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ENHANCING DIABETES MELLITUS (DM2) CARE THROUGH PHARMACEUTICAL INTERVENTIONS: A REVIEW OF THE LITERATURE

Bander Alshehri[1], Wan Ahmad Syazani Mohamed[2], Usman Ali[3], Abdur Rehman[4], Muhammad Mohsin[5*], Tariq Rafique[6], Shabana Naz[7]

[1]Assistant Professor, Department of Medicine, University of Jeddah, Saudi Arabia
[2]Medical Doctor, Nutrition Unit, Nutrition, Metabolism and Cardiovascular Research Centre (NMCRC), Institute for Medical Research (IMR), National Institutes of Health (NIH), Ministry of Health Malaysia, Level 3, Block C7, No. 1, Jalan Setia Murni U13/52, Seksyen U13, Setia Alam, 40170 Shah Alam, Selangor, Malaysia
[3]Resident Physician, Department of Medicine, Ayub Teaching Hospital Abbottabad, Pakistan,
[4]Resident Physician, Department of General Medicine, Ayub Teaching Hospital Abbottabad, Pakistan
[5*]Associate Editor, Research Journal of Innovative Ideas and Thoughts
Email: mmrrcc001@gmail.com
[6]Assistant Professor Dadabhoy Institute of Higher Education, Karachi, Pakistan
[7]Crop Reporting Service, Agriculture Department Sargodha, Government of Punjab, Pakistan

***Corresponding Author:** Muhammad Mohsin
*Associate Editor, Research Journal of Innovative Ideas and Thoughts,
Email: mmrrcc001@gmail.com

ABSTRACT:
Background: Diabetes mellitus (DM) poses significant public health challenges globally, including in Pakistan, where it ranks as the fourth leading cause of death. Chemists play a vital role in diagnosing, treating, and managing type II diabetes mellitus (DM2) patients.
Methods: A systematic review was conducted using medical databases SCIELO, LILACS, and VHL. A total of 1190 scholarly articles were screened, resulting in the inclusion of 31 investigations. Ten studies met the inclusion criteria.
Results: Pharmaceutical interventions have demonstrated efficacy in reducing the risk of complications associated with poorly controlled DM2 and promoting patient adherence to medication regimens. Pharmacy specialists are integral to DM2 patient care, contributing to glycemic control, adherence to dosage guidelines, lifestyle modifications, and medication selection based on necessity, efficacy, safety, and affordability.
Conclusion: The involvement of chemists in managing DM2 is crucial for improving patient outcomes and addressing the significant public health burden associated with the condition. Pharmacist-led interventions contribute to better disease control and patient adherence, ultimately reducing morbidity and mortality rates associated with DM2.

KEYWORDS: Type 2 Diabetes Mellitus; Diabetes Complications; Pharmaceutical Assistance; Adherence To Drug Treatment.

INTRODUCTION:

Diabetes mellitus (DM) is a collection of metabolic disorders characterised by elevated blood sugar levels brought on by abnormalities in the action or release of insulin or both. Long-term problems and damage to organs, particularly in the retina, bladder, nerve endings, heart, and vessels in the body, are linked to this chronic hyperglycemia. Diabetes mellitus (DM) is the fourth leading cause of death in Pakistan and is associated with significant public health issues, including high rates of morbidity and mortality (Badi et al., 2024; CG, Adibe, Ukwe, & Aguwa, 2030).

Furthermore, it can be related to chronic complications and comorbidities such as gastric syndrome, arterial disease, hypertension and coronary heart disease, which can lead to retinopathy and nephropathy, functional losses such as mobility difficulties, cognitive problems, and depression, among others, predisposition to numerous drugs, which cause a deficit in the quality of life of the patient (Baas et al., 2024; Khardali et al., 2024).

Its development is usually slow, especially in the early stages of the disease. Due to the gradual development of hyperglycemia and the absence of characteristic symptoms, the diagnosis becomes difficult and late, with a high probability of worsening the disease (Hias, Defieuw, Vanassche, Verhamme, & Van der Linden, 2024).

About 400 million individuals globally have diabetes (WORLD HEALTH ORGANISATION, 2016). Since type 2 diabetes is the most common form of the disease overall, it has been identified in 90–95% of cases in Pakistan and is proliferating, approaching epidemic proportions in several comparable nations (Fornwald et al., 2024; Nyamagoud, Swamy, & Kangrali, 2024).

It is the most prevalent kind of diabetes mellitus, affecting around 90% of diabetic patients. It is caused by inadequate secretion of insulin or its consequences, which can ultimately result in insulin-related alterations that increase glucose generation in the liver. Environmental and genetic variables are linked to DM2 susceptibility, and one key factor initiating it is lifestyle (Althubyani et al., 2024; Hall, Ashley, Schadler, & Naseman, 2024).

Numerous comorbidities, including depression, stress, cognitive impairment, and other psychological variables, have been linked to an increase in instances. By 2025, it is predicted that there will be 300 million type 2 diabetic patients worldwide. The primary causes of this growth in new cases are expected to be genetic and lifestyle factors (Espírito-Santo, Santos, & Estêvão, 2024; Masad et al., 2024).

Treatment of DM2 includes nonpharmacological measures that include ongoing health education, lifestyle changes, dietary reorganisation, physical activity, weight loss, monitoring blood sugar levels, and reducing or eliminating smoking and drinking alcohol if necessary. These changes, sometimes considered drastic, in personal and family lifestyle make it difficult to control the disease through nonpharmacological measures alone. Most patients require medications during treatment (Ekenberg, Qvarnström, Sundström, Martinell, & Wettermark, 2024; Ranganath & Panda, 2024).

Pharmacists must be present to increase adherence and improve medication management, guide the rational use of medicines, thus reducing prescribing, dispensing and administration errors and increasing patient awareness of the disease and the importance of appropriate management (Chen et al., 2024).

The article illustrates the chemist's responsibility for assessing and monitoring DM2 pharmacological treatment. Additionally, the listed precise goals are to determine the primary DM2 complications, confirm the primary selection criteria for antidiabetics, and examine the chemist's involvement in the assessment and observance of the pharmacological management of DM2 (Eshiet, Igwe, & Ogbeche, 2024; Katare & Ugale).

METHODOLOGY:

This systematic review search aims to find studies that meet the predetermined inclusion criteria. The databases listed below were consulted in this manner: Between January 2013 and August 2023, the following resources will be available: Virtual Health Library (VHL), Latin American and Caribbean Literature in Health Sciences (LILACS), and Scientific Electronic Library Online (SCIELO).

Medical science keywords MeSH: Type 2 Diabetes Mellitus, Complications of Diabetes, Adherence to pharmacological treatment, Pharmaceutical assistance (Parsons, Ekong, Charbonneau, Laisure, & Capoccia, 2024).

For the inclusion criteria, the following were determined: articles with abstracts, complete articles, articles according to descriptors, original articles, case studies, systematic and literature reviews, field research, desk research, cross-sectional research, a full archive of articles and all articles 'within the period explained. The delimited exclusion criteria are articles in languages other than English and Portuguese, articles that do not match the descriptors, and articles that do not fall within the indicated period (Albai et al., 2024; Le, Le, & Foo, 2024).

RESULTS:

A total of 1190 scientific articles, including 31 studies, were evaluated in the present study. Through the search methods, ten works that met the inclusion criteria were identified using the SCIELO, LILACS and BVS databases, where cross-checks were carried out with the descriptors who developed the quantitative numbers of the articles, and according to Figure 1 (Neeland et al., 2024; Tokita et al., 2024).

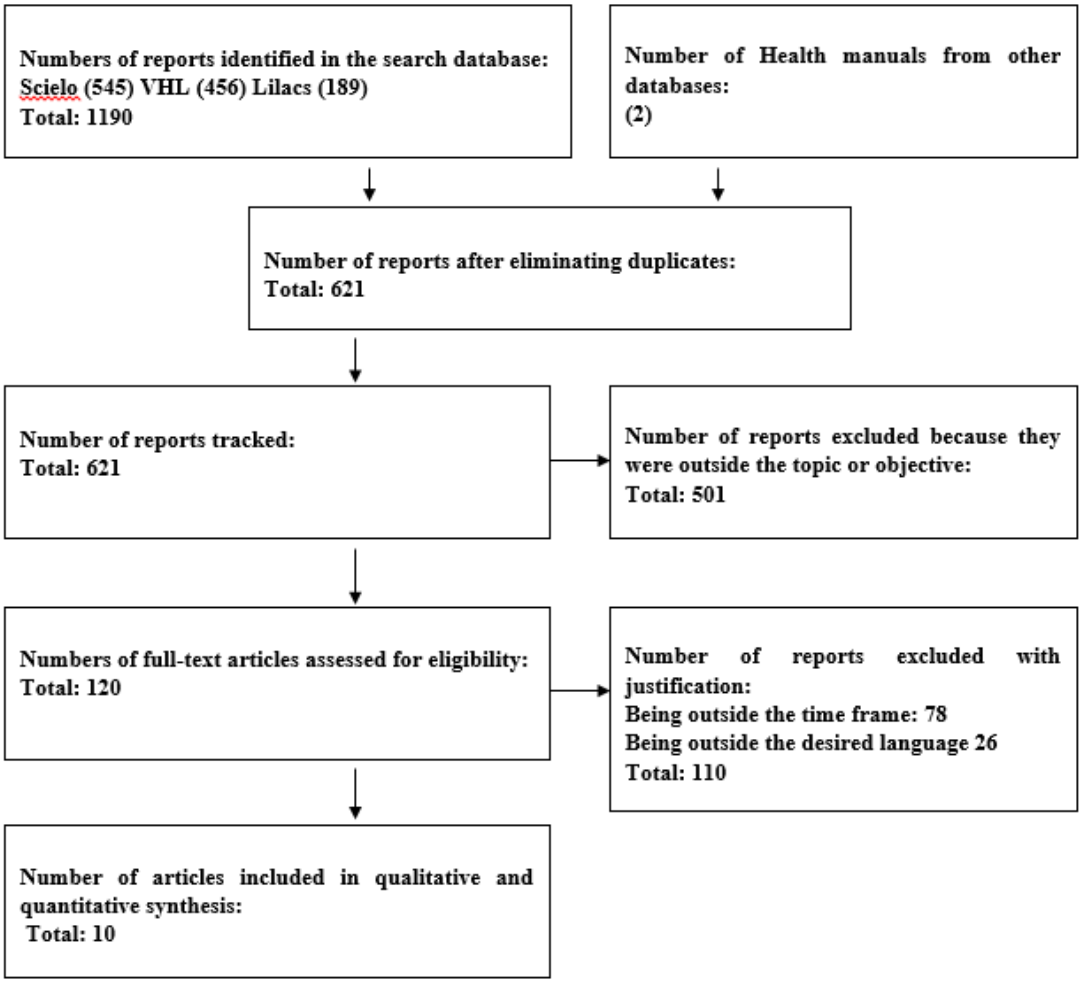

Table 1: shows the characteristics of the studies included in this review, presenting the following elements: authors, year of publication, topic, database, type of study, objective and results.

AUTHORS/YEAR	THEME	DATABASE	STUDY TYPE	OBJECTIVE	RESULTS
VICENTE, N.M.S. (2018)	A randomised controlled clinical research	VHL	Clinical Research Trial / Thesis	To assess how pharmaceutical care affects the	Pharmaceutical care has proven to be effective; in addition

	examined the effect of pharmaceutical care on enhancing pharmaceutical adherence and foot personal care among individuals with type 2 diabetes mellitus.			degree of pharmacologic adherence and the enhancement of self-care for DM patients' foot receiving treatment in Recife, PE.	to helping to improve patient adherence to medication, it also helps to adjust medication regimens to better control DM2 and reduce the risk of complications and related diseases caused by lack of power.
PARRINI, S. et al. (2020)	Glycated haemoglobin assessment in patients with type 2 diabetes mellitus receiving pharmacological therapy in an outpatient clinical setting in Teresópolis, RJ	VHL	Case study	To evaluate how well pharmacological treatment interventions manage glycated haemoglobin in DM2 patients.	Pharmaceutical care as a professional practice reestablishes the necessary bridge between pharmacist and patient as the main focus of their work. For the most part, the activities of pharmacists are focused on broad bureaucratic tasks, with medicines as their main target.
BAYER, M.; BORBA, H. H. L. (2021)	Influence of medication therapy on the clinical results of an insulin-using type 2 diabetic patient: case study	VHL	Case study	To assess the clinical results of a patient at a primary health unit in the city of Piraquara, PR, who has type 2 diabetes (DM 2) and uses insulin. The patient also receives pharmaceutical care from family health residents.	Pharmacotherapeutic monitoring positively impacts the metabolic control of DM 2 through behavioural changes, adequate storage of medications, waste reduction and improvement of medication adherence. A more in-depth Pakistanian study with a larger sample is necessary to determine better the impact of medication services using insulin for patients with DM 2.
GONÇALVES, E.A. (2021)	Evaluation of patients with type 2 diabetes who are receiving pharmaceutical treatment for adherence.	VHL	Analytical qualitative research	To assess type 2 diabetic patients' adherence to medication and potential adherence-influencing variables.	Study shows patient adherence to treatment and drug therapy; if there is no adherence to non-drug hypoglycemic strategies, there is a worse chance of prognosis. Therefore, it can be concluded that pharmaceutical care contributes to better results and improves the quality of life of people with DM2.

FERNANDES, S.S.C. et al. (2019)	Evaluation of Pharmacological Treatment Adherence for Elderly Patients with Type II Diabetes Mellitus Under Monitoring in a Vitória da Conquista - Bahia Pharmacy Network.	VHL	Investigative studies	To assess senior DM2 patients' adherence to pharmaceutical treatment.	Factors that provide good adherence It is essential to emphasise that adherence to diabetes treatment does not only mean the correct use of the medication but linking the correct use of the medication with adequate nutrition and physical activity (at least three times a day, a week).
SALIN, A. B. et al. (2019)	Type 2 Diabetes Mellitus: Porto Velho-RO Basic Health Unit population profile and characteristics related to treatment adherence.	LILACS	Descriptive research with quantitative methods	To determine the characteristics of patients with type 2 diabetes and the variables related to treatment compliance in Primary Health Units across the four districts of the Porto Velho municipality.	Non-adherence to treatment is due to the difficulty in accessing medicines, looking for an author who talks about the lack of drugs in the SUS, which means that, according to research, the lack of drugs in the public sector is a global problem.
AROUCHA, M.E. B. A. (2021)	Compliance with medication in individuals receiving treatment for type 2 diabetes at a primary health facility (UBS) in the Imperatriz, Massachusetts, municipality	VHL	A master's dissertation focused on intervention-action research. To comprehend the degree of therapy adherence among individuals receiving treatment at UBS for Diabetes Mellitus and to conduct an educational intervention to enhance therapy adherence.	Seven DM2-using UBS service users were included in the research effort. Information about DM2 care has been developed in this manner.	Patients had basic knowledge about the disease, and 73% of those interviewed never stopped taking their medications. It is essential to highlight that pharmaceutical assistance for people with DM2 can improve their quality of life.
PICCOLI, R. M. (2015)	Pharmaceutical care's cost-effectiveness in treating type 2 diabetic mellitus	VHL	Research using numbers and a master's thesis	Examine the association between the cost-effectiveness of pharmacological care and the management of type 2 diabetes.	Pharmacists play an essential role in managing DM2 and its complications, as in this study, there was a saving of R$48,522.66. In a multidisciplinary team, pharmacists are responsible for medication treatment. They must identify

					and resolve medication-related problems, help reduce medication errors and adverse reactions, and guide patients in the rational use of medications. Medicines to promote health education.
BALDONI, N. R. et al. (2016)	Compliance with pharmaceutical therapy for those diagnosed with Type 2 Diabetes Mellitus	SciELO	Interrelated studies	To assess DM2 patients' adherence to their pharmaceutical regimen.	The study showed that around 50% of participants adhered to the medication. Furthermore, a correlation was found between adherence, lower glycated haemoglobin below 7%, and physical activity. Therefore, measures are needed to improve medication adherence, glycemic control, and patient's quality of life, avoid complications and death in patients with DM2, and reduce the costs of health services.
ROSSI, V. E. C. et al. (2015)	Compliance with drug therapy in individuals diagnosed with type 2 diabetic mellitus	SciELO	Interrelated studies	To assess the level of medication adherence among individuals with type 2 diabetes registered in an interior Minas Gerais city's Family Health Strategy.	In the present study, a questionnaire was prepared with 142 predominantly female people to address adherence to oral medications or insulin; only 73 never forgot to take their medications. Therefore, ESF pharmacists must encourage self-care and treatment adherence to reduce the risk of complications and thus have a better quality of life.

DISCUSSION:

In the long term, regarding the complications of DM2, it is essential to highlight that high blood sugar can cause chronic alterations and complications, classified into microangiopathic diabetic retinopathy, which can lead to vision loss, and diabetic nephropathy, which can progress to kidney failure. Peripheral neuropathy, which is the increased risk of foot ulcers and possible development of amputation; macrovascular effects in coronary, cerebrovascular and peripheral vascular diseases (Moon, Chladek, Wilson, & Chui, 2024; Sperl-Hillen et al., 2024).

Among the factors implicated in the aetiology of chronic complications of DM2 are hyperglycemia, systemic arterial hypertension (SAH), dyslipidemia and smoking. Furthermore, other unconventional risk factors have been described, such as endothelial dysfunction, prothrombotic state and inflammation (Chui et al., 2024).

Therefore, complications from DM2 have increased over the years and identification of this association may serve as a strategy to outline measures to reduce complications early. Sociodemographic and clinical characteristics and their associations can guide healthcare providers in managing care and education programs for glycemic control (Torres-Novellas, Rius, Figueiredo-Escribá, Mariño, & Modamio, 2024).

One of the main challenges in treating DM2 is for people to learn about their medications. However, patients are advised to first receive specific treatment with Neutral Protamine Hagedorn (NPH) insulin based on their particular health conditions (hypertension and diabetes) (Jaber, Al Shihab, & Tamimi, 2024).

The choice of oral drugs for the treatment of DM2 is made based on the patient's clinical characteristics, as in this case, many believe that the drug is not necessary given the asymptomatic nature of the disease. When patients with DM2 do not respond or respond insufficiently to nonpharmacological measures, such as diet and exercise, one or more hypoglycemic drugs should be administered to control blood sugar and promote the reduction of glycosylated haemoglobin (Al-Samiry, Mohammed, & Khalaf, 2024; Oh et al., 2024).

Due to the high cost of drug therapy with contraindications and difficulty in understanding the correct dosage, nonpharmacological intervention strategies are proposed to be used first, starting the drug therapy activity when lifestyle changes (diet control and physical exercise) are insufficient to control the disease (Dibenedetto et al., 2024).

Since therapy significantly impacts its social sphere, it is a series of actions involving individuals to improve their quality of life. A balanced diet, physical activity, drug therapy and insulin therapy are essential elements of self-control in DM2. Each treatment considers the particularities of each patient; these are fundamental points for balancing blood glucose levels (Majd et al., 2024).

Because of the medication's long-term safety record, neutral effects, ability to minimise macrovascular effects, lack of low blood sugar, as well as decreased weight, it is contraindicated in individuals with renal failure. The medication reduces insulin resistance and the liver's glucose production by improving the body's ability to absorb and use glucose in the skeletal muscles (Berthoumieux et al., 2024).

The majority of DM2 cases involve medication combinations with distinct modes of action, which are typical of second-line pharmacological therapy due to the disease's progressive nature. Adding sulfonylurea is frequently the first action if metformin cannot control the patient's blood sugar. Sulfonylureas boost insulin secretion and lower plasma glucose levels by acting on the pancreatic beta cells. Sulfonylureas that are available in the SUS include glibenclamide and GliclazideGliclazide. Glibenclamide and GliclazideGliclazide are sulfonylureas available in the SUS (Mellot et al., 2024).

In patients with type 2 diabetes, insulin is a third-line treatment. The first assessment is only performed if the individual's fasting plasma glucose level is more significant than 300 mg/dl, particularly if it is accompanied by decreased weight, ketonuria, and ketonemia or if metabolic regulation is not obtained after between three and six months of the drug metformin along with sulfonylurea combination therapy (Mills et al., 2024).

Patient non-adherence to treatment for DM2 control is a frequent problem encountered by healthcare unit professionals. Since it is a disease that does not cause immediate discomfort, in most cases, those who suffer from it do not adhere to the recommended treatments. The reasons that make adherence difficult are the availability and accessibility of medicines in health services, the acceptance of medication by patients and changes in lifestyle habits (Burton, Gysel, & Tsuyuki, 2024).

Treatment adherence is essential to prevent diabetes complications and allow patients to live as normal as possible. It goes far beyond simply following the decisions a healthcare provider makes

for a patient and has the effect of having the autonomy from family, friends, neighbours and patients to accept or not accept the healthcare provider's advice (Zhang et al., 2024).

Therefore, medication adherence is essential to prevent these complications. Still, it is a complex goal due to the need for prolonged treatment, side effects of medications, and lack of understanding of drug therapy, factors that contribute to low adherence and treatment. In particular, due to the asymptomatic nature of the disease, patients with DM2 tend to have low adherence to treatment and certainly do not require drugs (Kozlowski et al., 2024).

Pharmacists are crucial to the management of type 2 diabetes. Although it is the doctor's responsibility to diagnose DM2, a chemist can help by identifying patients and assisting them in scheduling appointments for medical care through their work or brief interviews. As a result, it is imperative to discuss how this illness affects many people and outline how this medical professional may support these patients (Corvaisier & Annweiler, 2024).

Pharmaceutical assistance and the promotion of therapeutic adherence are services that play fundamental roles. Considering the adherence factors, there are many possibilities for pharmacist intervention, such as clarifying doubts and transmitting knowledge about the drug, mentioning the importance and necessity of taking the drug, implementing methods to avoid forgetting it, etc (Keller, Qureshi, Mays, Sarkisian, & Pevnick, 2024).

To provide pharmaceutical care that will benefit the patient to the fullest extent possible, the chemist and other medical experts must directly facilitate drug therapy to produce outcomes that enhance the standard of life of the individual who suffers from DM2. These findings have implications for disease prevention and treatment, symptom alleviation and prevention, and, most importantly, delaying and interrupting the disease's progression (Alatawi et al., 2024; Othman et al.).

CONCLUSION:

The intervention of pharmacy professionals in monitoring patients with DM2 is essential since the treatment involves glycemic control, dosage schedules, lifestyle changes and the choice of drugs based on need, safety, cost and effectiveness.

Pharmaceutical care is designed to collaborate with interdisciplinary teams to benefit people with diabetes, prevent complications, reduce possible adverse effects, adhere to treatment, assist in multidisciplinary activities, and improve medical prescribing.

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