International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

An Interventional Study to Assess and Improve Knowledge, Attitude, Practice, and Medication Adherence among Type-II Diabetes Patients in a Tertiary Care Teaching Hospital

Dr. S Vinod Naik[1], Bharathi[2], Ganeshakumara M[2], Vasalli Sai Vinay[2], Juby Mol[2], Abhijith G[2]

[1]Assistant Professor, Department of Pharmacy Practice, TVM College of Pharmacy, Ballari, Karnataka, India
[2]V Pharm D Student, TVM College of Pharmacy, Ballari, Karnataka, India

Abstract

Background: Type 2 diabetes mellitus (T2DM) is a chronic condition involving insulin resistance and impaired glucose regulation. Effective management depends on patient adherence to medications and lifestyle changes. However, poor knowledge, negative attitudes, and inappropriate practices (KAP) often impede optimal control of the disease. This study aims to assess the baseline KAP and medication adherence levels among T2DM patients and evaluate the effects of a targeted educational intervention.

Objectives: The main objective of our study is to assess and improve the level of medication adherence and knowledge, attitude, and practice among patients with diabetes mellitus.

Methodology: A prospective interventional study was conducted over six months at BMCRC, Ballari (Karnataka), involving 150 patients randomly divided into two groups: 75 in the interventional group and 75 in the control group.

Results: The data compares MARS and KAP scores between Control and Test Groups (75 participants each) on admission (DOA) and discharge (DOD). For MARS, the Test Group scored on DOA (5.07 ± 1.407) vs. Control (4.58 ± 1.027), and on DOD (5.97 ± 1.138) vs. Control (5.06 ± 0.528), indicating better medication adherence. For KAP, the Test Group also outperformed on DOA (9.32 ± 1.817) vs. Control (9.013 ± 2.177), with a significant increase by DOD (17.46 ± 2.309) vs. Control (9.8 ± 0.676). The P-values (0.00) confirm the intervention's strong statistical significance in improving outcomes for the Test Group.

Conclusion: The study concludes that pharmaceutical care and patient counseling significantly boost medication adherence and improve patients' understanding of their disease. These interventions help diabetic patients manage blood glucose levels more effectively. By providing tailored education, patients are more likely to follow their treatment plans, resulting in better health outcomes.

Keywords: Diabetes mellitus (DM), Knowledge, Attitude, Practice, Medication adherence, Educational intervention.

Introduction

Diabetes mellitus is a chronic metabolic disorder marked by elevated blood glucose levels, which, over time, can lead to serious complications involving the heart, kidneys, eyes, nerves, and blood vessels.[6] It has become a major public health issue globally due to lifestyle transitions, urbanization, and an aging population. [6]As of 2021, over 537 million adults aged 20–79 were living with diabetes, and this number is projected to rise to 643 million by 2030 and 783 million by 2045. [6]Among various types, Type 2 diabetes mellitus (T2DM) accounts for 90–95% of all cases and is primarily driven by sedentary behavior, poor dietary habits, and obesity.[6] Conversely, Type 1 diabetes mellitus (T1DM), though less prevalent, is increasing in incidence, especially among children and young adults.[5]

Global diabetes prevalence varies regionally. High-income countries report prevalence rates around 11–12%, while rapid increases are seen in South Asia, the Middle East, and Africa. [5] It is most common among people aged 55–74 and affects men and women almost equally. [5] Risk factors include obesity, physical inactivity, aging, genetics, and poor nutrition. [5] India ranks among the top countries for diabetes burden, with about 77 million adults affected and an overall prevalence rate of 8.9% in those aged 18–99 years.[7] Urban populations show a higher prevalence (11.2%) compared to rural areas (5.2%) [3]. State-level data from ICMR-INDIAB studies show variation, with Tamil Nadu (10.4%), Maharashtra (8.4%), and Chandigarh (13.6%) among the highest.[7]

Diabetes mellitus encompasses several types, with Type 1 (T1DM) resulting from autoimmune destruction of pancreatic β-cells and complete insulin deficiency, often linked to islet cell or insulin autoantibodies [1]. Type 2 (T2DM) arises from insulin resistance and β-cell dysfunction, commonly associated with obesity, hypertension, and dyslipidemia [1]. Gestational diabetes (GDM) affects about 7% of pregnancies and increases complication risks [1], while rarer forms include MODY, insulin receptor mutations, and syndromic diabetes like leprechaunism [8]. Symptoms include polyuria, polydipsia, fatigue, weight loss, and blurred vision [1], and if uncontrolled, may lead to microvascular (retinopathy, nephropathy, neuropathy) and macrovascular (CVD, PVD) complications [8]. T1DM pathogenesis involves genetic and environmental triggers causing autoimmune β-cell loss [3], whereas T2DM develops from insulin resistance progressing to β-cell failure [11]. Diagnosis is based on fasting glucose ≥126 mg/dL, 2-hr OGTT ≥200 mg/dL, random glucose ≥200 mg/dL with symptoms, or HbA1c ≥6.5% [10]. Management includes oral agents (e.g., metformin, sulfonylureas, DPP-4, SGLT2 inhibitors), insulin, and GLP-1 receptor agonists [4].

The **Medication Adherence Rating Scale (MARS)** is a validated tool to assess patients' adherence behaviors, such as forgetfulness or unauthorized medication changes. Developed in 2000 by Thompson, Kulkarni, and Sergejew, MARS shows strong reliability and uses a 0–10 scale, where higher scores reflect better adherence. [11,12] It helps identify nonadherence and enables personalized interventions to improve outcomes. [12]

Pharmacists play an essential role in promoting adherence by educating patients, simplifying regimens, addressing barriers like cost or misunderstanding, and working with healthcare teams to enhance diabetes care. [13] They also lead awareness and follow-up programs in communities to improve long-term adherence.

The **Knowledge, Attitude, and Practice (KAP) scale** assesses a patient's understanding of diabetes symptoms, self-care practices, and attitudes toward disease seriousness. [5,14,15] It comprises 25 items—18 knowledge, 3 attitude, and 4 practice questions—with scores classified as low (0–8), moderate (9–16), or high (17–25).[16] Pharmacists can enhance KAP scores through counseling, behavior change education, and regular support.

This study was designed in response to India's growing diabetes burden, poor treatment adherence, and limited disease awareness. These challenges contribute to higher complication rates and healthcare costs. Through structured interventions focusing on KAP and medication adherence, especially pharmacist-led, this study aims to empower patients, improve glycemic control, and enhance quality of life.

Aim and objectives of the study

The aim of this study was to assess and improve medication adherence and the levels of knowledge, attitude, and practice (KAP) among patients with diabetes mellitus. The objectives included evaluating the demographic profiles and social habits of the enrolled patients, assessing their baseline medication adherence and knowledge regarding diabetes, and determining the effectiveness of an educational intervention in improving these parameters. Additionally, the study aimed to anticipate each patient's capacity to manage their condition and maintain long-term health and well-being.

Methodology

A prospective interventional study was conducted for six months in the Department of General Medicine at VIMS, Ballari, involving 150 diabetic inpatients (75 test and 75 control). Patients aged 18 years and above, including those with comorbidities, were enrolled after obtaining informed consent, excluding gestational diabetes cases and those with incomplete data. Data were collected from patient case sheets and direct interviews using a structured form. Demographic details, clinical data, and treatment information were documented. Patients' knowledge, attitude, and practice (KAP) and medication adherence were assessed using validated KAP and MARS scales. A pretested and ethically approved protocol guided the study procedure. Pharmacist-led interventions were provided to the test group to improve diabetes management. Post-intervention, both KAP and MARS assessments were repeated. Data were statistically analyzed and represented using MS Excel. Ethical clearance was obtained before study initiation.

Results

A total of 150 patients with Type 2 Diabetes Mellitus were enrolled in this prospective interventional study and equally divided into control and test groups. In the control group, 43 (57%) were males and 32 (43%) females, whereas in the test group, 45 (60%) were males and 30 (40%) females. Most patients belonged to the 60–69 years age group in both groups. Regarding social habits, alcohol consumption was observed in 28% of the control group and 20% of the test group, while 16% of both groups had a history of smoking. In terms of disease duration, 43% of the control group and 37% of the test group had diabetes for 0–3 years, and 33% and 32%, respectively, for ≥10 years. Cardiovascular co-morbidities were predominant in both groups, accounting for 48% in the control group and 27% in the test group. Other co-morbidities involved respiratory, renal, and neurological systems.

Microvascular complications were seen in 25% of the control group and 19% of the test group, while macrovascular complications were 12% and 13%, respectively. In the control group, medication adherence (MARS) scores showed minimal change from admission (mean 4.58 ± 1.027) to discharge (5.06 ± 0.528), whereas the test group showed significant improvement from 5.07 ± 1.407 to 5.97 ± 1.138. Similarly, knowledge, attitude, and practice (KAP) scores in the control group increased marginally from 9.013 ± 2.177 to 9.8 ± 0.676. In contrast, the test group exhibited a substantial increase in KAP scores from 9.32 ± 1.817 at admission to 17.46 ± 2.309 at discharge. Statistical analysis confirmed that the improvements in both MARS and KAP scores in the test group were significant ($p < 0.05$), indicating the positive impact of pharmacist-led educational intervention on adherence and diabetes self-management.

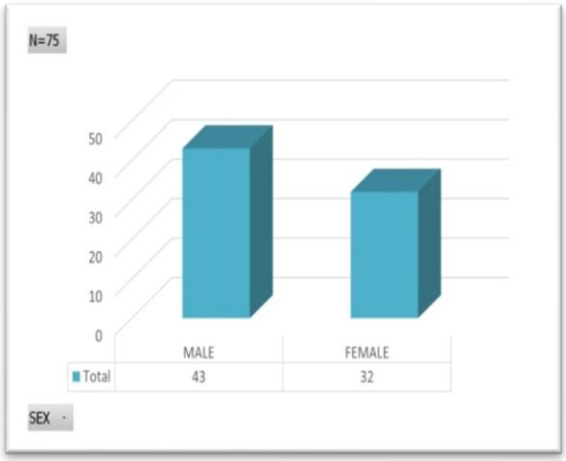


Fig-1: Gender wise distribution in control group

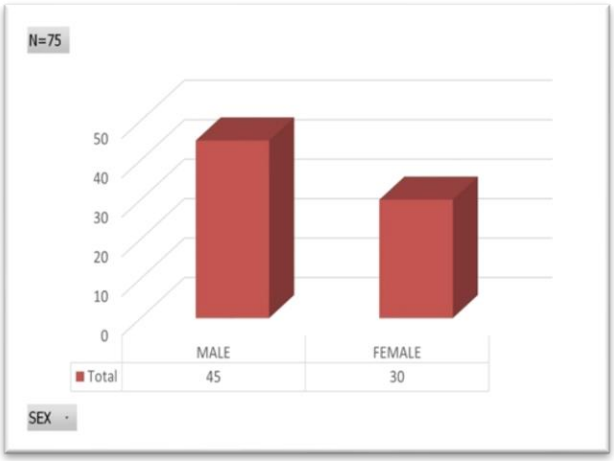


Fig-2: Gender-wise distribution in the test group

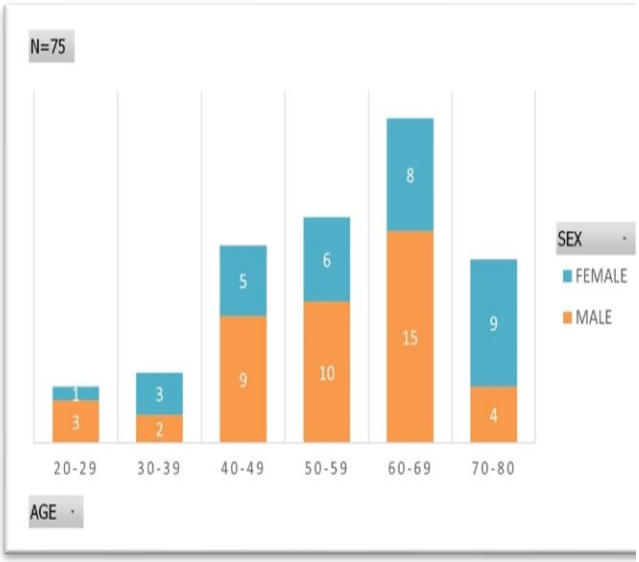


Fig-3: Age group-wise distribution of control group

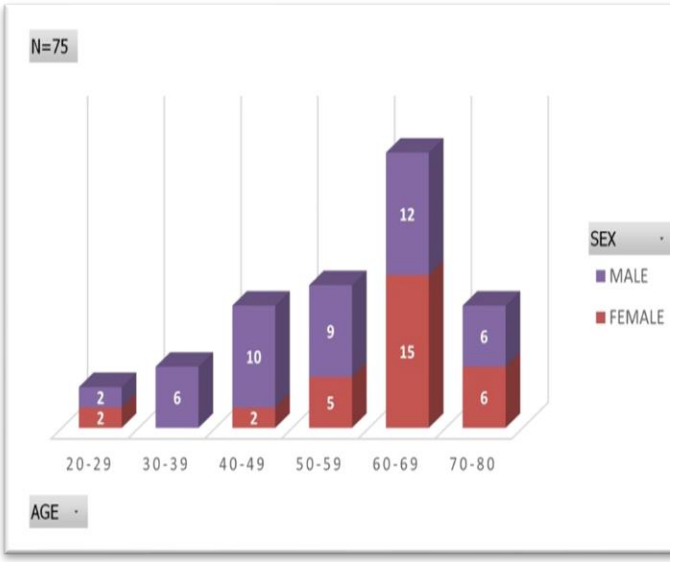


Fig-4: Age group-wise distribution of test group

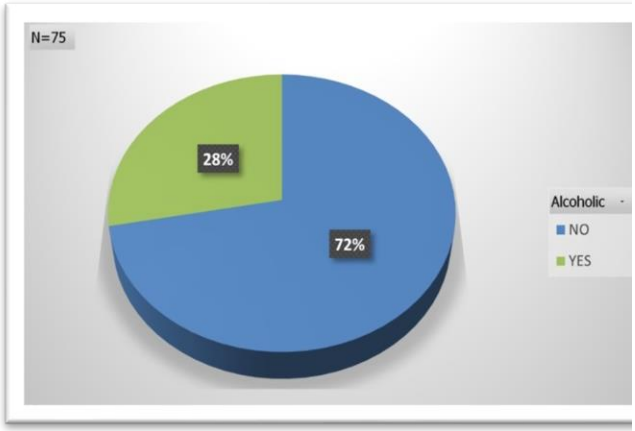


Fig-5: distribution of patients according to alcohol consumption of control group

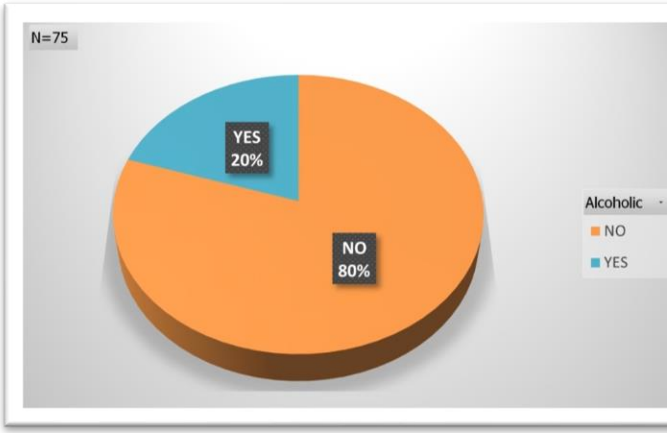


Fig-5: distribution of patients according to alcohol consumption of test group

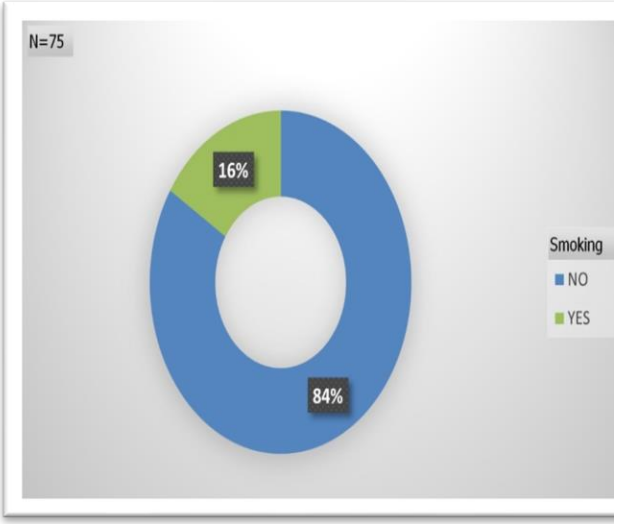


Fig-7: distribution of patients according to smoking history of control group

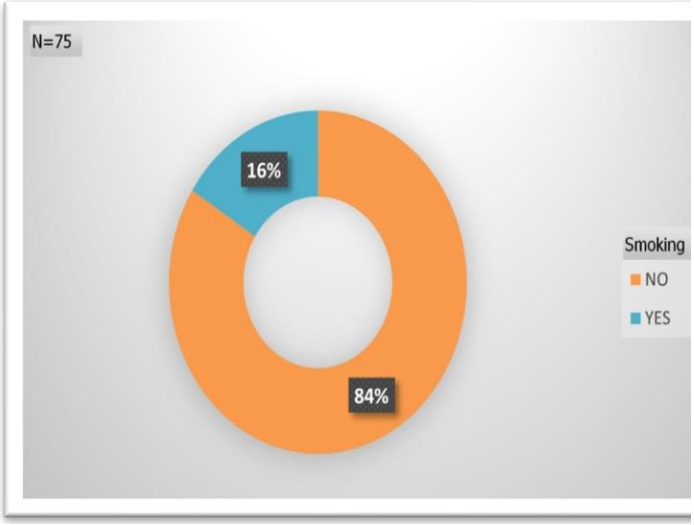
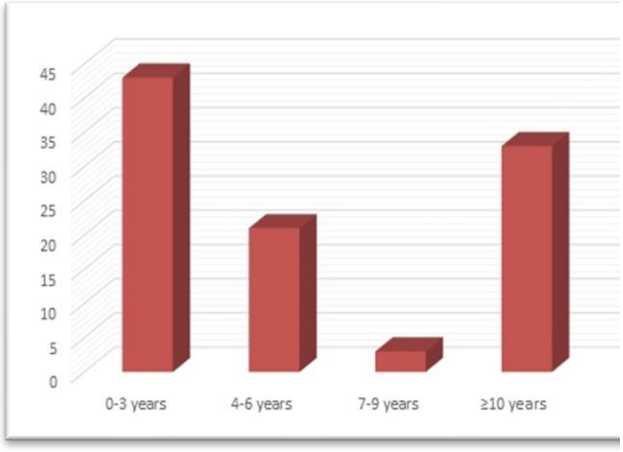


Fig-8: distribution of patients according to smoking history of test group



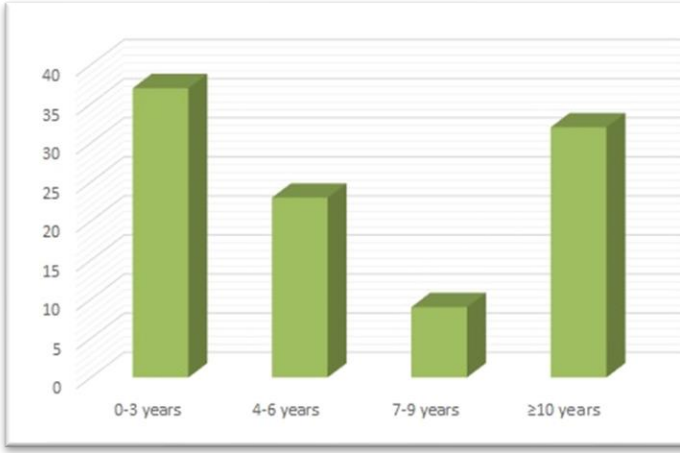


Fig-9: distribution of patients according to the duration of disease of control group

Fig-10: distribution of patients according to the duration of disease of test group

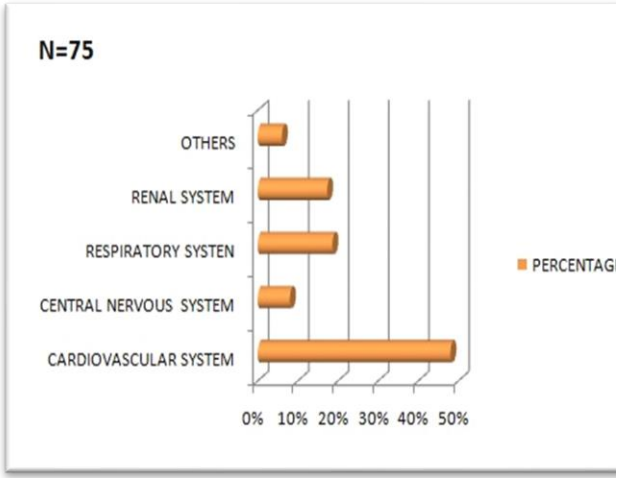


Fig-11: distribution of patients according to co-morbidities of control group

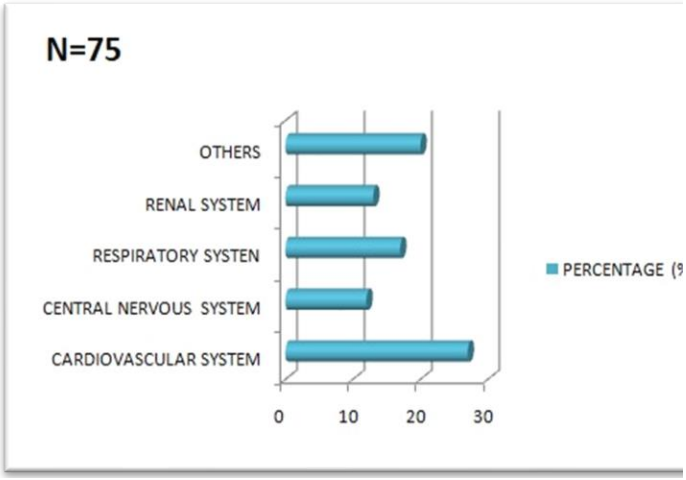


Fig-12: distribution of patients according to co-morbidities of test group

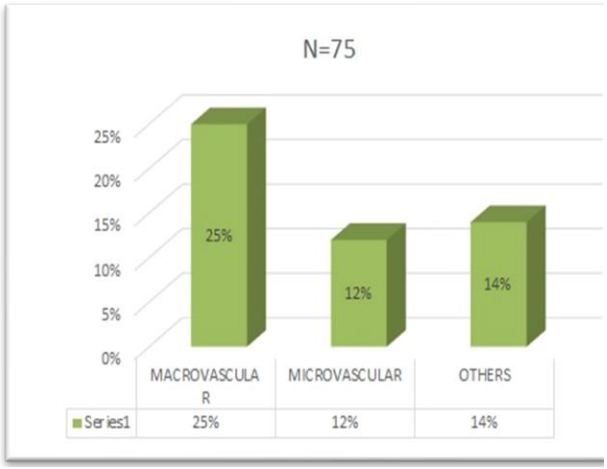


Fig-13: distribution of patients according to complications of control group

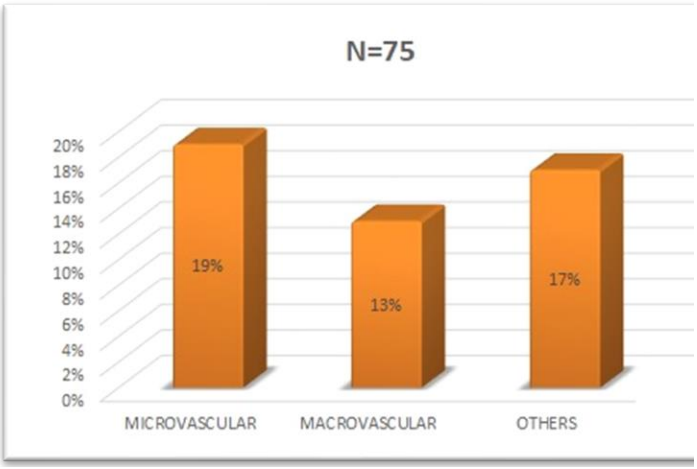


Fig-14: distribution of patients according to complications of test group

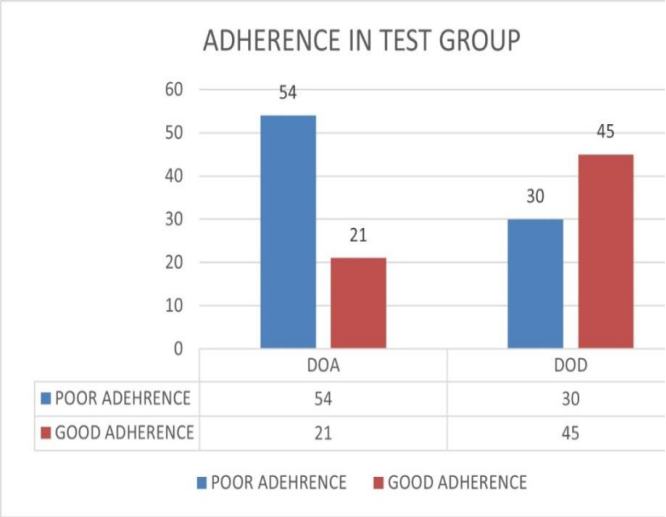


Fig-15: assessment of mars scale in test group

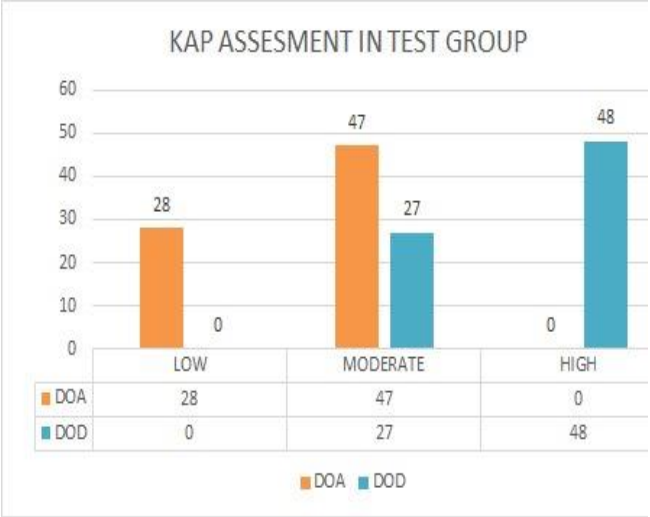


Fig-16: assessment of kap scale in test group

GROUP MEAN±SD	MARS (DOA)	MARS (DOD)	P VALUE	KAP (DOA)	KAP (DOD)	P VALUE
CONTROL GROUP (N=75)	4.58±1.027	5.06±0.528	0.00	9.013±2.177	9.8±0.676	0.00
TEST GROUP (N=75)	5.07±1.407	5.97±1.138	0.00	9.32±1.817	17.46±2.309	0.00

Table 1: Assessment Of Mars And Kap Score Mean±Sd For Control Group And Test Group

Discussion

Our prospective interventional study aimed to assess and improve KAP and medication adherence in T2DM patients using structured education. Out of 150 patients, those in the test group showed marked improvement post-intervention. The majority of participants were aged 60–69, with a male predominance—findings consistent with Prajapati et al.[18] and Verma et al.[30] Cardiovascular comorbidities were the most common, similar to Sangita Patel's study, followed by respiratory and renal issues. Complications such as microvascular and macrovascular were observed, echoing Judith Basker's association between poor adherence and complication risk.[21]

A major achievement of our study was the improvement in KAP scores in the test group from ~40% to 75% after education. This aligns closely with Rakhi Mishra et al.(44% to 73%)[17] and Acharya et al. (60% to 85%),[16] emphasizing pharmacist-led education. Our results were more successful than those of Lotfy et al., who reported a modest KAP improvement (40% to 60%), likely due to less frequent follow-ups.[24] Similarly, Judith Basker et al. saw KAP improvements from 54.75% to 78%, supporting our finding that personalized education enhances self-management.[33]

Medication adherence also increased significantly in the test group from 50% to 85%, measured using the MARS scale. This is in line with studies by Usha Rani et al. (55% to 80%),[32] Sankar et al. (48% to 74%),[31] and Basker et al. (54.75% to 78%), highlighting the impact of regular counseling. Our study also noted that patients with lower education benefitted more from simple, focused materials, echoing Pourhabibi et al.'s findings on health literacy.[44]

While our study did not directly include family support, one-on-one sessions likely offered similar benefits as observed by Xiling Hu, who saw a 25% improvement in dietary adherence through family involvement.[42] A key challenge remains sustaining these improvements long-term, as noted by Prathyusha Rani.[34] Wungrath et al.[38] suggested mobile-based interventions may help, and we recommend integrating such digital tools in future studies for better continuity.

Conclusion

This study demonstrated that structured educational interventions significantly improved knowledge, attitude, practice (KAP), and medication adherence among Type 2 diabetes patients. The test group showed better outcomes compared to the control group in terms of adherence and KAP scores. Most patients were aged 60–69, with a male predominance. Cardiovascular comorbidities and lifestyle factors like alcohol and smoking were common. The intervention effectively addressed these through patient education. Despite improvements, short follow-up and lack of psychological evaluation were limitations. Future studies should include mental health assessments and digital tools. Pharmacists played a key role in counseling and adherence improvement. Continuous education and support are essential for sustaining outcomes. Overall, targeted interventions can enhance diabetes management and patient quality of life.

Disclaimer (artificial intelligence)

Author(s) hereby declares that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

Ethical approval and consent

This study was conducted after obtaining approval from institutional ethics committee of T.V.M college of Pharmacy Ballari and Informed consent form (ICF) was obtained from the guardians of the study subjects.

Acknowledgement

Authors would like to express sincere gratitude to Dr. Somasekhar, Principal, Dr. R L N Murthy, HOD of Pharmacy Practice, and faculty of T.V.M college of pharmacy, Ballari and special thanks to the Department of General Medicine, Ballari medical college and research centre (BMCRC), Ballari, Karnataka for their encouragement and valuable support during the study.

References

1. Joseph T. Dipiro, RobertL. Talbert, Gary R. Matzke, Barbara G. Wells andL. MichaelPosey-

Pharmacotherapy a pathophysiologic approach, seventh edition, pg.no-1207.

2. Roger Walker and Whittlesea- Clinical pharmacy and therapeutics, fifthedition, pg.no-700.
3. Mohan,H.(2024).*TextbookofPathology*.7thEdition.JaypeeBrothersMedical Publishers. Pg no.820-822
4. KDTripati,Essentialsofmedicalpharmacology.8TH editionPg-285
5. Diabetes(who.int)
6. https://diabetesatlas.org/
7. https://diabetes.co.in/what-is-the-prevalence-of-diabetes-in-india-current-data-and-stats/
8. https://www.diabetes.org/
9. https://www.nature.com/articles/nrendo.2017.151
10. AmericanDiabetesAssociation.(2024).StandardsofMedicalCareinDiabetes—2024. Diabetes Care, 47(Supplement 1), S1-S142. https://care.diabetesjournals.org/content/47/Supplement_1.
11. **Thompson, K., Kulkarni, J., & Sergejew, A. A.** (2000). Reliability and validity of a new Medication Adherence Rating Scale (MARS) for the psychoses. *Schizophrenia Research*, 42(3), 241-247.
12. **Sabaté, E.** (2003). Adherence to long-term therapies: evidence for action. *World Health Organization*.
13. **Almazeedi, H. A., & Alsanea, S.** (2020). "Role of pharmacists in diabetes management: An updated review of the literature." *Saudi Pharmaceutical Journal*, 28(1), 1-8.
14. **Saleh, F., Mumu, S. J.,Ara, F., Hafez, M. A., & Ali, L. (2012).** "Knowledge, Attitude, and Practice of Type 2 Diabetic Patients regarding Obesity: Study conducted in Bangladesh."*Asian Journal of Medical Sciences,* 4(2), 10-13.
15. **Shrivastava, S. R., Shrivastava, P. S., & Ramasamy, J.** (2013). "Role of self-care in management of diabetes mellitus."*Journal of Diabetes & Metabolic Disorders,* 12(1), 14
16. **Leelavathi Dinesh Acharya, Subha Sheshadri, Divya Shree, Dr. Girish Thunga** (2019)" Study the Impact of Pharmaceutical Care On Diabetic Patients in a tertiary care hospital- South India".
17. **Mishra R, Sharma SK, Verma R, Kangra P, Dahiya P, Kumari P, Sahu P, Bhakar P, Kumawat R, Kaur R, Kant R.** Medication adherence and quality of life among type-2 diabetes mellitus patients in India. *World Journal of Diabetes*. 2021 Oct 10;12(10):1740.
18. **Prajapati VB, Blake R, Acharya LD, Seshadri S**. Assessment of quality of life in type II diabetic patients using the modified diabetes quality of life (MDQoL)-17 questionnaire. *Brazilian Journal of Pharmaceutical Sciences*. 2018 Mar 5;53.
19. **Mutagwanya R, Nyago CM, Nakwagala FN**. Effect of diabetes nutrition education on the dietary feeding practices and lifestyle of type 2 diabetic patients. *European Journal of Clinical Nutrition*. 2022 Feb;76(2):270-6.
20. **Kumar VV, Reddy AH, Sudharshan J, Lokendranath G, Ugandar RE, Chetty CM**. A Study on Impact of Pharmacist Interventions on Therapeutic Outcomes of Type II Diabetic Patients in a Tertiary Care Teaching Hospital. *Indian Journal of Pharmacy Practice*. 2020;13(3).
21. **Patel S, Parmar V, Iyer C, Patel J**. Role of Counselling and its Impact on the Dietary Habits, Glycemic

Control and Diabetic Awareness of Newly Diagnosed Type 2 Diabetes Mellitus Patients. *J Indian Med Assoc.* 2023 Aug 26;121(2):15-21.

22. **Jasim AH.** Effectiveness of an Educational Program on Diabetic Patient's Knowledge about Early Complications of Diabetes Mellitus: *Type I and Type II. Res Militaris*. 2022 Nov 12;12(2):4684-91.
23. **Kumar L,Mittal R, Bhalla A, Kumar A, Madan H, PandhiK, Garg Y,Singh K, Jain A, Rana S.** Knowledge and Awareness About Diabetes Mellitus Among Urban and Rural Population Attending a Tertiary Care Hospital in Haryana. *Cureus.* 2023 Apr;15(4).
24. **Lotfy SM, Bahgat MH, Khafagy MA, Abbas NE.** Knowledge, Attitude, and Practice of Diabetes Management among Patients with Type II Diabetes. *International Journal of Medical Arts*. 2022 Feb 1;4(2):2102-11.
25. **Zahedi M, Dehvan F, Albatineh AN, Gheshlagh RG.** Knowledge of Type II Diabetic Patients About Their Diabetes: A Systematic Review and Meta-Analysis. *Advances in Nursing & Midwifery*. 2020 Jan 1;29(1).
26. **Rajput M, Arivarasan Y, Khongsit A, Rajput R.** Quality of life among diabetics: A cross- sectional study in a tertiary care center of Rohtak, Haryana. *Indian Journal of Community Medicine.* 2020 Jul 1;45(3):283-6.
27. **Alaofè H, Amoussa Hounkpatin W, Djrolo F, Ehiri J, Rosales C**. Factors associated with quality of life in patients with type 2 diabetes of South Benin: A cross-sectional study. *International Journal of Environmental Research and Public Health*. 2022 Feb18;19(4):2360.
28. **Haider M, Verma M, Hakim A, Kumar A, Sharma S, Gautam V.** Health-related qualityof life in type II diabetics and its associated factors: a cross-sectional study at an urban health training center of Northern India. *Int J Community Med Public Health* [Internet]. 2021 Dec:6011-.6014
29. **Sharma S, Mohan U, Singh SK, Deori TJ, Misra AK.** Quality of life of type 2 diabetes mellitus patients attending a tertiary care hospital of Northern India: A cross-sectional study. *Journal of Family Medicine and Primary Care*. 2021 May 1;10(5):1938-44.
30. **Verma PR, Attar N, Tungikar SL, Patil R.** Knowledge, Attitude and Practice of Type II Diabetes Mellitus Patients Attending a Tertiary Care Teaching Hospital of Western Maharashtra; a Cross-Sectional Study. *SAS J Med.* 2022 Nov;11:805-11.
31. **Sankar V, Justin A, Payman HM, Swathy P, KUMAR NS, KUMAR RS**. Medication adherence and clinical outcomes in type 2 diabetes mellitus patients with depression: A prospective interventional study. *Marma pharma J*.2018;30(35):1.
32. **Padmanabha UR, Maheswaran R, Hiremath S, Puneeth N, Prithviraj R.** A study to assess the treatment adherence among patients with type 2 diabetes mellitus in rural andurban population of Bengaluru, South India. *Int J Community Med Public Health*. 2020 Aug;7:3105-10.
33. **Basker J, Mammen JA, Sreethu PT, MMahesh NM, Williams F, Chandrashekara P.** Assessment Of Diabetic Knowledge And Medication Adherence In Type 2 Diabetes Patients. *Indo-American Journal of*

Pharmaceutical Research. 2016;6(2):4479-91.

34. **Prathyusha PB, Fathima AA, Firdose A, Naser S, Begum N, Begum K.** Medication Adherence In Patients With Type 2 Diabetes Mellitus-A Cross-Sectional Study. *AsianJournal of Pharmaceutical and Clinical Research.* 2019;12(10).
35. **Anju PR, Siddiq A.** A Study of Medication Adherence and Medication Compliance to Insulin Therapy in Type I and Type II Diabetic Patients. *Indian Journal of Pharmacy Practice.* 2018;11(3).
36. **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;14(12).
37. **Onwuchuluba EE, Oyetunde OO, Soremekun RO.** Medication adherence in type 2 diabetes mellitus: a qualitative exploration of barriers and facilitators from socioecological perspectives. *Journal of Patient Experience*. 2021 Jul 23;8:23743735211034338.
38. **WungrathJ,AutornN.**EffectivenessofLineapplicationandtelephone-basedcounselingto improve medication adherence: a randomized control trial study among uncontrolled type 2 diabetes patients. *Health Promotion Perspectives*. 2021;11(4):438.
39. **Muhammad MB, Yasmin F, Alabed AA, Abdullah BF, Poddar S.** Medication adherence and self-management practices among type 2 diabetes mellitus patients in Jeli District, Kelantan, Malaysia. *Kesmas.* 2022;17(4):287-91.
40. **Mohamud MF, Jeele MO**. Knowledge, attitude, and practice regarding lifestylemodification among type 2 diabetes patients with cardiovascular disease at a TertiaryHospital in Somalia. *Annals of Medicine and Surgery*. 2022 Jul 1;79:103883.
41. **Kang Y, Hur Y**. Medication adherence and its associated factors in Laotians with type 2 diabetes mellitus. *Clinical Nursing Research*. 2020 Jun;29(5):331-8.
42. **Hu X, Zhang Y, Lin S, Guo X, Yang D, Cai M, Gao L.** Dietary knowledge, attitude and practice (KAP) among the family members of patients with type 2 diabetes mellitus (T2DM) and its influence on the KAP of T2DM patients. *Diabetes, Metabolic Syndrome, and Obesity*. 2021 Jan 15:205-13.
43. **Peter PI, Steinberg WJ, van Rooyen C, Botes J.** Type 2 diabetes mellitus patients' knowledge, attitude and practice of lifestyle modifications. *Health SA Gesondheid* (Online). 2022;27:1-7.
44. **Pourhabibi N, Mohebbi B, Sadeghi R, Shakibazadeh E, Sanjari M, Tol A, Yaseri M.** Determinants of poor treatment adherence among patients with type 2 diabetes and limited health literacy: a scoping review. *Journal of Diabetes Research*. 2022;2022(1):2980250.
45. **Jamaludin TS, Mohammad NM, Hassan M, Nurumal MS.** Knowledge and practice on medication adherenceamong type IIdiabetes mellitus patients. *Enfermería Clínica*. 2021Apr 1;31:S372-6.
46. **Chawla SP, Kaur S, Bharti A, Garg R, Kaur M, Soin D, Ghosh A, Pal R.**Impact of health education on knowledge, attitude, practices and glycemic control in type 2 diabetes mellitus. *Journal of family medicine and primary care*. 2019 Jan 1;8(1):261-8.

47. Mohammadi S, Karim NA, Talib RA, Amani R. Knowledge, attitude and practices on diabetes among type 2 diabetic patients in Iran: a cross-sectional study. *Science*. 2015 Jan 1;3(4):520-4.