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EXPLORING SELF-MEDICATION PATTERNS AMONG PHARMACY STUDENTS IN RURAL PUNJAB, PAKISTAN: A QUANTITATIVE STUDY

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ABSTRACT:

Background: The prevalence of type II diabetes mellitus (T2DM) is increasing worldwide, particularly among older populations. Long-term management is crucial for clinical improvement, and drug-nutrient interactions may affect treatment efficacy.

Objective: This study aimed to investigate drug-nutrient interactions in T2DM management, focusing on the impact of medications and dietary components on treatment effectiveness.

Methods: An integrated literature review guided the development of a primary question and inclusion/exclusion criteria for selecting relevant studies from PubMed and Google Scholar databases. Six hundred ninety-nine papers were reviewed, summarizing oral medications for DM2 and their modes of action. Additionally, the role of dietary therapy and its susceptibility to drug-nutrient interactions, leading to vitamin deficiencies (e.g., B12) and increased risk of bone fractures, was explored.

Results: Drug-nutrient interactions influence blood sugar regulation and impact patients' nutritional status, including dyslipidemia and weight gain. Certain patient groups, such as women, the elderly, and those with poorly controlled diabetes, are more susceptible to these interactions.

Conclusion: Understanding and routinely assessing drug-nutrient interactions and nutritional status are essential for optimizing T2DM treatment outcomes and enhancing patients' quality of life.

Keywords: Diabetes Mellitus; Nutrients; Interaction; Drugs; Health.

INTRODUCTION:

Hyperglycemia, or elevated blood sugar, is a hallmark of diabetes mellitus (DM), a metabolic condition brought on by malfunctions in the production of or reaction to insulin. As a result, both its incidence and frequency have significantly increased worldwide, particularly in older people. As a result, these figures are rising as a result of both population aging and the longer life expectancy of DM patients (Ahmed et al., 2024; W. Wang et al., 2024).

Since DM causes clinical changes that typically call for ongoing, long-term care, ensuring therapeutic efficacy and reducing potential interference with treatment is critical. Additionally, interactions between pharmaceutical drugs and food or nutritional ingredients in food products may make pharmacological therapies less effective for a variety of illnesses (Wang, Fang, & Yang, 2024; Zahedi et al., 2024).

Additionally, foods designed for specific purposes and providing an appropriate supply of nutrients in separated or mixed form are used exclusively or partly as a supplement to nutrition to aid in the production or control of diabetes mellitus (DM). This approach is based on pharmaceutical and non-pharmacological therapy (Kalva et al., 2024; Zhu et al., 2024).

However, when a drug is consumed with food, modifications may be made to the way it functions or is processed by the body. These modifications may impact the the pharmaceutical or kinetic dynamics of the drug substance and the nutrient (vitamins, minerals), which may affect the therapeutic's efficacy or nutritional balance. This phenomenon is known as a drug-nutrient interaction (Craig et al., 2024; Permana et al., 2024).

Thus, it is imperative to thoroughly examine the recommended diet and the numerous medications prescribed, considering the results of the nutritional assessment and potential interactions with pharmaceutical therapies (Xourafa, Korbmacher, & Roden, 2024).

Thus, this study intends to investigate and evaluate the primary interactions between medications and nutrients during the management of patients with Type II Diabetes Mellitus (DM2), illustrating the primary interactions between drugs and nutrients and how these relationships affect their management and wellness. This is based on a review of the literature (Nurgül & Tülüce, 2024; Peng, 2024).

METHODOLOGY:

This study was carried out in stages as follows and includes an integrated review of the literature: defining the inclusion and exclusion criteria for scientific studies, formulating the main question, searching databases, analyzing study summaries, selecting pertinent studies, assessing the specifics of the selected studies, and analyzing the data gathered (Chawla, Pradhan, & Gupta, 2024; Perakakis et al., 2024; Soto-Mota et al., 2024).

"What are the main interactions among nutrients and drugs in patients with type II diabetes mellitus, and how do these interactions affect the treatment of these patients?" is the study's topic. The "PICO" technique served as the foundation for formulating the guiding research question. In this strategy, "P" stands for patients with type II diabetes mellitus as the population, "I" for the intervention (drug and nutrition interactions), and "CO" for the setting (interaction evaluation) (Falkenhain et al., 2024; Gregg et al., 2024; Tobias et al., 2024).

To do this, searches in the PubMed and Google Scholar databases were conducted using combinations based on the English terms "Diabetes Mellitus" and "Drug-Nutrient interaction"

(Interaction). The study examined free articles published between 2018 and 2023; off-topic, duplicate, paid, and after-hours items were not included (Dimer et al., 2024; He et al., 2024; Ma, 2024).

RESULTS:

The flow diagram in Figure 1 shows that the search yielded 699 articles in the two sources employed (PubMed = 91, Google Scholar = 608) (Pathan et al., 2024; Vajdi et al., 2024).

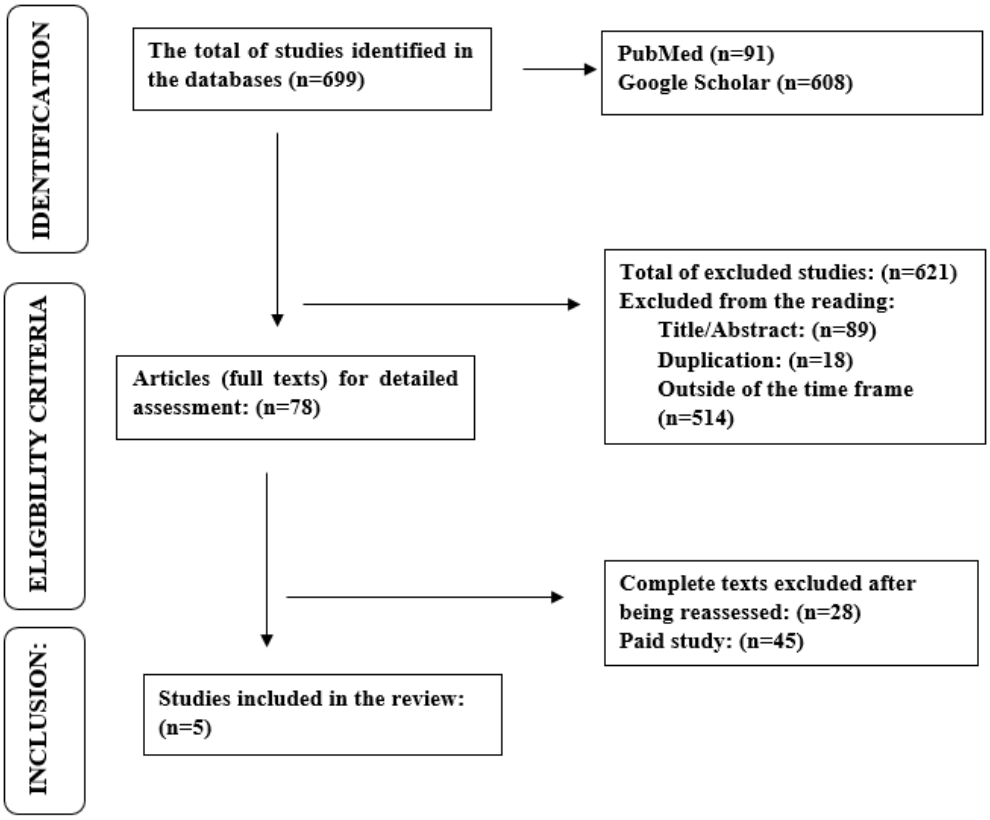

Figure 1. *Flowchart for identification, eligibility criteria, and inclusion of studies in the review.*

Table 1 illustrates the scientific papers in the search results according to the study's citation, type, title, and objective (Vajdi et al., 2024; Zhou & Xu, 2024).

QUOTE	TYPE OF STUDY	TITLE	OBJECTIVE
Pereira, 2018	Descriptive investigative research using a numerical methodology.	Drug-nutrient correlations of antihypertensive and antidiabetic medicines prescribed at the Alcides Carneiro University Hospital.	To assess the interactions between antihypertensive and antidiabetic medications and nutrients provided in a university hospital.
Mohn et al., 2018	Literature review	Indications of drug-nutrient interactions when using regularly prescribed drugs for a long time: a report.	Give current information on potential drug-nutrient interactions, concentrating on the most often given drugs for diseases usually diagnosed in the adult US population.
Owen et al., 2021	Literature review	Metformin, folate, and vitamin B12 interactions and their possible effects on fetal development and long-term metabolic health in diabetic pregnancies.	Examine how metformin, folate, and vitamin B12 interact throughout a diabetic woman's pregnancy and how this may impact the fetus's development and long-term metabolic health.
Dantas, 2019	Literature review	Drug-food interaction in older adults with type 2 diabetes mellitus.	To examine the relationship between food and medication in older adults with type 2 diabetes mellitus to find potential barriers to treatment efficacy.
Leal and Júnior, 2018	Literature review	Drug-nutrient interaction: description and novel approaches to assessment.	Examine how dietary supplements and medications interact and how this may impact the efficacy of medical interventions.

Table 1. *Selected articles, citations, type of study, title, and objective.*

Table 2 shows the results of a survey conducted in addition to the data shown in Table 1 and includes the primary classes of oral medications used to treat DM2. The drug label and mechanism of action were then listed (Frías et al., 2024; TAHA, Abd El-Azeaz, & ABD EL-RAZIK, 2025).

CLASS	MEDICINES	ACTION
BIGUANIDES	Metformin	It lessens the quantity of glucose that the liver releases. Increases susceptibility to insulin's effects.
	Metformin XR	
SULFONYLUREAS	Chlorpropamide	Causes the pancreas to produce more insulin when stimulated.
	Gliblencamide	
	Glipizide	
	Gliclazide	
	Gliclazide MR	
	Glimepiride	
MEGLITINIDES	Repaglinide	It causes an increase in insulin secretion by the pancreas right after a meal.
	Nateglinide	
GLITAZONES	Pioglitazone	Increases the production and release of insulin.
	Thiazolidinediones	
ALPHA-GLUCOSIDASE INHIBITORS	Acarbose	Slows down the process of absorbing carbs.
GLIPTINS	Sitagliptin	Increases the production and release of insulin.
	Vildagliptin	
	Linagliptin	
	Alogliptin	
SGLT2 INHIBITORS	Dapagliflozin	It increases the amount of extra glucose excreted in the urine by preventing the kidneys from reabsorbing glucose.
	Empagliflozin	

Table 2. *Main classes of drugs used in the treatment of type II diabetes mellitus.*

DISCUSSION:

As defined by the Institute of Medicine (IMS), dietary therapy treats a disease or condition by altering the amount of nutrients consumed. As a result, it is critical to attain appropriate glucose control, a crucial element in the effectiveness of DM2 medication therapy (Mohammadi et al., 2024; Paul et al., 2024).

As a result, the relationship between nutrition and medications has received increasing attention, maybe due to medications becoming more precise and effective. Furthermore, drugs and foods have numerous common traits, including physical aspects that can influence some biological responses and other dose-related adverse consequences (Hussain, Borah, & Ahmed, 2024; Tolentino & Brynes, 2024).

Pereira's research highlighted that metformin, a medication commonly prescribed as the first treatment for diabetes mellitus, needs particular attention since it can interfere with the metabolism of vitamin B12. This study and the one by Mohn and associates about metformin use can be correlated. Metformin use may lower vitamin B12 levels because of potential issues with intestinal absorption (Ghahfarrokhi et al., 2024; Wood & Pratt, 2024).

Thus, when taking the medication, those who have diabetes or are more likely to have low vitamin B12 levels may be particularly sensitive to these side effects. It was also noted in the research by Mohn and associates that extended usage of thiazolidinediones raises the likelihood of bone fractures. Furthermore, it has been shown that people with T2DM receiving antidiabetic medicine do not consume enough calcium, vitamin D, or magnesium nutrients necessary for maintaining healthy bones (Bonekamp et al., 2024; Manzano, Llames, & Macabeo, 2024).

According to Owen and colleagues' study, the action of metformin is similar to that of antifolates and can lower vitamin B12 levels. This can have long-term adverse effects, particularly for pregnant women with DM2 and gestational diabetes mellitus. (DMG), compromising aerobic respiration's mitochondrial activity and carbon metabolism (CG, Adibe, Ukwe, & Aguwa, 2030).

Dantas claims his research looked at potential interactions between medications and meals high in folic acid and vitamin B12. With a rate of 35.5%, metformin was used more frequently than

glimepiride, alogliptin and metformin, dapagliflozin and metformin, glimepiride, alogliptin and metformin, and metformin, which was used less frequently with a rate of just 1.5%. Since of this interaction, the body absorbs fewer vitamins, which can be detrimental to older persons since it increases the likelihood that they will become deficient in these vitamins and develop other health issues linked to nutrient deficiencies (Gierlach et al., 2024; Khairnar et al., 2024).

Moreover, the quality of life for senior DM2 patients and the efficacy of medication therapy may be affected by this interaction. In this context, metformin use remained to demonstrate a substantial connection with B12 deficiency even after accounting for characteristics like age, body mass index, use of vitamin B12 supplements, and medications that lower gastric acidity (Patil & Tupe, 2024; Thompson et al., 2024).

According to Leal and Júnior's study, the effects of drugs on nutritional status can be complex because they can affect food intake, digestion, absorption, and nutritional metabolic functioning. These changes in metabolic function can result from drug use and include weight gain, hyperglycemia, dyslipidemia, and other conditions. Furthermore, a correlation between weight gain and elevated blood glucose levels linked to medication use has been noted in certain studies, which may present further challenges for the management of diabetes mellitus (Salh, Aziz, Ahmed, & Mahwi, 2024).

As a result, specific patient populations such as women, the elderly, those who consume too many calories, and those with poorly managed diabetes are more likely to experience medication interactions (Shao, Shi, Nauman, Price-Haywood, & Stoecker, 2024).

CONCLUSION:

Consequently, we can conclude that drug-nutrient interactions are essential when treating DM2 patients based on the data in the study. Moreover, these interactions may affect patients' nutritional state and the efficacy of their medication regimen.

Moreover, it has been noted that metformin, a medication frequently prescribed for the first course of therapy for diabetes mellitus, may have adverse effects on the body's ability to absorb vitamin B12, potentially leaving patients deficient in it. In this regard, people with DM2 have been linked to an elevated incidence of bone fractures due to various medications, including thiazolidinediones.

It has also been discovered that patients with DM2 receiving antidiabetic medication do not consume enough calcium, vitamin D, or magnesium, which might harm bone health. It is crucial to remember that not every patient is affected by these interactions similarly and may differ depending on age, body mass index, and supplement use. To guarantee efficient treatment and the preservation of a patient's quality of life, it is crucial to be aware of these correlations and to evaluate the nutritional state of the patients periodically.

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