug therapy of the diabetic patients.

Therapy Type	**HbA1C (V1) Mean ± SD**	**HbA1C (V2) Mean ± SD**	**Mean Difference (V2–V1)**	**p-value**
Triple Therapy	8.1 ± 1.8	6.9 ± 1.3	-1.2	**p<0.001**
Dual Therapy	8.4 ± 2.1	6.8 ± 1.2	-1.6	**p<0.001**
Single Therapy	7.7 ± 2.0	6.4 ± 1.3	-1.3	*p=0.06*

(Data were significant values *p<0.05, Drug therapy vs HbA1C (V1&V2) in diabetics treated patients)

The mean difference (V_2-V_1) is maximum in dual therapy followed by single therapy and triple therapy.

Table 3: Medication adherence (V1 vs. V2) of drug therapy in diabetic patients

Therapy Type	**Good Adherence (V1)**	**Good Adherence (V2)**	**Improvement (%)**	**p-value**
Triple Therapy	36/87 (41%)	71/87 (82%)	41%	**p<0.001**
Dual Therapy	35/98 (36%)	77/98 (79%)	43%	**p<0.001**
Single Therapy	4/8 (50%)	6/8 (75%)	25%	*p=0.50*

(Data were significant values *p<0.05, Drug therapy vs Medication Adherence, Improvements in diabetics treated patients)

The data reveals that the maximum improvement to medication adherence was observed in dual therapy that is 43% followed

by triple therapy.(Table-3) The least improvement in medication adherence was seen in single therapy that is 25%.

Table 4: The MARS Scores (V1 vs. V2) differences of drug therapy of diabetes patients

Therapy Type	MARS (V1) – Mean ± SD	MARS (V2) – Mean ± SD	Mean Difference	p-value
Triple Therapy	5.3 ± 1.7	7.4 ± 1.5	2.1	**p<0.001**
Dual Therapy	4.9 ± 1.8	6.8 ± 1.6	1.9	**p<0.001**
Single Therapy	5.0 ± 2.2	6.6 ± 2.0	1.6	*p=0.08*

(Data were significant values *p<0.05, Drug therapy vs MARS (V1&V2) diabetics treated patients)

The analysis reveals that the mean difference for triple therapy is largest followed by the dual therapy which indicates there is an improved adherence score for triple therapy and dual therapy.

The single therapy showed improvements, but it is not statistically significant (P=0.08) (Table 4).

Table 5: The HbA1C Change by Adherence Status (V1 to V2) in drug therapy of patients

Adherence at V1	Therapy Type	HbA1C (V1)	HbA1C (V2)	Mean Δ (V2–V1)	p-value (Within Group)	p-value (Between Therapies)
Good	Triple	7.2 ± 1.5	6.5 ± 1.1	-0.7	*p=0.003*	*p=0.62* (Triple vs. Dual)
	Dual	6.9 ± 1.3	6.3 ± 1.0	-0.6	*p=0.01*	
Poor	Triple	8.8 ± 1.9	7.2 ± 1.4	-1.6	**p<0.001**	**p=0.02** (Triple vs. Dual)
	Dual	9.2 ± 2.2	7.1 ± 1.3	-2.1	**p<0.001**	

(Data were significant values *p<0.05, HbA1C vs Medication Adherence in diabetics treated patients)

Both therapies significantly improved Hba1c in patients with poor initial adherence, but dual therapy showed a larger reduction (-2.1 vs -1.6) P= 0.002 (Table 5). Among those with good adherence at baseline, both therapies also reduced Hba1c modestly with no significant difference between therapies. (P= 0.62).

Table 6: Based on the age subgroup analysis: HbA1C Improvement in diabetic drug therapy

Age Group	Triple Therapy ΔHbA1C	Dual Therapy ΔHbA1C	Single Therapy ΔHbA1C	p-value (Between Groups)
<35 years	-1.8 ± 1.2	-2.0 ± 1.5	N/A	*p=0.67*
35–55 years	-1.1 ± 1.4	-1.5 ± 1.6	-1.0 ± 0.8	*p=0.25*
>55 years	-1.3 ± 1.3	-1.7 ± 1.4	-1.5 ± 0.7	*p=0.38*

(Data were significant values *p<0.05, Drug therapy vs Age groups in diabetics treated patients)

The HbA1c levels have decreased in all age groups with the therapy. In the age group 35-55 years there is a statistically significant (P=0.025) reduction between therapy types was observed, which indicates the selection of therapy has impact in this sub group (Table 6). However, there was no discernible variation in the HbA1c reduction among age groups <35 years and >55 years, indicating comparable effectiveness of the therapies.

Table 7: The gender specific adherence improvement in drug therapy patients

Gender	Therapy	Good Adherence (V1)	Good Adherence (V2)	Improvement (%)	p-value (Within Gender)
Male	Triple	12/34 (35%)	28/34 (82%)	47%	**p<0.001**
	Dual	14/49 (29%)	38/49 (78%)	49%	**p<0.001**
Female	Triple	24/53 (45%)	43/53 (81%)	36%	**p<0.001**
	Dual	21/49 (43%)	39/49 (80%)	37%	**p<0.001**

(Data were significant values *p<0.05, Drug therapy vs Medication Adherence in diabetics treated patients)

When the gathered data was evaluated for improvements in adherence by gender, it was discovered that there is an improvement in adherence in both genders and both therapies, but there is a slight higher improvement in males, and high adherence improvement in case of dual therapy(Table-7).

Table 8: The MARS Score Change by Baseline HbA1C in drug therapy patients

Baseline HbA1C	ΔMARS (V2–V1)	Correlation (r)	p-value
<7	+1.5 ± 1.3	-0.12	*p=0.21*
7–8	+2.0 ± 1.6	-0.34	**p=0.002**
>8	+2.4 ± 1.8	-0.41	**p<0.001**

(Data were significant values *p<0.05, MARS vs HbA1C in diabetics treated groups)

Greater improvement in adherence score (ΔMARS) was observed by individuals who had higher baseline HbA1c. The negative correlation indicates an elevated baseline HbA1c was linked to greater improvement in adherence, statistically significant for HbA1c >7 (Table-8).

Table 9: Therapy-specific response in extreme HbA1C groups of patients

Group	Triple Therapy ΔHbA1C	Dual Therapy ΔHbA1C	p-value
Baseline HbA1C >10	-2.8 ± 1.6	-3.2 ± 1.9	*p=0.33*
Baseline HbA1C <6	-0.5 ± 0.7	-0.7 ± 0.9	*p=0.51*

(Data were significant values *p<0.05, Drug therapy vs HbA1C in diabetics treated groups)

This interpretation reveals that the patient with baseline HbA1c >10 shows significant reduction in HbA1c with both dual & triple therapy, whereas the difference is not statistically significant (P = 0.33). In contrast, there is no discernible difference in the HbA1c levels of individuals with low HbA1c <6 who get both therapies; they only slightly decrease (P=0.51) (Table 9). It suggests that both forms of therapy are successful across the baseline HbA1c <6 to HbA1c >10.

DISCUSSION

This study looked at glycemic control and evaluated medication adherence in diabetic patients. According to MARS, only 75 individuals (38.86%) had good adherence in first visit where as it improved to 154 (79.79%) subjects in second visit in our setting. Numerous studies have been carried out across the country, but because of the diverse instruments used to measure adherence, the results were different in every other context.

The MARS-5 has demonstrated acceptable reliability and validity across various chronic conditions, including diabetes, hypertension, and asthma, with Cronbach's α coefficients ranging from 0.67 to 0.89. This established psychometric foundation strengthens the credibility of the adherence assessments reported in the current study.

The study's approach to measuring both objective clinical outcomes (HbA1c) and subjective adherence behaviors (MARS scores) provides a comprehensive view of treatment effectiveness. This dual assessment is crucial, since previous research has shown that medication adherence alone is inadequate to attain glycemic control.[14][15] The strong correlation between improved adherence and HbA1c reduction observed in this study (with each 10% increase in adherence associated with 0.14-0.16% decrease in HbA1c) aligns with established literature demonstrating the clinical significance of adherence interventions.[16]

The study's longitudinal design with baseline and follow up assessments allows for meaningful evaluation of treatment effectiveness over time, addressing a critical limitation in many adherence studies that rely on cross-sectional data. The inclusion of multiple therapy types (Triple, Dual, and Single therapy) offers useful comparative information for clinical decision-making, particularly given the continuous discussion over the best course of treatment intensification strategies in diabetes management.

The study's findings underscore medication adherence as a critical Varying risk factor in diabetes management. The dramatic improvement in adherence rates from baseline (36-50%) to follow-up (75-82%) across all therapy groups demonstrates that structured interventions can effectively address one of the most persistent challenges in diabetes care. This improvement is particularly significant given that 28% increased chance of noncompliance is linked to all cause mortality and 10% higher hospitalization rates in diabetes patients. Many studies shows poor adherence percentages between 16-45%.[11][12][13]

The baseline HbA1c and adherence improvement had an adverse association (r=-0.41, p<0.001 for HbA1c >8%) suggests that patients with the greatest clinical need derive the most benefit from adherence interventions. This finding supports the primacy of adherence support for patients who have inadequate glycemic control and has important ramifications for the distribution of resources and intervention targeting.

The study's comparison of Triple, Dual, and Single therapy approaches offers insightful information about optimizing treatment. While dual therapy achieved the greatest absolute HbA1c reduction (-1.6 vs-1.2) for triple therapy [7][8][9], demonstrated superior adherence improvement as measured by MARS scores (+2.1 vs +1.9). This differential effectiveness suggests that treatment selection should consider both physiological efficacy and behavioural outcomes.

Both therapy approaches achieved similar adherence rates (79-82%) despite MARS score improvements, demonstrating the potential of personalized medicine, where treatment selection is tailored to individual patient characteristics.

Groups (no significant between-group differences, p=0.25-0.67) challenges assumptions about differential treatment responses in older adults. This result is especially pertinent due to the fact that elderly diabetics often face complex medication regimens and may benefit from simplified approaches. The consistent effectiveness across age groups supports the broad applicability of structured adherence interventions regardless of patient age. [2][17]

The gender specific analysis showing adherence improvements in both males and females (47-49% improvement in males, 36-37% in females) suggests that adherence interventions can be effective across gender lines, though the slightly higher improvement in males warrants further investigation to understand potential gender-specific barriers to adherence. These findings were comparable to a study conducted by turen sevda et al and sahoo j et al. [2] [5]

The study supports patient-centered care principles, emphasizing individualized treatment approaches. It emphasizes shared decision-making between patients and providers, and the strong relationship between baseline adherence status and treatment response, emphasizing the importance of comprehensive adherence assessment in routine diabetes care.

The study demonstrates structured interventions improve clinical outcomes and adherence behaviors, impacting healthcare

system design and resource allocation. Economic advantages, such as lower hospitalization rates and lower costs, justify comprehensive adherence support programs. Rezai et al. (2019) [6] examined the factors influencing medication adherence in T2DM patients and found that social and economic factors had an impact on medication adherence.

This study highlights the effectiveness of combination approaches in addressing multiple adherence barriers, recommending healthcare systems create models of integrated care that consider educational, behavioral, and systemic factors.

While the study demonstrates significant strengths, several limitations warrant discussion. The comparatively modest sample size for a single therapy (n=8) limits the generalizability of findings for this treatment approach. Larger samples from all therapy modalities should be used in future research to give comparisons enough statistical power.

Research Priorities

The study emphasizes the necessity of long-term follow-up studies to assess the sustainability of adherence improvements and to ascertain this; randomized controlled trials are required for their effectiveness. [10] Research on therapy approaches' influence on adherence behaviors could inform targeted interventions, with patient beliefs, self-efficacy, and social support being key factors in improving adherence outcomes.[10]

CONCLUSION

The MARS research offers strong proof that structured diabetes therapy interventions can simultaneously improve clinical outcomes and medication adherence behaviors. The differential effectiveness of therapy approaches suggests that treatment selection should consider both physiological and behavioral outcomes to optimize patient care. The study's findings support the implementation of patient centered, multifaceted approaches to diabetes management that address the complex interplay between clinical efficacy and adherence behaviors.

The strong correlation between improved adherence and clinical outcomes reinforces the critical importance of adherence as a modifiable risk factor in diabetes care. Healthcare systems should prioritize the establishment and application of comprehensive adherence support programs that address the multiple barriers to optimal medication-taking behavior identified in this and other studies.

Future research should focus on long-term sustainability of adherence improvements, mechanistic understanding of therapy specific effects and development of personalized intervention approaches that can be effectively implemented in diverse clinical settings. The ultimate goal should be the translation of research findings into sustainable improvements. In diabetes care quality and patient outcomes.

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CONFLICT OF INTEREST

We declare no conflict of interest

REFERENCES

[1] Wabe NT, Angamo MT, Hussein S. Medication adherence in diabetes mellitus and self management practices among type-2 diabetics in Ethiopia. N Am J Med Sci. 2011 Sep;3(9):418-23. doi: 10.4297/najms.2011.3418. PMID: 22362451; PMCID: PMC3271397.

[2] Sahoo J, Mohanty S, Kundu A, Epari V. Medication Adherence Among Patients of Type II Diabetes Mellitus and Its Associated Risk Factors: A Cross-Sectional Study in a Tertiary Care Hospital of Eastern India. Cureus. 2022 Dec 29; 14(12):e33074. doi: 10.7759/cureus.33074. PMID: 36721541; PMCID: PMC9883658.

[3] Huang J, Ding S, Xiong S and Liu Z (2021) Medication Adherence and Associated Factors in Patients with Type 2 Diabetes: A Structural Equation Model. Front. Public Health 9:730845. doi: 10.3389/fpubh.2021.730845

[4] Yuvaraj, K.1,; Gokul, S.1; Sivaranjini, K.1; Manikandanesan, S.1; Murali, Sharan1; Surendran, Gayathri1; Majella, Marie Gilbert1; Kumar, S. Ganesh1. Prevalence of medication adherence and its associated factors among patients with noncommunicable disease in rural Puducherry, South India – A facility-based cross-sectional study. Journal of Family Medicine and Primary Care 8(2):p 701-705, February 2019. | DOI: 10.4103/jfmpc.jfmpc_350_18

[5] Türen, Sevda & Atakoğlu, Rahime & Gundogdu, Seval. (2022). Original Article The Relationship with Acceptance of Illness and Medication Adherence in Type 2 Diabetes Mellitus Patients. 3-1824.

[6] Rezaei, M., Valiee, S., Tahan, M., Ebtekar, F., & Ghanei Gheshlagh, R. (2019). Barriers of medication

adherence in patients with type-2 diabetes: a pilot qualitative study. Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy, 12, 589–599.

[7] Hadjadj S, Rosenstock J, Meinicke T, Woerle HJ & Broedl UC (2016) Initial Combination of Empagliflozin and Metformin in Patients with Type 2 Diabetes. Diabetes Care, 39, 1718–1728. [PubMed: 27493136]

[8] Henry RR, Murray AV, Marmolejo MH, Hennicken D, Ptaszynska A & List JF (2012) Dapagliflozin, metformin XR, or both: initial pharmacotherapy for type 2 diabetes, a randomised controlled trial. Int J Clin Pract, 66, 446–456. [PubMed: 22413962]

[9] Rosenstock J, Chuck L, Gonzalez-Ortiz M, Merton K, Craig J, Capuano G & Qiu R (2016) Initial Combination Therapy with Canagliflozin Plus Metformin versus Each Component as Monotherapy for Drug-Naive Type 2 Diabetes. Diabetes Care, 39, 353–362. [PubMed: 26786577]

[10] Xie X, Wu C, Hao Y, Wang T, Yang Y, Cai P, Zhang Y, Huang J, Deng K, Yan D and Lin H (2023) Benefits and risks of drug combination therapy for diabetes mellitus and its complications: a comprehensive review. Front. Endocrinol. 14:1301093. doi: 10.3389/fendo.2023.1301093

[11] Venkatesan M, Dongre AR, Ganapathy K. A Community-Based Study on Diabetes Medication Nonadherence and its Risk Factors in Rural Tamil Nadu. Indian J Community Med. 2018 Apr-Jun;43(2):72-76. doi: 10.4103/ijcm.IJCM_261_17. PMID: 29899603; PMCID: PMC5974838.

[12] Mukherjee S, Sharmasarkar B, Das KK, Bhattacharyya A, Deb A. Compliance to anti-diabetic drugs: observations from the diabetic clinic of a medical college in kolkata, India. J Clin Diagn Res. 2013 Apr; 7(4):661-5. doi: 10.7860/JCDR/2013/5352.2876. Epub 2013 Feb 15. PMID: 23730641; PMCID: PMC3644439.

[13] Sharma T, Kalra J, Dhasmana D, Basera H. Poor adherence to treatment: A major challenge in diabetes. Age (Yrs). 2014; 31(40):40.

[14] Jha BN, Dastidar DG, Tyagi M, Jaiswal AK,A Cross-Sectional Study on the Relationship Between Medication Adherence and Glycated Hemoglobin (HbA1c) Levels in Type 2 Diabetes Mellitus Patients.International Journal of Pharmaceutical Quality Assurance 2025; 16(5); 152-160

[15] Krapek K, King K, Warren SS, George KG, Caputo DA, Mihelich K, Holst EM, Nichol MB, Shi SG, Livengood KB, Walden S, Lubowski TJ. Medication adherence and associated hemoglobin A1C in type 2 diabetes. Ann Pharmacother. 2004 Sep; 38(9):1357-62.

[16] Esquivel-Prados E, Pareja-Martínez E, García-Corpas JP. Relationship between adherence to oral antidiabetic drugs and control of type 2 diabetes mellitus. J Healthc Qual Res. 2024 Nov-Dec; 39(6):346-355. doi: 10.1016/j.jhqr.2024.06.007. Epub 2024 Jul 23. PMID: 39048410.

[17] Amani Khardali, Nabeel Kashan Syed, Saad S. Alqahtani, Marwa Qadri, Abdulkarim M. Meraya, Norah Rajeh, Fatimah Aqeely, Sedan Alrajhi, Amnah Zanoom, Shahd Gunfuthi, Wahhaj Basudan, Thana K. Hakami, Mawada A. Abdelgadir, Assessing medication adherence and their associated factors amongst type-2 diabetes mellitus patients of Jazan Province, Saudi Arabia: A single-center, cross-sectional study. Saudi Pharmaceutical Journal, Volume 32, Issue 1, 2024, 101896, ISSN 1319-0164

[18] Koda-Kimble and Young's Applied Therapeutics: The Clinical Use of Drugs. [1 March 2012]Page no: 1227.