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Diabetes and cardiac complications: A narrative review

Diabetes y complicaciones cardíacas: Una revisión narrativa

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ABSTRAC

Objective: to carry out a narrative review on diabetes and cardiac complications, through risk factors, treatment and etiology.
Method: an information search was conducted in Scoopus, PubMed, and Google Scholar. Data selection: Documents were selected and analyzed through a critical literature review, taking into account inclusion and exclusion criteria.
Results: a corpus of 23 articles was analyzed, of which 6 correspond to systematic studies, 6 to literary studies, 3 to narrative studies, 2 to cross-sectional studies, 2 to descriptive studies, 2 to quantitative studies, 2 to multicenter studies. The population studied includes older people, pregnant mothers, young people, the elderly. The studies were carried out in various countries, such as the United Kingdom, Japan, Singapore, the United States, Australia, Ghana-United Arab Emirates, Italy, China, Indonesia and Chile. The diagnoses were characterized by 7 articles that addressed diabetes risk factors, 9 to treatment, 8 to etiology. Regarding socioeconomic level, 2 articles mentioned that they were from low-income countries, 12 articles mentioned that they were from upper-middle countries, 6 articles mentioned that they were medium-high countries, and 3 from countries that do not specify their socioeconomic level.
Conclusion: Type 2 diabetes is associated with heart failure in women that worsens with coronary artery disease, directly impacting the myocardium with risk of death. The use of SGLT2 inhibitors represents an important therapeutic advance, since it promotes renal glucose elimination, improves metabolic control and reduces heart failure events. Diabetes causes progressive damage to the cardiovascular system, where endothelial dysfunction plays a central role by promoting inflammation and vascular deterioration. The studies, carried out mostly in middle- and high-income countries, show barriers such as misinformation, failures in prevention and inequality in access to diagnosis. The need to improve education and access to health services is highlighted, especially in low-resource contexts, since this affects patients with DM2, T1D, cardiovascular risk, cardiac complications, heart failure and diabetic cardiomyopathy.

Keywords: Diabetes; Risk Factors; Treatment and Etiology.

RESUMEN

Objetivo: realizar una revisión narrativa sobre la diabetes y complicaciones cardíacas, a través de factores de riesgo, tratamiento y etiología.

Método: se desarrolló una búsqueda de información en Scoopus, PubMed, Google Schoolar. Selección de datos: Los documentos fueron seleccionados y analizados bajo una revisión crítica de literatura tomando en cuenta los criterios de inclusión y de exclusión.
Resultados: se analizó un corpus de 23 artículos, de los cuales 6 corresponden a estudios sistemáticos, 6 a estudios literarios, 3 a estudios narrativos, 2 a estudios transversales, 2 a estudios descriptivos, 2 a estudios cuantitativos, 2 a estudios multicéntrico. La población estudiada incluye personas mayores, madres gestantes, jóvenes, ancianos. Los estudios se desarrollaron en diversos países, tales como Reino unido, Japón, Singapur, Estados unidos, Australia, Ghana- Emiratos Árabes Unidos, Italia, China, Indonesia y Chile. Los diagnósticos se caracterizaron por 7 artículos que abordaron factores de riesgo de la diabetes, 9 a tratamiento, 8 a etiología. Respecto al nivel socioeconómico, 2 artículos mencionaron que eran de países de bajos ingresos, 12 artículos mencionaron que eran de países de medios-altos, 6 artículos mencionaron que era países medio y 3 de países que no especifican su nivel socioeconómico.
Conclusión: la diabetes tipo 2 se asocia a insuficiencia cardíaca en mujeres que se agrava con enfermedad coronaria impactando directamente el miocardio con riesgo de muerte. El uso de inhibidores SGLT2 representa un avance terapéutico importante, ya que favorece la eliminación de glucosa por vía renal, mejora el control metabólico y disminuye los eventos de insuficiencia cardíaca. La diabetes provoca daños progresivos en el sistema cardiovascular, donde la disfunción endotelial juega un papel central al favorecer la inflamación y el deterioro vascular. Los estudios, realizados mayormente en países de ingresos medios y altos, Se evidencian barreras como desinformación, fallas en prevención y desigualdad en el acceso al diagnóstico. Se resalta la necesidad de mejorar la educación y el acceso a servicios de salud, especialmente en contextos de bajos recursos, ya que esto afecta a pacientes con DM2, DT1, riesgo cardiovascular, complicaciones cardíacas, insuficiencia cardíaca y miocardiopatía diabética.

Palabras claves: Diabetes, Factores de Riesgo, Tratamiento y Etiología.

INTRODUCTION

Diabetes mellitus is a global public health problem (Ling et al., 2020). It is also a chronic disease that is constantly on the rise and poses a risk for developing cardiovascular problems (Alarco, 2020), while heart failure is considered one of the most significant complications of diabetes (Xiao et al., 2020). This is due to the cause of morbidity and mortality in people with diabetes, which increases healthcare costs as it is related to biological factors that worsen the short- and long-term prognosis (Richardson et al., 2021). The relationship between diabetes mellitus and heart failure reflects a high prevalence of morbidity that increases the risk of hospitalization in patients (Echouffo et al., 2022).

Recent findings confirm that diabetes mellitus is a major risk factor for developing heart failure due to its direct impact on the metabolic and inflammatory mechanisms that damage the myocardium and promote disease progression. In addition, SGLT-2 inhibitors have been shown to significantly reduce mortality and hospitalizations due to cardiac causes (X. Li, Zhou, and Gao 2024). Likewise, it has been identified that, even in the early stages of prediabetes, insulin resistance and endothelial dysfunction predispose to progressive cardiac deterioration, reinforcing the need for early diagnosis and control of cardiometabolic biomarkers (Berezin, Lichtenauer, and Berezin 2022).

On the other hand, it is recognized that the relationship between the two pathologies is bidirectional, as heart failure worsens glycemic control and insulin resistance, underscoring

the need for a comprehensive approach between endocrinology and cardiology (Elendu et al., 2023).

In terms of treatment, studies show that SGLT-2 inhibitors improve cardiovascular outcomes in patients with type 2 diabetes and heart failure and are currently considered among the most effective therapies (Chen et al., 2021). Similarly, it has been confirmed that diabetes doubles the risk of heart failure even in people without previous coronary heart disease, making cardiometabolic surveillance and strict glucose control crucial for preventing complications. Likewise, the triglyceride-glucose index has been identified as a reliable marker of insulin resistance and an early predictor of heart failure, and it is useful for preventive strategies in diabetic populations or those at high metabolic risk (Khalaji et al., 2023).

Diabetes can cause structural and functional damage to blood vessels and the heart, affecting circulation and increasing the risk of cardiovascular disease. Therefore, understanding its causes and mechanisms is essential to prevent complications and improve patients' overall health (Lu et al., 2023). In addition, multiple studies demonstrate the close relationship between diabetes and heart problems, highlighting the need to promote healthy lifestyles and metabolic control strategies that reduce the development of heart disease (Tuñón et al., 2021). In this regard, new recommendations and treatments have been incorporated to prevent heart failure and improve the quality of life of diabetic patients (Alarco, 2020).

Likewise, current efforts focus on preventing heart damage caused by diabetes and on strengthening health education and timely medical care. Therefore, scientific evidence emphasizes the importance of raising awareness about the prevention and early treatment of diabetes in order to protect cardiovascular health and reduce the burden of disease at the population level (Bahtiyar et al., 2020).

Therefore, the objective of this study is to conduct a narrative review on diabetes and cardiac complications, considering risk factors, treatment, and etiology.

METHOD

A comprehensive narrative review of diabetes and cardiac complications was conducted to explore the existing scientific literature, drawing on the following databases: Scopus, PubMed, and Google Scholar.

To refine the search, the terms "diabetes mellitus," "heart failure," "diabetic cardiomyopathy," "cardiac fibrosis," "SGLT2 inhibitors," "glycemic control," and "cardiovascular complications" were used. In addition, the Boolean operator AT was used to refine and broaden the search scope, and the search period extended from August to November 2025, with articles published between 2018 and 2025 reviewed. This search covered texts written in any language, specifically excluding case reports, interviews, letters to the editor, theses, and books, due to their less empirical nature or specific focus.

Within the databases, a total of 96 articles were initially identified using the designed search string. Of these, 25,556 corresponded to the Scopus database, 18,348 to PubMed, and 12,530 to Google Scholar. Next, 0 duplicate articles were removed. Subsequently, 20 articles that did not align with the study objective and another 27,550 that did not meet the established inclusion criteria were excluded. As a result of this filtering and selection process, a final corpus of 30 articles relevant to the review was obtained.

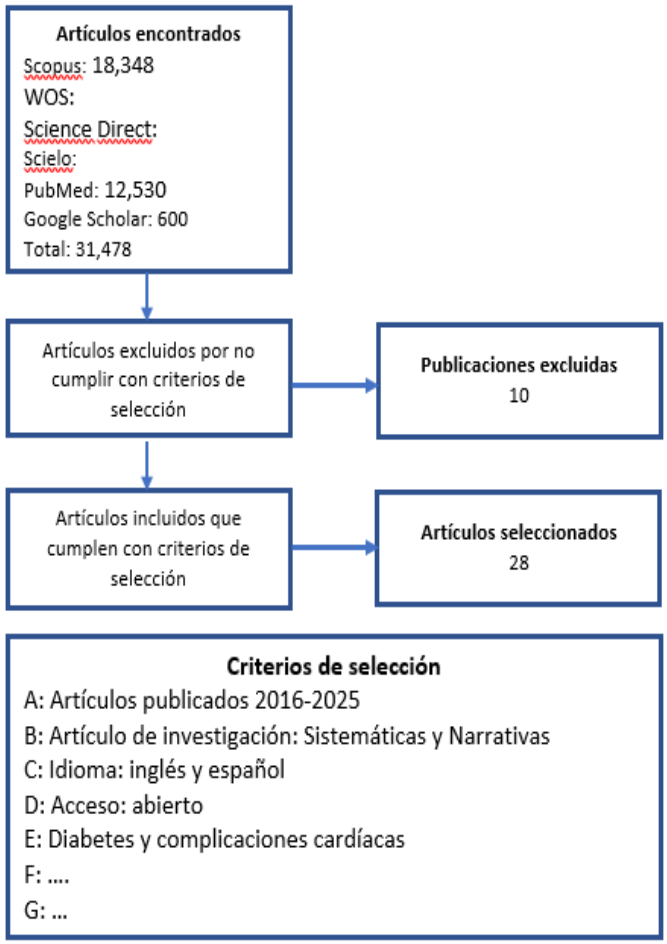

Figure 1. Flow diagram

RESULTS

A corpus of 23 articles was analyzed, comprising 6 systematic studies, 6 literary studies, 3 narrative studies, 2 cross-sectional studies, 2 descriptive studies, 2 quantitative studies, and 2 multicenter studies. The population studied includes older adults, pregnant women, young people, and the elderly. The studies were conducted in various countries, such as the United Kingdom, Japan, Singapore, the United States, Australia, Ghana, the United Arab Emirates, Italy, China, Indonesia, and Chile. Eight articles were identified that addressed diabetes risk factors, seven on treatment, four on etiology, and four on sequelae. Likewise, the conditions of the participants in the studies were characterized by patients with HF, patients with DM2, heart surgery, pregnant women, gastric bypass surgery, cardiac arrest, patients with T1D, medical diagnosis of type 2 diabetes, patients hospitalized for HF, cardiovascular risk, physical activity, undergoing treatment, cardiac complications, cardiac fibrosis, cardiovascular complications, coronary heart disease, and diabetic cardiomyopathy. Regarding socioeconomic status, most studies were conducted in low-, middle-, and high-income countries.

Table 1. Results

Study title	Methodology	Objective/Sample	Main results
Di Panchalaclaire et al., 2024) abetes and risk of heart failure in people with and without cardiovascular disease	Systematic review and meta-analysis	To estimate the association between diabetes and incident heart failure (HF), compared to people without diabetes, in individuals with and without CVD	The studies showed that people with type 2 diabetes, with or without cardiovascular disease, have a higher risk of heart failure than those without diabetes, with no significant differences according to the meta-regression.
Diabetes mellitus and risk of new-onset and recurrent heart failure (Kodama et al. 2020a)	Systematic review and meta-analysis	To assess the risk of new-onset and recurrent heart failure in DM.	Diabetes mellitus is a major risk factor for both new-onset and recurrent heart failure.
Effect of glycaemic control on complications following cardiac surgery (Navaratnarajah et al. 2020)	Literature review	To evaluate the relationship between glucose control and outcomes in cardiac surgery, comparing current treatment with the standard in patients with diabetes or prediabetes.	Preoperative and perioperative hyperglycemia is associated with worse outcomes in patients with and without diabetes undergoing coronary artery bypass grafting (CABG).
Potential molecular mechanism underlying cardiac fibrosis in diabetes mellitus (Ridwan et al. 2023)	Narrative review	Exploring mechanisms of fibrosis in diabetic cardiomyopathy.	Cardiac fibrosis in diabetes occurs due to an increase in TGF-β1, a protein that regulates tissue growth. Its excess hardens the heart by activating cardiomyocytes, which cause the heart to contract, and fibroblasts, which form the fibers of cardiac tissue.
Gestational diabetes mellitus and intergenerational CVD (Chen et al. 2024a)	Literature review	To synthesize evidence on gestational DM and CV risk in mother/child.	The results indicate that gestational diabetes increases the risk of cardiovascular disease in mothers and children, with a 46% higher risk in children, highlighting the need for early preventive measures.
Diabetes Mellitus and Heart Failure (Kodama et al. 2020a)	Systematic review	Review the relationship between diabetes and heart failure.	Diabetes and heart failure are mutually related, increasing the risk of complications in patients.
Diabetic Cardiomyopathy: Current and Future Therapies (Borghetti et al. 2018)	Cross-sectional review	Review pathophysiology and emerging therapies in diabetic cardiomyopathy.	Innovative therapies, such as gene therapy and non-coding RNA-based therapy, have been developed and show great potential for treating diabetic patients by regulating common factors in diabetic cardiomyopathy and heart failure.
Precision prognostics for CVD in Type 2 diabetes. (Ahmad et al., 2024a)	Narrative review	To find new factors that help better predict the risk of cardiovascular disease in people with type 2 diabetes.	Research highlights that cardiac, metabolic, and genetic biomarkers stand out as predictors of cardiovascular risk in type 2 diabetes, with NT-proBNP (N-terminal pro-B-type natriuretic peptide) being the most widely supported.

Type 1 Diabetes and Risk of Heart Failure (Julián et al. 2024)	Systematic review	To evaluate the association between T1DM and the risk of developing HF.	•People with T1D have a significantly higher risk of developing HF compared to people without diabetes. •The risk of HF was higher in women with T1D than in men
Basic Mechanisms of Diabetic Heart Disease (Rebecca and Dale 2019)	Descriptive review	Review structural and functional mechanisms of the diabetic heart.	Diabetes increases the risk of heart failure by causing early dysfunction and structural remodeling due to multiple mechanisms.
Endothelial Dysfunction and Diabetic Cardiomyopathy (Wang et al. 2022a)	Cross-sectional study	Analyze the role of endothelial dysfunction in diabetic cardiomyopathy.	It is concluded that new diabetes drugs improve patient prognosis except for endothelial dysfunction, which is a thin layer of cells that lines the inside of blood vessels.
Pathophysiology and Treatment of Diabetic Cardiomyopathy (Nakamura et al. 2022a)	Narrative review	Describe mechanisms (glucotoxicity, lipotoxicity) and therapeutic options.	Diabetic cardiomyopathy is a disease of the myocardial muscle, and its treatments include the use of sodium-glucose cotransporter 2 inhibitors.
A multidisciplinary, shared care clinic using personalized medicine and coordinated care in patients with concomitant type 2 diabetes and cardiovascular disease. Protocol and baseline characteristics. (Pontoppidan et al. 2024)	Literature review	Analyze the bidirectional relationship between CVD and T2DM.	The relationship between type 2 diabetes and cardiovascular disease represents a major challenge for the healthcare of those who suffer from them.
Rationale and strategies for improving glycemic control in diabetic patients undergoing cardiac surgery: a narrative review (Sara Volpi, Tanisha Rajah, and Jason M. Ali. 2024)	Descriptive review	Optimizing perioperative glycemic control in cardiac surgery.	Adequate glycemic control in diabetic patients undergoing cardiac surgery improves outcomes and reduces morbidity and mortality, justifying specific efforts in its management.
Lipoxin A4 in diabetes-associated cardiac dysfunction (Fu et al. 2024)	Multicenter study	Evaluate the effect of LXA4 on diabetic cardiac remodeling.	Treatment with LXA4, a lipid mediator derived from arachidonic acid, reduced diabetes-induced inflammation and cardiac remodeling, improving heart function.
Vascular complications of diabetes (Lu et al. 2023)	Systematic review	Characterize vascular complications in diabetes.	Microvascular complications affect the quality of life of patients with diabetes, while macrovascular complications significantly increase the risk of death, especially in those with type 2 diabetes.

Acute Sheehan's syndrome with diabetes insipidus postpartum (Olmes et al. 2022)	Narrative review	Describe the presentation and sequelae of Sheehan's syndrome with DI.	Sheehan's syndrome is a complication of childbirth caused by severe bleeding that damages the pituitary gland. When it occurs together with diabetes insipidus, it affects several hormonal functions and can be a serious condition; elevated prolactin indicates its severity.
Cardiac Autonomic Neuropathy in Diabetes Mellitus with Insulin-Dependent Diabetes (Shruti Agashe and Steven Petak 2018)	Descriptive	Review the epidemiology and consequences of cardiac autonomic neuropathy.	Cardiovascular autonomic neuropathy is damage to the nerves that control the heart and blood vessels. It is common in people with diabetes and increases the risk of complications.
Diabetes and Heart Failure (X. Li et al. 2024)	Narrative review	Update diagnosis and management of HF in diabetes.	Heart failure and diabetes are related as mutual risk factors; prolonged hyperglycemia can cause autonomic neuropathy, microcirculation disorders, and metabolic changes.
Impact of diabetes on the effects of sodium glucose co-transporter-2 inhibitors on kidney outcomes: collaborative meta-analysis of large placebo-controlled trials (Baigent et al. 2022)	Systematic review and meta-analysis	To evaluate the renal/CV effect of SGLT2 in patients with/without DM.	SGLT2 inhibitors significantly reduced the progression of kidney disease, the risk of acute kidney injury, and the likelihood of cardiovascular death or hospitalization for heart failure, with similar effects in patients with and without diabetes.
Proteomic signatures of type 2 diabetes predict coronary heart disease (Li et al., 2025)	Quantitative review	Identify proteomic signatures associated with coronary heart disease in T2DM.	Type 2 diabetes causes an increase in blood glucose and various complications, with coronary heart disease being one of the most serious, as it increases the risk of death.
Diabetes and Heart (Carlos Zavala and Fernando Florenzano 2020)	Literature review	Review cardiac complications associated with diabetes.	Diabetes increases the risk of atherosclerosis, cerebrovascular disease, and heart failure.

Mitochondrial quality control in diabetic cardiomyopathy: from molecular mechanisms to therapeutic strategies (Cai et al. 2022)	Literature review	Evaluate the role of mitochondrial quality in DC.	It is confirmed that mitochondrial quality defects promote heart damage in diabetes.
Prevalence and incidence of heart failure in type 2 diabetes (Gonzalez et al. 2024)	Multicenter study	Analyze the prevalence and incidence of HF in T2DM in a clinical population.	In patients with type 2 diabetes treated in cardiology and endocrinology clinics, heart failure showed high prevalence and incidence, associated with unfavorable social factors and comorbidities, especially cardiometabolic ones.

DISCUSSION

The review has identified the risk factors, treatment, and etiology of diabetes and cardiac complications for comparison with other results.

Risk factors

Type 2 diabetes is associated with an increased risk of incident heart failure (Panchalaclaire et al., 2024) and a higher probability of recurrence (Kodama et al., 2020b), especially in women (Haji et al., 2023). The coexistence of diabetes and heart failure worsens clinical outcomes and increases complications (Triposkiadis et al., 2021), promoting rapid myocardial deterioration (Yu et al., 2024a). In the case of type 1 diabetes, early glycemic control acts as a protective factor against hospitalization and mortality from heart failure (Julián et al., 2024). Likewise, gestational diabetes increases cardiovascular risk in both the mother and the child in the medium and long term (Chen et al., 2024b). The incorporation of cardiometabolic biomarkers and genetic profiles improves the detection and prognosis of cardiovascular risk (et al., 2024b), while interdisciplinary management between cardiology and diabetology is essential to reduce associated complications (Pontoppidan et al., 2024).

Heart failure

Type 2 diabetes is associated with an increased risk of incident heart failure and a higher probability of recurrence, especially in women (Kodama et al., 2020b). The coexistence of diabetes and heart failure worsens clinical progression and increases complications (Triposkiadis et al., 2021). Recent evidence confirms that diabetes significantly increases the incidence and severity of heart failure, even without coronary artery disease, due to its direct metabolic impact on the myocardium (Li et al., 2022). The association between the two conditions is linked to higher mortality and functional impairment, so a joint approach and ongoing cardiometabolic monitoring are recommended (Siao et al., 2022). In addition, early detection using biomarkers and echocardiography improves clinical prognosis (Firas Al Badarin et al. 2023). In type 1 diabetes, the risk is even higher, highlighting the need for early and sustained follow-up (Julián et al., 2024), considering that heart failure remains a frequent and underestimated complication in the diabetic population (Ahmad et al., 2024b).

Myocardial deterioration

Promoting rapid myocardial deterioration (Yu et al., 2024b), diabetes, hyperglycemia, and insulin resistance can induce apoptosis and fibrosis in cardiac tissue, causing structural and functional damage even in the absence of coronary artery disease (Jin Huo et al., 2023). This deterioration may be subclinical and detected by imaging techniques that reveal fibrosis and early diastolic dysfunction (Rodríguez et al., 2024). Factors such as lipotoxicity and oxidative stress contribute to mitochondrial damage and progressive loss of myocardial function (Shou et al., 2024). In addition, the hypertrophy and fibrosis observed in diabetes increase the vulnerability of the heart and promote heart failure (Zhou et al., 2022), affecting up to one-third of long-term diabetic patients due to ventricular remodeling and energy impairment (Rakhis et al., 2022).

Glycemic control

In the case of type 1 diabetes, early glycemic control acts as a protective factor against hospitalization and mortality from heart failure (Julián et al., 2024). Type 2 diabetes, being a chronic metabolic disease, increases cardiovascular complications, so maintaining glycemic control is essential (Zhou et al., 2022). The global increase in this disease affects quality of life and healthcare costs, highlighting the importance of early and sustained control (Jing et al.,

2023). Glycosylated hemoglobin is the most reliable parameter for assessing glycemic balance and preventing complications (Rakhis et al., 2022). Therefore, self-monitoring, supported by healthy habits and therapeutic compliance, maintains metabolic stability (Butayeva et al., 2023), and weight loss through appropriate diets improves insulin sensitivity and promotes metabolic control (Yuan et al., 2020).

Cardiometabolic biomarkers

The incorporation of cardiometabolic biomarkers and genetic profiles improves the detection and prognosis of cardiovascular risk (Ahmad et al., 2024a), as cardiovascular diseases arise from the interaction among genetic predisposition, lifestyle habits, and dietary quality (Ellis et al., 2022). Serum biomarkers also facilitate the identification of metabolic alterations associated with diet and lifestyle (Jin et al., 2023). Reducing saturated fats helps prevent atherosclerosis and insulin resistance (Li et al., 2022), and a diet rich in fruits and vegetables contributes to metabolic control. It reduces the risk of metabolic syndrome (Bonora et al., 2021), and a balanced diet strengthens antioxidant defenses, helping prevent cardiometabolic diseases (Helm et al., 2023).

Treatment

Glycemic control and lifestyle changes prevent cardiovascular complications (Brennan et al., 2018), and supervised training improves cardiac variability (Li et al., 2025). In addition, perioperative glycemic control improves cardiac surgery and reduces post-surgical morbidity and mortality (Fu et al., 2024). SGLT2 inhibitors (sodium-glucose cotransporter 2, drugs that reduce renal glucose reabsorption and protect the heart and kidneys) decrease heart failure events (Nakamura et al., 2022a) and renal progression (Baigent et al., 2022), providing significant cardiovascular protection (Yankah, Anku, and Eligar, 2024), while statins reduce cardiovascular events. However, their use remains limited (Gonzalez et al., 2024). Lipoxin A4 (LXA4) (an endogenous anti-inflammatory lipid mediator that regulates the inflammatory response and promotes cardiac tissue repair) improves myocardial function (Fu et al. 2024), and gene and RNA therapies show potential for modifying the disease (Borghetti et al., 2020).

SGLT2 inhibitors

SGLT2 inhibitors (sodium-glucose cotransporter 2, drugs that reduce renal glucose reabsorption and protect the heart and kidney) decrease heart failure events (Nakamura et al., 2022a). These drugs block renal glucose reabsorption, promoting its elimination and better metabolic control (Vallon & Verma, 2021). In addition to their hypoglycemic effect, they improve cardiovascular outcomes and reduce mortality (Dharia et al., 2025). Their use in combination with GLP-1 agonists is recommended when seeking to control weight and reduce cardiovascular risk (Muller et al., 2023). They also offer renal protection, even in the absence of diabetes, by reducing oxidative damage and preserving glomerular function (Vallon & Verma, 2021). Their anti-inflammatory and metabolic actions are a promising option for the treatment of cognitive disorders (Mei et al., 2024).

Cardiovascular protection

Providing significant cardiovascular protection (Yankah et al., 2024), cardiovascular diseases continue to be the leading cause of death worldwide, requiring strengthened prevention (Collado et al., 2021), with the main risk factors being obesity, smoking, and physical inactivity, which can be controlled through healthy habits (Ghasemiardekani et al., 2024). However, the increase in sedentary lifestyles and the rise in obesity rates are contributing to the increase in cardiovascular diseases. obesity, smoking, and physical inactivity, which can be controlled

through healthy habits (Ghasemiardekani et al., 2024). However, increased sedentary lifestyles and high-calorie diets have led to an increase in obesity and type 2 diabetes, raising cardiovascular risk (Elrakaybi et al., 2022). SGLT2 inhibitors represent a therapeutic advance by improving cardiac function and reducing cardiovascular events (Ray, 2020). In women, a pregnancy with normal blood pressure can reduce cardiovascular risk, demonstrating the protective role of hormones (Feng et al., 2024).

Statins

Although statins reduce cardiovascular events, their use remains limited (Gonzalez et al., 2024). Heart disease is the leading cause of death in older adults, and diabetes increases this risk (Horodinschi et al., 2019). These drugs inhibit the enzyme HMG-CoA reductase, blocking the mevalonate pathway and decreasing cholesterol synthesis (Fracassi et al., 2017). This metabolic pathway is essential for cellular balance and can be altered in diabetes, affecting lipid regulation (Tripathi, Gupta, and Galande 2024). In addition, statins improve glycemic and metabolic control in patients with hyperglycemia (Sadowska et al., 2023). They may exert additional protective effects, although their influence on cancer risk remains inconclusive (Das, 2025).

Lipoxin A4

Lipoxin A4 (LXA4) (an endogenous anti-inflammatory lipid mediator that regulates the inflammatory response and promotes cardiac tissue repair) improves myocardial function (Fu et al., 2024) by exerting anti-inflammatory and antioxidant effects that reduce neutrophil activation and endothelial damage, protecting cardiac tissue (Wang et al., 2020). In addition, it improves mitochondrial function and decreases oxidative stress, preserving cell stability (Kyriazis et al., 2022). Its action reduces ischemia-reperfusion injury and maintains vascular function (Zhang et al., 2021). Inflammation and vascular damage increase the risk of cerebral hemorrhage in people with chronic metabolic disorders (Zhang et al., 2022). However, adequate glycemic and blood pressure control prevents microvascular complications such as diabetic retinopathy (Lee et al., 2024).

Etiology

Gestational diabetes increases the risk of cardiovascular disease in mothers and children, with a significantly higher incidence in offspring (Chen et al., 2024a). Although new antidiabetic treatments improve prognosis, endothelial dysfunction persists as a relevant pathogenic mechanism (Julián et al., 2024). Diabetic cardiomyopathy is characterized by structural and functional alterations of the myocardium that respond favorably to the use of SGLT2 inhibitors, which reduce renal progression and the risk of cardiovascular death (Nakamura et al., 2022b). In addition, these drugs have shown sustained clinical efficacy in reducing major cardiac events (Baigent et al., 2022). Type 2 diabetes causes chronic hyperglycemia and progressive cardiovascular damage, with coronary heart disease being one of its most serious complications (Gonzalez et al., 2024). In patients with hypertrophic cardiomyopathy, it aggravates cardiac dysfunction. It accelerates hemodynamic deterioration (Yu et al., 2024a), and finally, mitochondrial alterations emerge as a key factor in the structural and functional deterioration of the diabetic myocardium (Brennan et al., 2020).

Endothelial dysfunction

Although new antidiabetic treatments improve prognosis, endothelial dysfunction remains a relevant pathogenic mechanism (Wang et al., 2022b). Vascular cell damage promotes inflammation and is associated with metabolic diseases such as diabetes and psoriasis (Li et

al., 2024). The endothelium regulates vasodilation and coagulation, and its deterioration causes inflammation and vascular dysfunction (Cardinal et al., 2018), which is sensitive to hyperglycemia due to its constant exposure to glucose (Rebecca & Dale, 2019). Similarly, severe COVID-19 shares inflammatory mechanisms, reinforcing the central role of the endothelium in the systemic response (Gavriilaki et al., 2020). In the cornea, endothelial alterations cause edema and visual loss, although new transplants allow for faster recovery (Price et al., 2021).

Diabetic cardiomyopathy

Diabetic cardiomyopathy is characterized by structural and functional alterations of the myocardium that respond favorably to the use of SGLT2 inhibitors, which reduce renal progression and the risk of cardiovascular death (Nakamura et al., 2022a). It is also recognized as a distinct entity, independent of other cardiac factors, and is promoted by chronic metabolic alterations (Bonora et al., 2021). In other words, contractile dysfunction derives from structural changes in myocardial tissue (Dillmann, 2019). Sustained hyperglycemia induces fibrosis and cardiac remodeling (Jia et al., 2018), while insulin resistance and mitochondrial damage contribute to heart failure, with ischemic heart disease being the leading cause of death in people with diabetes (Jin et al., 2023).

Coronary heart disease

Type 2 diabetes causes chronic hyperglycemia and progressive cardiovascular damage, with coronary heart disease being one of its most serious complications (Gonzalez et al., 2024). This disease is the leading cause of death and disability worldwide, although it can be prevented through cholesterol control, a balanced diet, and regular exercise (Nasr et al., 2022). Most cardiac deaths are associated with atherosclerosis linked to unhealthy lifestyles (Rodríguez et al., 2024). Coronary heart disease progresses slowly and can manifest as angina or myocardial infarction (Bottardi et al., 2024). In women, the risk increases after menopause due to the loss of hormonal protection (Miao et al., 2024). In addition, depression is common in these patients and worsens the cardiovascular prognosis (Echouffo et al., 2022).

Mitochondrial alterations

Mitochondrial alterations emerge as a key factor in the structural and functional deterioration of the diabetic myocardium (Brennan et al., 2018). In diabetes, mitochondria reduce energy production and increase oxidative damage (Wu et al., 2024), thereby disrupting calcium homeostasis and cellular respiration (Spina et al., 2025). In addition, the heart, which depends on fatty acid oxidation to produce ATP, has its function compromised by hyperglycemia (Vázquez et al., 2025). This dysfunction affects other organs and amplifies systemic damage (Eysert et al., 2024). Therefore, preventive strategies are needed to reduce the metabolic complications of diabetes (Chen et al., 2021).

Identification of limitations

This research has certain limitations, as it was not possible to cover all the existing literature on the subject. Therefore, only some associated and clinical factors were addressed. In addition, the studies mentioned in the discussion have a particular focus depending on the population and methodology used, while this study conducted a more general analysis. For this reason, it is recommended that the review of sources be expanded to develop a systematic review in the future.

CONCLUSION

Type 2 diabetes is associated with heart failure in women, which is aggravated by coronary

artery disease, directly impacting the myocardium with a risk of death. Early detection improves clinical prognosis by preventing further damage. Myocardial deterioration is related to fibrosis, oxidative stress, and mitochondrial damage that alter cardiac function before visible symptoms appear, which can be controlled with adequate glycemic management from early stages.

The use of cardiometabolic biomarkers and a balanced diet facilitates risk identification and strengthens prevention, contributing to a better quality of life and reduced complications in people with diabetes.

The use of SGLT2 inhibitors represents an important therapeutic advance, as it promotes the elimination of glucose via the kidneys, improves metabolic control, reduces the incidence of heart failure, and offers renal protection and anti-inflammatory effects that strengthen cardiovascular health. Prevention remains essential, as unhealthy lifestyles increase the risk of heart disease; adopting healthy habits and strengthening metabolic control contribute to a better quality of life. Statins complement this approach by reducing cholesterol and stabilizing lipid metabolism, helping to prevent complications in people with diabetes and promoting glycemic balance. Likewise, lipoxin A4 stands out as a protective mediator with antioxidant and reparative action on cardiac tissue, reinforcing the importance of comprehensive management that combines pharmacotherapy, prevention, and metabolic control to reduce the impact of cardiovascular disease.

Diabetes causes progressive damage to the cardiovascular system, where endothelial dysfunction plays a central role in promoting inflammation and vascular deterioration, directly affecting cardiac function. These alterations contribute to the development of diabetic cardiomyopathy, characterized by fibrosis, tissue remodeling, and loss of contractile function.

In turn, coronary heart disease manifests as one of the main complications, exacerbated by chronic hyperglycemia, unhealthy lifestyles, and hormonal changes in women. In addition, mitochondrial alterations decrease cellular energy and increase oxidative stress, affecting the function of the myocardium and other organs. Therefore, diabetes not only alters metabolism but also compromises heart and blood vessel health, underscoring the need for comprehensive, preventive management to reduce its complications.

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