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The Analysis Study of Prevalence of Gastrointestinal Complication in Patients with Type 2 Diabetes Mellitus : A Comprehensive Systematic Review

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ABSTRACT

Background: Diabetes, a chronic metabolic disorder, has a high prevalence worldwide due to changing lifestyles and urbanization. It is associated with life-threatening hazards and disabling complications, decreasing life expectancy. Gastroparesis, a well-known manifestation, is more prevalent in women. Understanding the prevalence of gastrointestinal complications in type 2 diabetes mellitus patients is crucial for creating effective treatment regimens. **Methods:** Adhering to the PRISMA 2020 principles, this systematic study focused on analyzing complete English literature texts published from 2011 to 2024. Several websites, such as ScienceDirect, PubMed, and SagePub, were used to collect the literature. **Result:** The study examined over 4000 publications sourced from recognized platforms such as Science Direct, SagePub, and PubMed. Following the decision to subject eight publications to further scrutiny, a comprehensive examination of the complete body of literature was conducted. **Conclusion:** Diabetes often leads to gastroparesis, a condition affecting the upper gastrointestinal tract, associated with metabolic imbalance, high blood sugar levels, low insulin, hormone release, and H. pylori infection. This condition is linked to the contractile activity of the duodenum, and is associated with various liver conditions, including diabetic fibrosis and cirrhosis.

Keyword: Diabetes, gastrointestinal complications, liver, metabolic

INTRODUCTION

Diabetes is a chronic metabolic disorder that has become more prevalent worldwide due to changing lifestyles and urbanization.¹ Diabetes has become one of the most common and severe chronic diseases, with an alarming prevalence. This condition is associated with life-threatening hazards and disabling complications, which in turn decrease life expectancy.² Globally, the number of adults with diabetes has risen to 537 million, with projections indicating that this figure will continue to rise to 643 million by 2030 and 783 million by 2045.³ It is anticipated that by 2025, over 75% of individuals with diabetes will reside in underdeveloped countries.⁴

Although the complications of diabetes have garnered considerable attention, the influence of gastrointestinal (GI) symptoms on individuals with diabetes has frequently been disregarded.⁵ GI symptoms are a major cause of morbidity and have the potential to significantly impact the quality of life and overall disease management of individuals with diabetes.⁶ Gastrointestinal symptoms in patients

with diabetes can present in a variety of ways, including heartburn, dyspepsia, dysphagia, gastroparesis, constipation, diarrhea, and fecal incontinence, which affect both the upper and lower gastrointestinal tracts.^{7,8} Gastroparesis is a well-known gastrointestinal manifestation of diabetes that is more prevalent in women. Researchers have observed delayed gastric emptying in 27% to 65% of patients with type 1 diabetes mellitus (T1DM) and up to 30% of patients with type 2 diabetes mellitus (T2DM).^{9,10}

In light of the high prevalence of diabetes, there is conflicting evidence regarding the prevalence of gastrointestinal symptoms and the detrimental effect of these symptoms on the quality of life of patients with diabetes. Understanding the prevalence of gastrointestinal complications in type 2 diabetes mellitus patients is critical for creating effective treatment regimens. The objective of this systematic literature review was to examine the prevalence of gastrointestinal complications in patients with diabetes mellitus type 2 by utilizing

research conducted over the past decade.

METHODS

Protocol

The study's author rigorously followed the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) 2020 criteria to ensure full compliance with all requirements. The presentation of research findings was executed with a thoughtful and meticulous method, ensuring both persuasiveness and accuracy.

Criteria for Eligibility

This paper provides a thorough analysis of the studies published in the last ten years on the connection between the occurrence of gastrointestinal issues in individuals with type 2 diabetes mellitus. This program aims to enhance patient care practices by undertaking thorough data analysis. The main objective of this thesis is to highlight the significance of specific themes that are widespread throughout a wide range of literary works.

Rigorous inclusion and exclusion criteria were adopted to ensure the accuracy of the data used

in this research. Any English-language content officially released between 2011 and 2024 is deemed eligible for inclusion. Submissions without a DOI, published reviews, editorials, and duplicate entries within the same magazine are not considered.

Search Strategy

We used "gastrointestinal complications OR type 2 diabetes mellitus OR prevalence." as keywords. The search for studies to be included in the systematic review was carried out using the PubMed, SagePub, and Sciencedirect databases.

Data retrieval

Prior to commencing this exhaustive inquiry, the authors thoroughly evaluated the pertinence of each publication by scrutinizing its abstract and title. Only research that fulfilled the aims and met the inclusion criteria of the article were assigned greater significance. After making multiple investigations, a clear and unequivocal pattern was consistently established. Only English allowed full-text

submissions. A meticulous screening method was utilized to obtain content that was directly relevant to the study's subject matter and fulfilled all established inclusion criteria. The research findings that failed to meet these criteria were mostly ignored and did not receive substantial attention. The examination encompassed a diverse array of data, comprising factors, titles, authors, publication dates, places, and study methodologies.

Quality Assessment and Data Synthesis

The authors carefully examine the abstract and title of each article to identify those that necessitate additional research. Consequently, every document that was first submitted for review had to undergo a comprehensive assessment. The choice of review papers was impacted by the assessment results. This criterion expedited the swift selection of papers for additional scrutiny, so allowing for a more thorough study of prior research and the context in which it was assessed.

Table 1. Search Strategy

<i>Database</i>	<i>Search Strategy</i>	<i>Hits</i>
Pubmed	<i>("gastrointestinal complications"[MeSH Subheading] AND "type 2 diabetes mellitus"[All Fields] OR "T2DM" [All Fields]) AND ("GI complications"[All Fields] OR "prevalence"[All Fields])</i>	4915
Science Direct	<i>("gastrointestinal complications" AND "type 2 diabetes mellitus" AND "prevalence")</i>	128
Sagepub	<i>("gastrointestinal complications" AND "type 2 diabetes mellitus" AND "prevalence")</i>	28

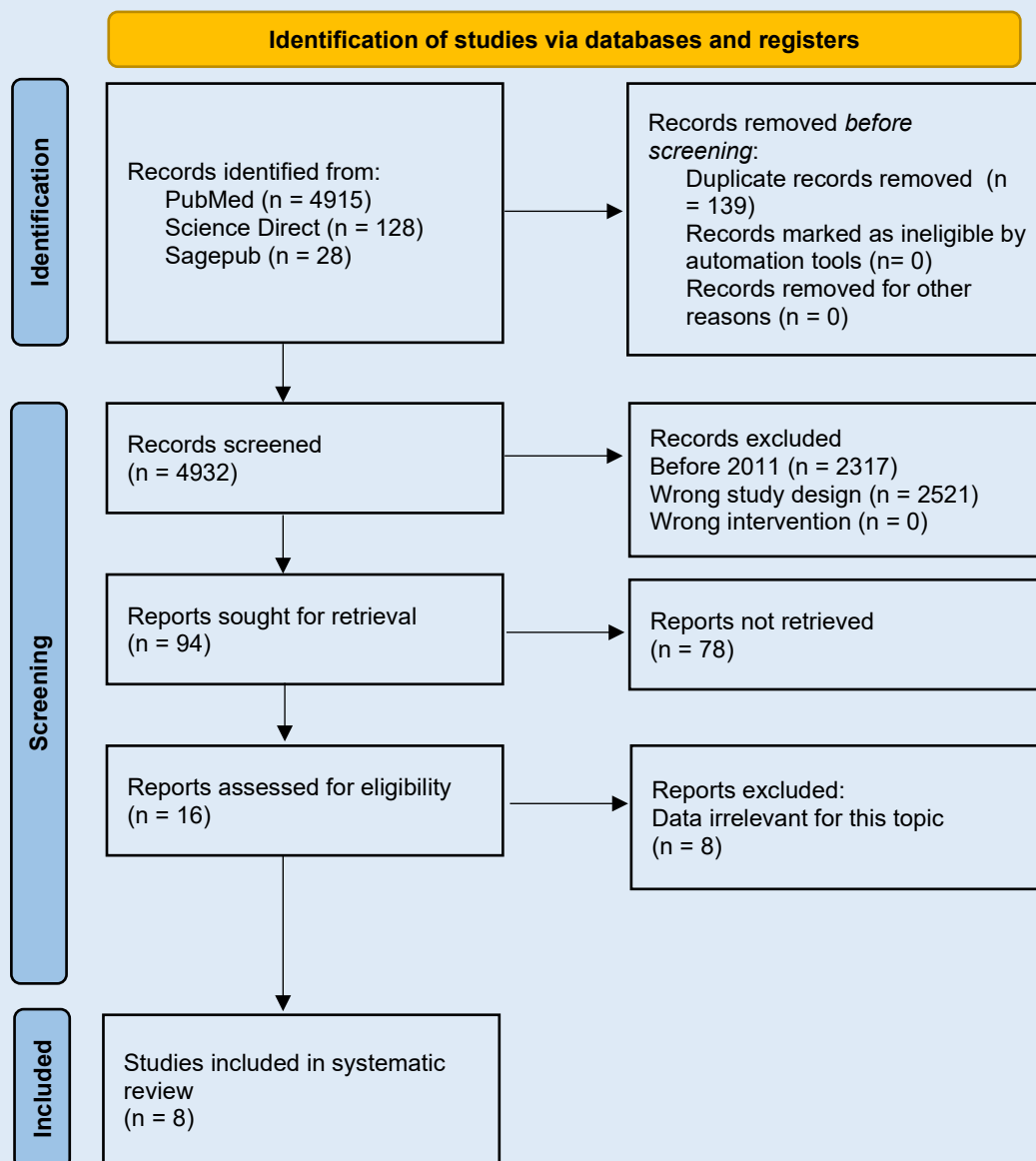


Figure 1. Article search flow chart

Table 2. Critical appraisal of Study

Parameters	(Mais ey, A., 2016)	(Zawa da et al., 2018)	(Kurn iawa n et al., 2019)	(Mora di et al., 2019)	(Kaze minia et al., 2022)	(Mare et al., 2022)	(Ud- din et al., 2022)	(Samak et al., 2023)
1. Bias related to temporal precedence								
Is it clear in the study what is the “cause” and what is the “effect” (ie, there is no confusion about which variable comes first)?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2. Bias related to selection and allocation								
Was there a control group?	No	No	No	No	No	No	No	No
3. Bias related to confounding factors								
Were participants included in any comparisons similar?	No	No	No	Yes	Yes	No	No	No.
4. Bias related to administration of intervention/exposure								
Were the participants included in any comparisons receiving similar treatment/care, other than the exposure or intervention of interest?	No.	No.	No.	Yes.	Yes.	No.	No.	No.
5. Bias related to assessment, detection, and measurement of the outcome								
Were there multiple measurements of the outcome, both pre and post the intervention/exposure?	No	No	No	Yes	Yes	No	No	No.
Were the outcomes of participants included in any comparisons measured in the same way?	No	No	No	Yes	Yes	No	No	Yes
Were outcomes measured in a reliable way?	No	No	No	Yes	Yes	No	No	Yes
6. Bias related to participant retention								
Was follow-up complete and, if not, were differences between groups in terms of their follow-up adequately described and analyzed?	No	No	No	Yes	Yes	No	No	No
7. Statistical conclusion validity								
Was appropriate statistical analysis used?	No	No	No	Yes	Yes	No	No	Yes

RESULT

We commenced the inquiry by methodically collecting a substantial array of documents from esteemed sources such as Science Direct, PubMed, and SagePub. Following a comprehensive three-stage evaluation procedure, we have chosen eight papers that are very relevant to our current systematic investigation. Afterwards, we chose specific subjects for additional analysis and thoroughly assessed each report. To streamline our analysis, we have incorporated a succinct overview of the assessed data in Table 3.

Table 3. The literature included in this study

Author	Origin	Method	Sample	Result
Maisey, Abigail¹¹ (2016)	United Kingdom	Review	-	Diabetes often leads to gastrointestinal symptoms such as enteropathy, which includes constipation, diarrhea, and fecal incontinence. This complex condition is linked to chronic hyperglycemia and diabetes duration. Management requires a multidisciplinary approach, focusing on symptom mitigation and glycemic control.
Zawada et al.¹² (2018)	Poland	Review	-	Diabetes mellitus is a systemic disease linked to hyperglycemia, chronic inflammation, and organ damage. It causes gastroenterological complaints like abdominal pain, diarrhea, nausea, flatulence, and vomiting. Complications in the alimentary system include gastroparesis and pancreatic dysfunction. Diabetes can aggravate coexisting diseases, such as gastroesophageal reflux or periodontitis. Long-term complications include hepatic microangiopathy and tumors linked to insulin resistance. Rapid diagnosis and treatment

				improve patient quality of life.
Kurniawan et al.¹³ (2019)	Indonesia	Review	-	Diabetic gastroenteropathy is a common complication in diabetes mellitus patients, causing symptoms like heartburn, abdominal pain, and constipation. It's a major morbidity, requiring early diagnosis and management to improve quality of life and maintain glycemic control.
Moradi et al.¹⁴ (2019)	Iran	Meta Analysis	45 studies	A meta-analysis of 45 studies found a high prevalence of major microvascular complications in Iranian patients with type 2 diabetes (T2DM). These complications include diabetic foot ulcer, cardiovascular disease, retinopathy, neuropathy, and nephropathy, providing practical evidence for better planning and clinical decision making.
Kazeminia et al.¹⁵ (2022)	Iran	Meta Analysis	10 studies	Gastronomical complications are a significant issue in patients with type 2 diabetes, with a prevalence rate of 52.3% in 10 studies in Iran. The study highlights the need for appropriate measures to improve the condition of diabetic patients through appropriate policy-making and feedback to hospitals and patients, despite the potential for publication bias in reporting results.
Mare et al.¹⁶ (2022)	Romania	Review	-	Diabetes mellitus, a chronic condition characterized by damage to

				peripheral nervous system nerve fibers, is a significant issue in developing countries. Digestive complications, a result of diabetic autonomic neuropathy, are often overlooked by diabetologists. Additionally, patients are at risk of developing liver diseases.
Ud-din et al.¹⁷ (2022)	Sweden	Review	-	Diabetes significantly impacts gastrointestinal symptoms, with symptom prevalence being a major concern. The DICODI project aims to estimate symptom prevalence, identify risk factors, and classify complications in a societal setting, benefiting individuals with diabetes, healthcare professionals, and society.
Samak et al.¹⁸ (2023)	Iran	Cross Sectional Study	2669 participants	Diabetes patients have a higher prevalence of upper gastrointestinal symptoms (GI) compared to those without diabetes. Eructation is the most common GI symptom in diabetes patients (18.6% vs. 14.9%). The prevalence of GI symptoms is high in both diabetic and non-diabetic patients, with a higher chance of developing GI upper symptoms in diabetes patients.

DISCUSSION

Diabetes frequently causes gastroparesis, a collection of symptoms that affect the upper portion of the gastrointestinal tract and disrupt the process of stomach emptying. Delayed stomach emptying is a prevalent issue in patients with other difficulties, with 47% experiencing this condition.¹⁹ In individuals with diabetes, the severity of symptoms frequently corresponds to a lack of metabolic equilibrium. High blood sugar levels, low insulin levels, hormone release, and H. pylori infection can cause disturbances.²⁰ People who have gastroparesis have chronic inflammation, which lowers the number of interstitial Cajal cells (ICCs), which are neurons that release nitric oxide (NO) and cause smooth muscle to waste away. Macrophages that express the CD206 protein provide a protective role against gastroparesis. Interstitial cells of Cajal (ICCs) positively correlate with their number.²¹

Researchers have found that gastroparesis, a condition where the stomach doesn't empty properly, is more strongly linked to the contractile activity of the duodenum than the

motor activity of the cardia.²² The diagnosis of gastroparesis is frequently inconclusive, with isotope scintigraphy being the main diagnostic approach. To treat the illness, we use pro-kinetic medicines like metoclopramide, itopride, and relamorelin. However, their effectiveness is restricted or not widely available. Regularly consuming small meals and following a low-fat liquid diet will greatly reduce discomfort. Proton pump inhibitors and antidepressants such as amitriptyline and escitalopram can also be utilized. Researchers have conducted experiments to investigate the use of irbesartan in reducing leptin levels, revealing a significant delay in gastric emptying. However, the results of this research have been inconclusive, and additional observation is needed.^{12,23}

Research indicates that celiac disease impacts a significant portion, ranging from 6 to 15%, of individuals with diabetes. Most of these individuals typically receive a diagnosis of celiac disease within five years of their diabetes diagnosis.²⁴ However, a mere 10% of patients exhibit the characteristic clinical

signs and symptoms of the condition. The prevalence of celiac disease among diabetic people is nearly equivalent, exhibiting a unique trajectory in comparison to individuals without diabetes. To rule out celiac disease, medical professionals utilize anti-TTG antibodies and genetic investigations to detect the presence of HLA-DQ2 antigen. This antigen is found in 90% of people with celiac disease and 55% of people with type 1 diabetes. Diabetic individuals may also encounter intermittent episodes of diarrhea, which frequently resolve on their own.¹² Diabetic patients, especially those with type 2 diabetes, have a higher prevalence of small intestinal bacterial overgrowth (SIBO). Nonetheless, the available data on the subject is inconclusive, with certain studies suggesting a reduced occurrence compared to the general population and establishing a connection between dietary changes and diabetic patients.²⁵

Colorectal cancer has a substantial risk because of variables such as a diet rich in fat and carbohydrates, obesity, and disruptions in glucose metabolism.

Diabetes is a risk factor that has been found to have a positive correlation with the incidence of intestinal polyps, as shown in a study in 2018.¹² Metformin, an initial treatment for type 2 diabetes, decreases hyperinsulinemia and improves insulin sensitivity. Research has found that there is a notable decrease in the occurrence of colorectal polyps, as well as a reduction in their size and number. Additionally, there is a decreased incidence of hyperplastic and villiform polyps, as well as less advanced cases of colorectal carcinoma.²⁶ Vitamin B12 levels drop when metformin is used for a long time. This is similar to what happens when proton pump inhibitors (PPIs) are used to treat stomach problems.²⁷

Diabetes is linked to various liver conditions, such as simple fatty liver degeneration, obesity, lipid abnormalities, and nonalcoholic fatty hepatitis, which can lead to liver fibrosis and cirrhosis. People with type 1 diabetes (DM1) and type 2 diabetes (DM2) commonly develop diabetic fibrosis, a liver disease that affects small blood vessels, especially those with a long history of diabetes and other complications, such as

diabetic kidney disease.¹² A chronic increase in alkaline-phosphatase activity is also frequently observed. Diabetic individuals have a heightened vulnerability to infections, such as viral hepatitis. This susceptibility can lead to insulin resistance, increased release of tumor necrosis factor-alpha (TNF-a), and a direct impact of viral proteins on insulin function. 2018 research has confirmed a link between HCV infection and type 1 diabetes. However, the incidence of this link is lower compared to type 2 diabetes.^{12,28}

Individuals with diabetes are at an elevated risk of getting a pancreatic tumor in their digestive system as a result of variables such as being overweight or obese, having high levels of insulin in the blood, and being resistant to insulin. These circumstances result in increased levels of IGF-1, which promote unregulated cell growth and prevent programmed cell death.²⁹ Excessive administration of insulin in individuals with type 1 diabetes can result in abnormal enlargement of cells and tissues, known as pathological hypertrophy. Individuals

diagnosed with type 2 diabetes have a higher propensity to develop tumors in the liver, pancreas, esophagus, and large intestine. Among females, rectal tumors are more prevalent. Physicians express particular concern about pancreatic cancer, particularly when it manifests in patients newly diagnosed with diabetes.³⁰ Only patients with a significant likelihood of developing pancreatic cancer undergo imaging examinations. Researchers have discovered that metformin, a primary medication for type 2 diabetes, inhibits tumor growth and reduces the incidence of breast cancer.³¹

CONCLUSION

Diabetes often causes gastroparesis, a condition that affects the upper gastrointestinal tract and disrupts stomach emptying. Metabolic imbalance, high blood sugar levels, low insulin levels, hormone release, and H. pylori infection are associated with this condition. Gastroparesis is more strongly linked to the contractile activity of the duodenum than to the motor activity of the cardia. Diabetic individuals are at a higher risk of developing small intestinal bacterial overgrowth (SIBO), colon cancer,

liver conditions, and pancreatic tumors. Numerous liver conditions, including diabetic fibrosis and cirrhosis, are associated with diabetes. Metformin, an initial treatment for type 2 diabetes, can decrease hyperinsulinemia and improve insulin sensitivity, reducing the incidence of colorectal polyps and pancreatic tumors.

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