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ASSESSMENT OF KNOWLEDGE, ATTITUDE AND PRACTICE AMONG DIABETES MELLITUS PATIENTS ATTENDING A TERTIARY HOSPITAL AND THE IMPACT OF PHARMACIST-LED EDUCATION

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Abstract:

Background: *Diabetes mellitus is a chronic metabolic disorder characterised by elevated blood glucose levels due to defects in insulin secretion or action. With Over 537 adults affected globally and a high burden in India it has emerged as an major public health concern the prevalence continues to rise imposing substantial economic and healthcare challenges.*

Materials and Methods: *This is a prospective randomised and interventional study conducted at MAMS hospital, Hyderabad, Over a period of 6 months. A total of 390 DM patients were enrolled and randomized into test and control group using block randomization technique. The knowledge attitude and practice (KAP) questionnaire and medication adherence rating scale (MARS) where administered at baseline and across 3 subsequent monthly follow ups. The test group received structured pharmacist led education on disease awareness medication difference and diet, lifestyle modification at every visit while control group received routine care.*

Results: *A significant Improvement in clinical and behavioural parameters were observed in test group compared to the control group ($p<0.05$). In the test group systolic blood pressure drop from 160 to 120 MmHg and diastolic blood pressure normalised to 80 mmHg. Glycaemic levels also saw significant reductions with FBS falling from 150 to 100 mg/dL. Behaviorally the test groups KAP scores search from 23.9 at baseline to a perfect 100% by the final follow up. And medication Terence improved from 30 to 90%. Conversely the control group showed no significant clinical or behavioral improvements.*

Conclusion: *pharmacist led education significantly improves the understanding, medication adherence and clinical outcomes of patients with diabetes mellitus. Through structured counselling and consistent monitoring Pharmacists play a critical role in Transforming diabetic care from passive treatment to active patient management.*

Keywords: *Diabetes Mellitus, pharmacist led education, KAP questionnaire, medication adherence, patient counselling, glycemic control.*

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INTRODUCTION:

Diabetes mellitus is a chronic metabolic disorder characterized by elevated blood glucose levels due to defects in insulin secretion, insulin action, or both [1,2,3]. The term originates from Greek and Latin words meaning "to pass through" and "sweet," reflecting early observations of sweet-tasting urine in affected individuals [4]. Scientific advancements in the late 19th and early 20th centuries established the role of the pancreas and insulin in diabetes, with insulin discovery in 1922 marking a major therapeutic breakthrough [5].

Diabetes is broadly classified into Type 1, Type 2, and gestational diabetes, along with less common forms such as MODY and neonatal diabetes [6]. Type 1 diabetes is primarily an autoimmune condition leading to destruction of pancreatic beta cells and absolute insulin deficiency [7]. Type 2 diabetes, the most common form, is associated with insulin resistance and relative insulin deficiency, often linked to obesity, sedentary lifestyle, and aging [8].

Globally, diabetes has emerged as a major public health concern. According to recent estimates, over 537 million adults are living with diabetes, with projections indicating a continuous rise in prevalence [9,10]. In India, the burden is particularly high, with millions affected and a significant proportion remaining undiagnosed [11]. This growing prevalence imposes substantial economic and healthcare challenges worldwide [12].

The pathophysiology of diabetes involves impaired glucose metabolism. In Type 1 diabetes, autoimmune destruction of beta cells leads to insulin deficiency, whereas in Type 2 diabetes, insulin resistance combined with inadequate insulin secretion results in hyperglycemia [13]. Chronic hyperglycemia contributes to metabolic disturbances affecting carbohydrates, fats, and proteins, and may lead to complications such as ketoacidosis in severe cases [14].

Clinical manifestations vary between types but commonly include polyuria, polydipsia, polyphagia, fatigue, weight loss, blurred vision, and recurrent infections [15]. Type 1 diabetes often presents acutely, while Type 2 develops gradually and may remain asymptomatic for years [16]. If uncontrolled, diabetes can lead to long-term complications such as cardiovascular disease, nephropathy, neuropathy, retinopathy, and foot Disorders. [17].

Risk factors for Type 1 diabetes include genetic predisposition and autoimmune triggers, whereas Type 2 diabetes is strongly associated with modifiable factors such as obesity, physical inactivity, poor diet, hypertension, and dyslipidemia [18]. Early identification of these risk factors is essential for prevention and control [19].

Diagnosis of diabetes is based on laboratory tests such as fasting plasma glucose, HbA1c, oral glucose tolerance test, and random plasma glucose measurements [20]. Early diagnosis is critical to prevent complications and improve outcomes [21].

Management of diabetes includes both non-pharmacological and pharmacological approaches. Lifestyle modifications such as diet control, physical activity, and regular monitoring play a key role [22]. Pharmacological treatment includes insulin therapy and oral hypoglycemic agents such as metformin and sulfonylureas [23]. Patient education and adherence to therapy are crucial for effective disease management [24].

Healthcare professionals, particularly pharmacists, play an important role in diabetes care through patient education, medication management, and screening programs.

In conclusion, diabetes mellitus is a rapidly growing global health issue with significant morbidity and mortality. Early detection, proper management, and increased awareness are essential to reduce its burden and prevent complications. (25).

MATERIAL AND METHODS:

This is a Prospective, randomized and interventional study conducted in Mamatha Academy of Medical Sciences [MAMS] Hospital, Bachupally, Hyderabad, India. The study was carried out over a period of 6

months. Patients meeting specific inclusion and exclusion criteria were enrolled in the study using the block randomization technique to avoid selection bias and to ensure equal distribution.

Patients aged 18 and older, newly or previously diagnosed with diabetes mellitus, who were willing to provide informed consent and attend follow-ups for 3 months, were included. Patients who had not received structured diabetes education in the last 3 to 6 months were also included. Patients with cognitive impairment, psychiatric illness, severe complications, or those critically ill in the ICU were excluded.

A data collection form was developed to obtain details, including patients' demographics (age, gender, occupation), educational status, duration of diabetes, and family history. Clinical parameters, including fasting blood sugar [FBS], post – lunch blood sugar [PLBS], and blood pressure [BP], were recorded along with behavioural parameters.

STUDY TOOLS AND DATA COLLECTION :

The fundamental data was collected through in-person interviews using two standardized tools: Knowledge, Attitude and Practice [KAP] questionnaire. It consists of 23 questions and is used to estimate awareness and self-care practices. Each correct answer was scored 2 points, while an incorrect answer scored 1 point.

Medication Adherence Rating Scale[MARS]: A 10-item(0-10) scale where higher scores indicate better treatment adherence.

The study was conducted in many phases. During the baseline assessment[T0], clinical and behavioural data were recorded for all participants. Patients were then randomised into two groups:

TEST GROUP**:** Received structured pharmacist-led education on disease awareness, medication adherence, diet, and lifestyle modifications at every follow-up.

CONTROL GROUP: Received routine care, with educational intervention provided only at the final follow-up.

All patients were followed for 3 months with an interval of 30 days between visits(T1, T2 and T3). At every follow-up visit, clinical parameters (FBS, PLBS, BP) were measured, and KAP and MARS questionnaires were re-administered.

STATISTICAL ANALYSIS:

The Statistical Package for the Social Sciences [SPSS] was used to examine the data. Descriptive statistics, including mean ± SD, median, and interquartile range, were applied. Since the data was not normally distributed, non-parametric tests were used. The Wilcoxon signed-rank test was used to compare baseline and follow-up data between the groups to determine the influence of the pharmacist intervention. Spearman's correlation was applied to assess the association between the various domains of the KAP scores. A p-value of <0.05 was considered statistically significant.

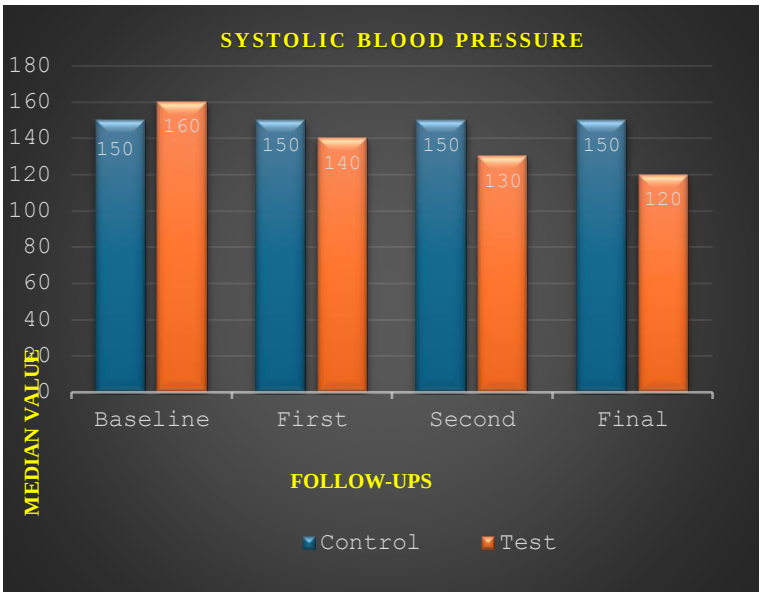
RESULTS:

A total of 390 patients were enrolled from the General Medicine and Endocrinology department of MAMS Hospital. Details are mentioned below in the table.

Table: Demographic details.

PARAMETER	**CONTROL** (n=190)	**TEST** (n=200)
Gender	N (%)	N (%)
• Male	127(66.85)	143(71.5)
• Female	63(33.15)	57(17.53)
Age		
• 31-40	7(3.68)	8(4)
• 41-50	15(7.89)	20(10)
• 51-60	75(39.47)	69(34.5)
• 61-70	93(48.94)	103(51.5)
Educational Qualification		
• Uneducated	36(18.94)	40(20)
• Primary school	47(24.73)	32((16)
• Secondary school	10(5.26)	100(50)
• Intermediate	52(27.33)	16(8)
• Graduate	45(23.68)	12(4.8)
Occupational Status		
• Farmer	67(35.26	70(35)
• Daily wage worker	47(24.73)	25(12.5)
• Housewife	8(4)	10(5)
• Business	168.43)	16(8)
• IT employee	25(13.15)	47(23.5)
• Teacher	1(0.52)	4(2)

• Engineer	14(7.36)	12(6)
• Others	12(6.31)	16(8)
Annual Income		
• <50,000	40(21.05)	40(22.5)
• 50,001-1,00,00	60(31.57)	70((35)
• 1,00,001-1,50.000	30(15.78)	30(15)
• 1,50,001-3,00,000	27(14.21)	27(13.5
• 3,00,001-5,00,000	23(12.10)	23(11.5)
• >5,00,000	10(5.26)	10(5
Marital Status		
• Married	100(52.63)	106(53)
• Unmarried	86(45.26)	87(43.5)
• Divorce	4(2.21)	7(6.33)
Alcoholic Status		
• Non-alcoholic	76(40)	67(33.5)
• Social drinker	45(23.68)	51(25.5)
• Alcoholic	37(19.47)	68(34)
• Past alcoholic	32((16.84)	14(7)
Smoking Status		
• Non- Smoker	86(45.26)	73(36.5)
• Smoker	76(40)	83(36.5)
• Past smoker	14(7.33	44(22



MEDIAN SYSTOLIC BLOOD PRESSURE BETWEEN THE FOLLOW-UPS AMONG THE CONTROL AND TEST GROUPS:

The study monitored systolic blood pressure (SBP) from baseline to final follow-up. The Test group achieved a significant reduction from 160 mmHg to 120 mmHg ($p < 0.001$). Conversely, the Control group showed no significant change ($p > 0.12$), highlighting the effectiveness of the intervention in maintaining SBP within target ranges.

MEDIAN DIASTOLIC BLOOD PRESSURE BETWEEN THE FOLLOW-UPS AMONG THE CONTROL AND TEST GROUPS

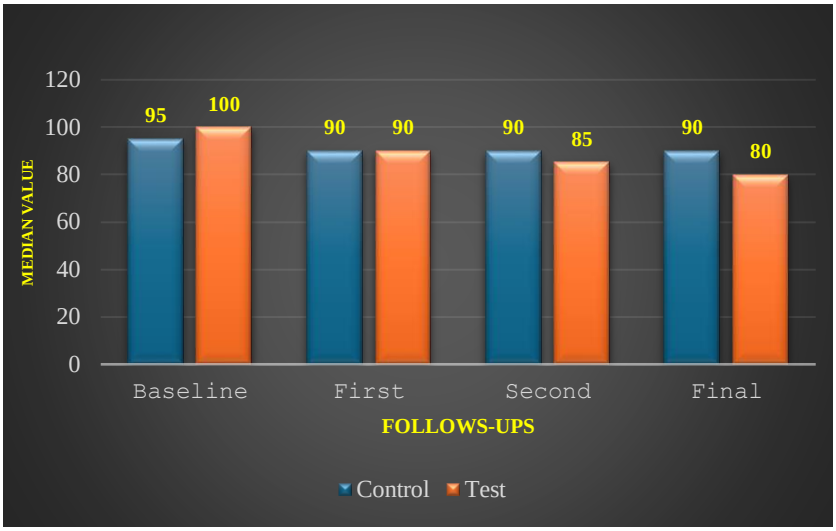


Figure 2 Median diastolic blood pressure among control and test group

Diastolic blood pressure (DBP) was tracked across all follow-ups. The Test group showed a statistically significant reduction from 100 mmHg to 80 mmHg ($p < 0.001$). In contrast, the Control group remained virtually unchanged ($p > 0.98$), demonstrating that the intervention successfully normalized DBP levels over time.

MEAN FBS AND PLBS AMONG THE CONTROL GROUP PATIENTS

The mean FBS and PLBS at the baseline follow-up in the control group were 150 mg/dl and 260mg/dl, respectively. In the final follow-up, the mean FBS and PLBS were 150 mg/dl and 260 mg/dl. These values suggest that the glycemic control did not improve significantly in the control group patients. The findings are presented in the figure

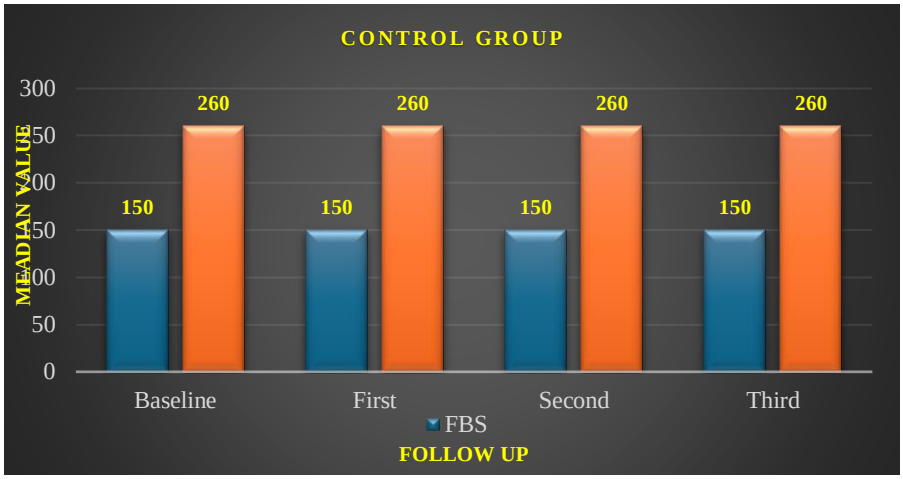
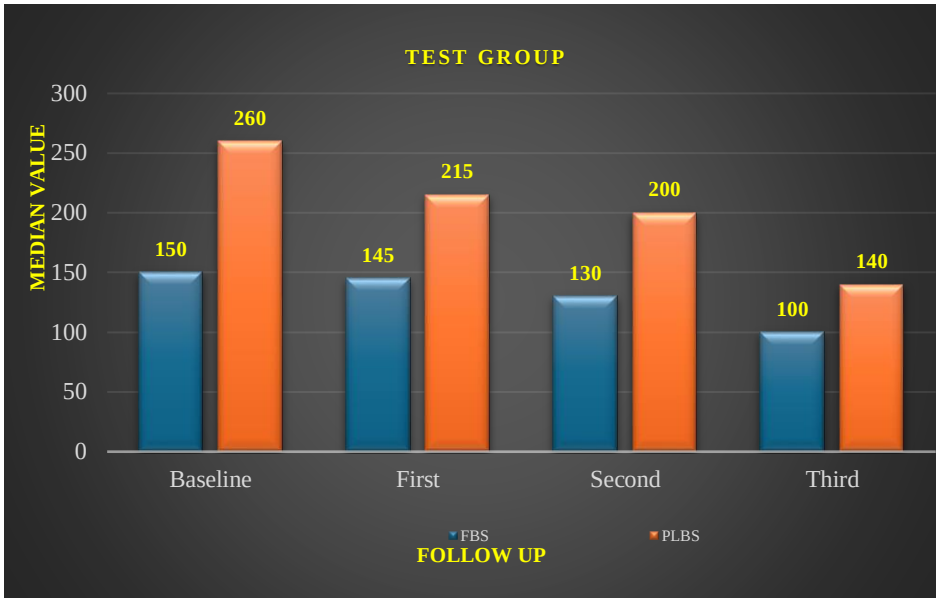


Figure 3 Mean FBS and PLBS levels among the Control group patients

MEAN FBS AND PLBS AMONG THE TEST GROUP PATIENTS

The mean FBS and PLBS at the baseline follow-up in the test group were 150 mg/dl and 260 mg/dl, respectively. In the final follow-up, the mean FBS and PLBS were 100 mg/dl and 140mg/dl, which showed a significant improvement in the test group patients. The observations are presented in the figure.



A pilot study was conducted among 10% of the total sample size to determine the patients' understanding of the questionnaire. A Cronbach alpha value was calculated for the questionnaire used in the study to determine the questionnaire's reliability. The Cronbach alpha for the KAP questionnaire was 0.76 (The knowledge domain was 0.69, the Attitudes domain was 0.7, and the Practices domain was 0.79).

Mean and Median scores of the KAP questionnaire among the control and test groups

Descriptive statistics were applied to obtain mean and median values of the KAP questionnaire for every follow-up are represented in the table.

Mean and median scores of the KAP questionnaire among control and test groups:

KAP Scores	Control 0 Mean±SD Median [IQR]	Control 1 Mean±SD Median [IQR]	Control 2 Mean±SD Median [IQR]	Control 3 Mean±SD Median [IQR]	Test 0 Mean±SD Median [IQR]	Test 1 Mean±SD Median [IQR]	Test 2 Mean±SD Median [IQR]	Test 3 Mean±SD Median [IQR]
K	4.±1.8 4 (2-4)	4.±1.8 4 (2-4)	4.±1.8 4 (2-4)	4.±1.8 4 (2-4)	4.±1.8 4 (2-4)	8±2.3 8(6-8)	10±2.8 10(9-10)	16±0.5 16(14-16)
A	3±2.1 4(2j4)	3±2.1 4(2j4)	3±2.1 4(2j4)	3±2.1 4(2j4)	3±2.1 4(2j4)	7±1.1 7 (6-7	9±1.3 10(9-10)	14±1.2 14(12-14)
P	4.1±1.8 4 (2-4)	4.1±1.8 4 (2-4)	4.1±1.8 4 (2-4)	4.1±1.8 4 (2-4)	4.1±1.8 4 (2-4)	8.2±2.3 4 (2-4)	9.6±2.8 10(9-10)	15.3±0.5 16(14-16)
KAP	11±2.5 11(10-11)	11±2.5 11(10-11)	11±2.5 11(10-11)	11±2.5 11(10-11)	11±2.5 11(10-11)	23.4±2.6 24(22-24)	28.3±3.6 28 (25-28)	45.3±0.75 46(42-46)

The table shows that the KAP scale was used in both groups at baseline, first, second, and final follow-up. A significant improvement was observed in the test group patients compared to the control group patients.

CORRELATION OF KAP SCORES BETWEEN THE DOMAINS AMONG THE CONTROL GROUP

8		
Follow-up	Spearman Correlation	p-value*
Baseline	1	0.134
First Follow-up (T1)	1	0.062
Second Follow-up (T2)	1	0.179
Final Follow-up (T3)	1	0.179
Correlation between A-P scores		
Baseline (T0)	1	0.005
First Follow-up (T1)	1	0.020
Second Follow-up (T2)	1	0.041
Final Follow-up (T3)	1	0.041
Correlation between K-P scores		
Baseline (T0)	1	0.003
First Follow-up (T1)	1	0.010
Second Follow-up (T2)	1	0.015
Final Follow-up (T3)	1	0.015

Correlation of KAP scores between the domains among the control group

*Spearman Correlation test

*correlation was significant at ≤0.05 (2-tailed)

CORRELATION OF KAP SCORES BETWEEN THE DOMAINS AMONG THE TEST GROUP

Correlation between K-A scores		
Follow-up	Spearman Correlation	p-value*
Baseline	1	0.164
First Follow-up (T1)	1	0.053
Second Follow-up (T2)	1	**<0.001****
Final Follow-up (T3)	1	**<0.001****
Correlation between A-P scores		

Baseline (T0)	1	0.543
First Follow-up (T1)	1	**<0.001****
Second Follow-up (T2)	1	**<0.001****
Final Follow-up (T3)	1	**<0.001****
Correlation between K-P scores		
Baseline (T0)	1	0.131
First Follow-up (T1)	1	**<0.001****
Second Follow-up (T2)	1	**<0.001****
Final Follow-up (T3)	1	**<0.001****

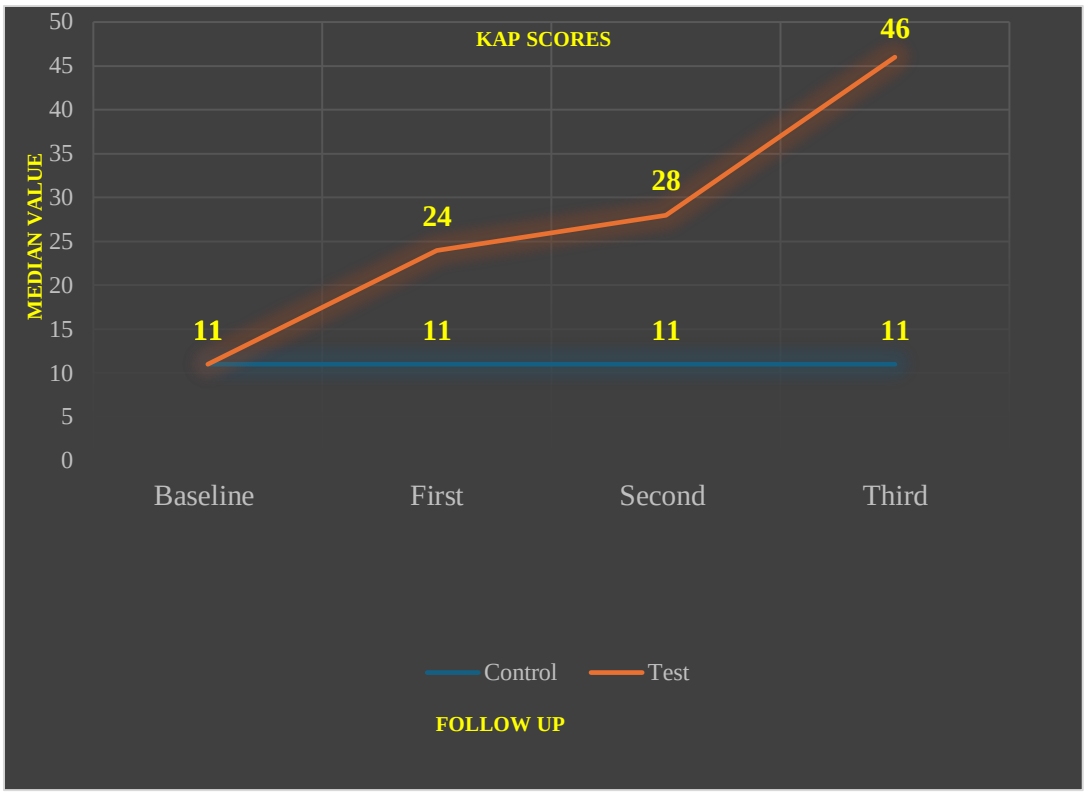


Figure 5 Median KAP score from baseline to final follow-up among the control and test groups

At baseline, both groups had low KAP scores of 11 (23.91%). By the final follow-up, the Test group achieved a perfect score of 46 (100%), reflecting total mastery of health literacy ($p < 0.001$). The Control group showed no change, emphasising that structured education is vital for behavioural shifts.

Medication adherence scores	Control 0 Mean ±SD Median [IQR]	Control 1 Mean ±SD Median [IQR]	Control 2 Mean ±SD Median [IQR]	Control 3 Mean ±SD Median [IQR]	Test 0 Mean ±SD Median [IQR]	Test 1 Mean ± SD Median [IQR]	Test 2 Mean ±SD Median [IQR]	Test 3 Mean ±SD Median [IQR]
MARS	2.63± 0.733 (2-3)	2.63± 0.733 (2-3)	2.63± 0.733 (2-3)	2.63± 0.733 (2-3)	2.63± 0.733 (2-3)	4.71 ± 1.23 5 (4-6)	6.72± 0.718 (6-7)	8.60 ±0.676 9 (8-9)

Table of Mean and median score of the MARS questionnaire among control and test groups:

The table shows that the Medication Reporting scale was used to assess the medication adherence behaviour of the patients in both groups at baseline, first, second, and final follow-up. A significant improvement in medication behaviour was observed in the test group patients compared to that of the control group patients.

Median MARS score from baseline to final follow-up among the control and test group

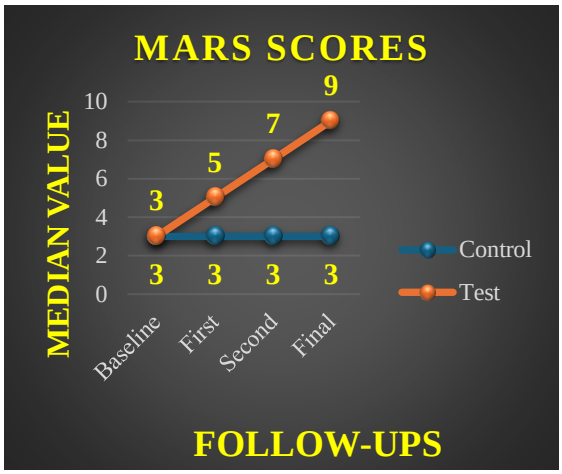


Figure 6 :Median MARS score from baseline to final follow up among the control and test groups

Both groups began with low medication adherence scores of 3 (30%). By the final follow-up, the Test group significantly improved to 9 (90%) due to targeted counselling ($p < 0.001$). Meanwhile, the Control group remained stagnant at 30%, showing no behavioural improvement ($p > 0.05$).

Table of Comparison of MARS scores between the follow-ups among the control and test groups:

MARS SCORES	CONTROL		TEST	
	Z -value	P-value	Z-value	P-value
T_0-T_1	0.000	1.000	14.393	< **0.001****
T_1-T_2	0.000	1.000	14.098	< **0.001****
T_0-T_3	0.000	1.000	14.452	< **0.001****
T_1-T_2	0.000	1.000	14.123	< **0.001****
T_1-T_3	0.000	1.000	14.133	< **0.001****
T_2-T_3	0.000	1.000	14.453	< **0.001****

This study followed 390 patients, primarily low-income males aged 61–70. The Test group achieved remarkable clinical results: Systolic BP dropped from 160 to 120 mmHg, while Diastolic BP normalized to 80 mmHg. Glycaemic levels also saw significant reductions, with FBS falling from 150 to 100 mg/dl.

Behaviourally, the intervention was transformative. The Test group's KAP scores surged from 23.9% to a perfect 100%, and medication adherence (MARS) jumped from 30% to 90%. In contrast, the Control group showed no clinical or behavioural improvement ($p > 0.05$), proving that structured pharmacist-led counselling successfully turns medical knowledge into life-saving practice.

DISCUSSION:

This study of 390 diabetic patients—low-income elderly males—demonstrates the transformative power of pharmacist-led intervention. While both groups began with poor health literacy and low medication adherence (24–28%), the Test group showed dramatic clinical improvements. Their blood pressure stabilized from 160/100 to 120/80 mmHg, and blood glucose levels normalized significantly.

Beyond physical markers, the intervention achieved a 100% median KAP score, indicating perfect health literacy post-counselling. Medication adherence also surged to 86%, driven by consistent telephone reminders. In contrast, the Control group remained stagnant, proving that structured educational support is essential for managing chronic diseases**.**

CONCLUSION:

The study highlights the **pharmacist's critical role** in transforming diabetic care from passive treatment to active patient management. Through structured counselling, patients achieved significant clinical improvements and higher medication adherence. However, the study's impact is limited by its **single-site scope** (Hyderabad), short duration, and reliance on self-reported data, which may introduce recall or social desirability bias.

Future research should focus on **multicentre trials** and long-term monitoring. Integrating digital health tools and evaluating the economic benefits—such as reduced hospitalization rates—will be essential to proving the sustainability and scalability of pharmacist-led interventions for complex, comorbid conditions.

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