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Literature Review

Exploring The Correlation Between Diabetes and Cardiovascular Disease: Literature Review Study

Vira Zahra Alkharis [1], Aris Nurkohilal [2], Sulami [3]

[1,2,3]Akademi Keperawatan Patria Husada Surakarta, Surakarta, Indonesia

ABSTRACT

Background: This article aims to examine the relationship between diabetes mellitus and cardiovascular disease and identify the implications of nursing in efforts to reduce cardiovascular risk in people with diabetes.

Methods: The research method used is literature review with a narrative review approach. The article search was conducted through Google Scholar using the keywords diabetes, type 2 diabetes mellitus, cardiovascular, and cardiovascular disease. The selected articles are articles from reputable international journals that are indexed by Scopus or Web of Science and published in the last five years (2021–2026). A total of five articles that met the inclusion criteria were analyzed descriptively.

Results: The results of the study showed that diabetes mellitus increases the risk of cardiovascular disease through the mechanisms of insulin resistance, dyslipidemia, hypertension, and chronic systemic inflammation that accelerate atherosclerosis. This condition has a direct impact on the increased incidence of coronary heart disease, heart failure, and ischemic stroke. From a nursing perspective, diabetes management not only focuses on glycemic control, but also includes cardiovascular risk factor monitoring, health education, lifestyle modifications, improved therapy adherence, and patient and family empowerment.

Conclusion: In conclusion, the role of nurses is very important in the implementation of holistic and sustainable nursing care to reduce the risk of cardiovascular complications in diabetics and improve the quality of life of patients.

KEYWORDS

Diabetes Mellitus, Type 2 Diabetes Mellitus, Cardiovascular Disease, Emergency, Literature Review

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CONTACT

Vira Zahra Alkharis

virazahraalkharis@yahoo.com
Akademi Keperawatan Patria Husada Surakarta

INTRODUCTION

Diabetes mellitus is a long-term metabolic problem that causes high blood glucose levels because the body cannot produce or use insulin properly. The disease has become a widespread epidemic and affects millions of people around the world. According to *International Diabetes Federation* (IDF), about 463 million people aged 20-79 had diabetes in 2019, and this figure is expected to increase to 700 million by 2045 (International Diabetes Federation, 2025). Diabetes doesn't just cause high blood glucose levels; but it also causes a number of long-term problems that have a major impact on the health and well-being of the sufferer. One of the most worrying things about diabetes is that it can lead to chronic heart disease (CHD). Cardiovascular diseases, such as coronary artery disease, heart failure, and stroke, are the leading causes of death and disability in people with diabetes. Studies have repeatedly shown that people with diabetes are two to four times more likely to develop CHD than people without diabetes (Jyotsna et al., 2023). This higher risk is caused by a number of things, such as insulin resistance, dyslipidemia, high blood pressure, and systemic inflammation, all of which can result in atherosclerosis, the main cause of most cardiovascular events, growing and worsening. Diabetes also causes endothelial dysfunction, oxidative stress, and abnormal platelet function deteriorates, which makes the chances of heart problems even higher (An et al., 2023). In addition, having diabetes and cardiovascular disease (CHD) at the same time often exacerbates the situation, so the likelihood of the same thing happening repeatedly increases and health care costs increase (Lim et al., 2023). Because of this, the association between diabetes and CHD has an important clinical impact, and it is important to find effective ways to manage cardiovascular risk in diabetic patients. Because diabetes is a big problem and has a huge impact on cardiovascular health, it's important to look at all the data on how to manage cardiovascular risk in diabetic patients. Over the years, various treatment methods in this vulnerable group have been researched to improve outcomes and reduce the likelihood of CHD. Glycemic control, which aims to keep blood glucose levels within the target range, is an important part of diabetes care. It has been proven that intensive blood sugar control lowers the likelihood of microvascular problems such as nephropathy and retinopathy (Tang et al., 2024). However, the evidence on its effect on cardiovascular outcomes is still mixed. Some studies show a small decrease in cardiovascular incidence, while others raise concerns about the possible dangers of hypoglycemia and weight gain caused by some diabetes medications (International Diabetes Federation, 2025). In recent years, there has been a shift in the way diabetic patients with cardiovascular risk are treated, with more attention being paid to multifactorial intervention methods. This method is called the "ABC" of diabetes treatment because it tries to treat not only hyperglycemia but also high blood pressure, high cholesterol, and being overweight or obese. Several important clinical studies have shown that aggressive risk factor management can lower the number of cardiovascular events in people with diabetes. For example, the Empagliflozin Cardiovascular Occurrence Trial in Patients with Type 2 Diabetes Mellitus (EMPA-REG OUTCOME) and the Canagliflozin Cardiovascular Assessment Study (CANVAS) have shown that sodium glucose cotransporter-2 (SGLT-2) inhibitors, a class of antidiabetic agents, not only improve glycemic control but also provide cardiovascular benefits, including a reduced risk of heart failure and cardiovascular death (Jyotsna et al., 2023). Trials examining the effects of glucagon-1-like peptide receptor agonists (GLP-1 RA), such as Liraglutide Effect and Action in Diabetes: Evaluation of Cardiovascular Outcome Results (LEADER) and Trial to Evaluate Cardiovascular and Other Long-term Outcomes with

Semaglutide in Subjects with Type 2 Diabetes (SUSTAIN-6), have shown that cardiovascular risk is lower in diabetic patients (Samuel & Shulman, 2019). Based on these recent results, it is clear that diabetic patients need a complete narrative review of how to manage cardiovascular risk. This review aims to provide a full understanding to diabetes mellitus patients, medical personnel, especially nurses and patients' families as companions on the latest evidence-based strategies in the prevention of complications from diabetes mellitus to cardiovascular disease in people with diabetes. This is done by analyzing the available literature and combining the results of relevant clinical trials and disease prevention.

MATERIALS AND METHOD

This research is a literature review research with a narrative review type. The scientific articles used in this study amounted to five scientific articles from reputable international journals. The design used is literature review, articles are collected using the Google Scholar search engine. The data presentation technique is to use a table of scientific publication articles that will be analyzed into research data. The data analysis technique is carried out descriptively by analyzing and identifying scientific articles so as to produce a more informative summary. The criteria for scientific articles used as data are scientific articles sourced from reputable international journals indexed by Scopus and Web of Science (WOS) with the latest update of the last five years, namely from 2021-2026. Scientific articles are articles that are publicly accessible. The steps taken in the context of searching for articles as literature research data are as follows: (1) Visit the Google Scholar website as follows, https://scholar.google.co.id, (2) Keywords in finding articles, namely diabetes, type 2 diabetes mellitus, cardiovascular and cardiovascular disease. The researchers used "AND" as the Boolean operator. The use of the boolean operator "AND" aims to combine different concepts and aspects as search keywords to narrow down the document to be obtained. Based on the search results, the number of articles according to keywords through the web https://scholar.google.co.id was 24,700 in total, (3) The next stage was to validate scientific articles by eliminating scientific articles with similar topic ideas if found in each source. The goal is to minimize the possibility of multiple research topic ideas. Scientific articles are also selected by year. The data of scientific articles obtained in this process is as many as five articles.

RESULTS

The five articles analyzed consisted of two cohort studies, one retrospective observational study, one case study, and one narrative review, all of which were published in the 2022–2023 range and sourced from the PubMed database.

Title, Database, Author(s) and Research Design	Results
Exploring the Complex Connection Between Diabetes and Cardiovascular Disease: Analyzing Approaches to Mitigate Cardiovascular Risk in Patients With Diabetes. PubMedCentral https://pmc.ncbi.nlm.nih.gov/articles/PMC10511351/ with Narrative Review (Jyotsna et al., 2023)	This narrative review provides a comprehensive examination of the complex relationship between diabetes and cardiovascular disease (CVD), This review discusses the impact of inflammation, endothelial dysfunction, and accelerated atherosclerosis on increased CVD risk. Highlighting the importance of adopting a multidisciplinary approach, the collaborative efforts of healthcare professionals from different disciplines aim to tailor treatment plans based on individual characteristics, thereby maximizing the effectiveness of patient-centered management. Patient education and empowerment are fundamental elements in achieving effective cardiovascular risk reduction. These elements facilitate informed participation in health management by promoting shared decision-making and improving adherence to treatment plans. The integration of scientific knowledge and patient-centered care presents exciting opportunities for innovative approaches, including better risk prediction models, tailored interventions, and effective research implementation. By leveraging this combination, healthcare providers have the opportunity to transform cardiovascular risk reduction, thereby driving a more promising future for individuals with diabetes. This can be achieved through collaborative efforts that include research, clinical practice, policy, and patient engagement. This review highlights the potential for applying a multidisciplinary approach that combines scientific advances with compassionate care. Such an approach has the capacity to improve outcomes and overall well-being for individuals living with diabetes.
Relationship Among Diabetes, Obesity, and Cardiovascular Disease Phenotypes: A UK Biobank Cohort Study. PubMed https://pubmed.ncbi.nlm.nih.gov/37368983/ with Cohort study (Brown et al., 2023)	The study presents a detailed analysis of cardiovascular phenotypes and outcomes related to metabolic parameters in a large cohort grouped by diabetes status and BMI category at the start of the study. Cardiovascular death and nonfatal events are more common as BMI increases, but in the presence of diabetes, the incidence rate is much higher. Indeed, UKB participants with diabetes and normal BMI experienced nominally higher adjusted incidence rates than obesity participants without diabetes. However, the adverse association of obesity with mortality and cardiovascular events was comparable in participants with and without diabetes, suggesting that the two interacted additively rather than synergismically. In contrast, while our sensitivity analysis revealed that central obesity was associated with an increased risk of adjusted cardiovascular death in participants without diabetes, this was not apparent in those with diabetes. These data emphasize the complex interaction between diabetes and obesity in modulating cardiovascular disease. Imaging data corroborated the presence of progressive cardiovascular disorders with increased BMI in participants without diabetes. Interestingly, the cardiovascular imaging phenotype in diabetes with normal BMI was generally comparable to that of obesity without diabetes, with only a slight increase in cardiovascular abnormalities as BMI increased in the diabetes group. Further, the duration of diabetes and HbA1c were poorly correlated with cardiovascular phenotypes in participants with diabetes, with adiposity metrics showing the strongest (albeit moderate) correlation. These findings raise the possibility that the ideal target range for adiposity metrics may be lower than those currently proposed in people with diabetes. Our data also reveal scope for improving adherence to existing targets around modifiable cardiovascular risk factors (e.g., smoking cessation) in people with diabetes and/or high BMI.

The Management Correlation Between	The results of this study revealed that there is a high prevalence rate of cardiovascular disease (CHD) in patients with type 2 diabetes mellitus (T2DM) in Anhui
The results of this study revealed that there is a high prevalence rate of cardiovascular disease (CHD) in patients with type 2 diabetes mellitus The Management Correlation Between Metabolic Index, Cardiovascular Health , and Diabetes Combined with Cardiovascular Disease. PubMed: https://pubmed.ncbi.nlm.nih.gov/367785 94/ With Cohort Study (Zhang et al., 2023)	Province. The findings of this study show the potential benefits of increased multifactorial and multifaceted interventions to prevent CHD in T2DM patients. Therefore, the right strategy can remedy this situation by establishing a tiered system of diagnosis and treatment, tracking and monitoring it at all levels, and providing feedback to hospitals, which can provide effective numerical data to reduce financial burdens and economic pressures in the future.
Diabetes and Ischemic Stroke: An Old and New Relationship an Overview of the Close Interaction between These Diseases. PubMed: https://pubmed.ncbi.nlm.nih.gov/352165 12/ the Battle of the (Maida et al., 2022)	Vascular diseases, particularly atherosclerosis, are undoubtedly the leading cause of disability and death in patients with diabetes mellitus. Diabetes mellitus significantly increases the risk of developing coronary, cerebrovascular and peripheral artery diseases. The pathophysiology of vascular disease in diabetes involves abnormalities in the function of endothelial, vascular smooth muscle cells, and platelets. The metabolic disorders that characterize diabetes—such as hyperglycemia, increased free fatty acids, and insulin resistance—trigger molecular mechanisms that contribute to vascular dysfunction. These mechanisms include decreased bioavailability of NO (Nitric Oxide), increased oxidative stress, disruption of intracellular signal transduction, and activation of receptors for AGEs. In addition, platelet function is abnormal, and there is an increase in the production of several prothrombotic factors. These abnormalities contribute to the cellular events that lead to atherosclerosis and further increase the risk of adverse cardiovascular events in diabetic patients, such as ischemic stroke. The close relationship between cerebrovascular disease and ischemic stroke has been widely proven, and the burden of stroke among diabetic patients is considerable in terms of mortality and morbidity. Therefore, despite tremendous pharmacological and technical advances, especially in the acute phase of ischemic stroke, the demand for treatments that can reduce the risk of stroke and have neuroprotective effects has increased drastically. Diabetes determines the onset of stroke and affects its prognosis through several mechanisms. The influence of this disease on atherosclerosis and plaque formation has been well documented. However, many studies highlight the influence of the disease on microcirculation regulation by altering the production of cerebral vasomotic mediators and modulating neuroinflammation. A better understanding of the mechanisms by which hyperglycemia and diabetes exert harmful effects on stroke onset and prognosis may uncover new strategies to reduce cerebrovascular morbidity and mortality in diabetic patients. However, in recent years, a growing body of evidence suggests that new antidiabetic drugs are safe and effective in controlling blood glucose and provide some effects that interfere with the molecular mechanisms underlying vascular damage in diabetes. Like the 'butterfly effect', this effect can limit the consequences on cerebral circulation and neurological changes resulting from ischemic stroke. Therefore, further studies are needed to precisely determine the extent of the reduction in cerebrovascular risk induced by new antidiabetic drugs, thus opening up new scenarios in the management of diabetic patients with stroke.
Real-World Treatment Patterns of Glucose-Lowering Agents Among Patients with Type 2 Diabetes Mellitus and Cardiovascular Disease or At Risk for Cardiovascular Disease: An Observational, Cross-Sectional, Retrospective Study. PubMed: https://pubmed.ncbi.nlm.nih.gov/361310 (Nazir et al., 2022)	This study provides an annual cross-sectional overview from 2015 to 2019 of the use of different classes of GLA among patients with type 2 diabetes (T2D) with pre-existing atherosclerotic cardiovascular disease (ASCVD)/heart failure (HF) or at risk of developing ASCVD/HF. Despite the increase in use during the study period, overall utilization of GLA with proven cardioprotective benefits (SGLT2is and GLP-1 RA) remained low, especially in the elderly. Increased awareness among healthcare providers about recommended therapies, especially the proven cardioprotective benefits of SGLT2is and GLP-1 RA, and addressing potential barriers to treatment may aid in cardiovascular management and improve patient outcomes among patients with T2D. As recent guidelines further support the use of GLP-1 RA and SGLT2is, future studies should be conducted to evaluate changes in the use of these drugs among patients with T2D and cardiovascular disease (CVD/Cardiovascular Disease) or at risk of CVD

Based on the results of the literature search that has been conducted, five scientific articles that meet the inclusion criteria were obtained and analyzed further. The articles were published in the 2022–2023 range and were entirely sourced from the PubMed database. The research designs used vary, including prospective cohort studies, retrospective observational studies, case studies, and narrative reviews, with a primary focus on the relationship between diabetes mellitus and cardiovascular disease. The results of the study showed that diabetes mellitus was consistently associated with an increased risk of cardiovascular disease events, including coronary heart disease, heart failure, and ischemic stroke. Some studies report that individuals with diabetes have a higher cardiovascular risk than the population without diabetes, regardless of age and gender factors. In addition, the duration of diabetes and poor glycemic control were reported to be associated with an increased incidence of cardiovascular complications. Some articles also identified the role of obesity and body mass index (BMI) in modifying cardiovascular risk in diabetic patients. One large cohort study reported that diabetic patients with normal BMI retained significant cardiovascular risk, suggesting that diabetes itself is an independent risk factor for cardiovascular events. These findings confirm that cardiovascular risk in diabetes is not only influenced by weight status, but also by underlying metabolic and vascular mechanisms. In addition to risk factors, the results of the study also highlight the effect of the use of certain antidiabetic therapies on cardiovascular output. Some articles report that the use of antidiabetic drugs with cardioprotective effects, such as SGLT2 inhibitors and GLP-1 agonists, is associated with a decrease in major cardiovascular incidence and cardiovascular mortality. These findings are supported by observational data and the results of synthesis from the narrative review. Overall, the results of this literature review show a consistent pattern of association between diabetes mellitus and increased risk of cardiovascular disease, as well as the important role of metabolic factors, weight status, and treatment choice in influencing cardiovascular outcomes in diabetic patients. A summary of the characteristics and key findings of each article is presented in the Results Table.

DISCUSSION

To clarify the pathophysiological mechanisms underlying the relationship between type 2 diabetes mellitus and cardiovascular disease, Figure 1 presents a conceptual framework describing the role of insulin resistance as an early factor in the occurrence of diabetes mellitus as well as its impact on various cardiovascular pathways.

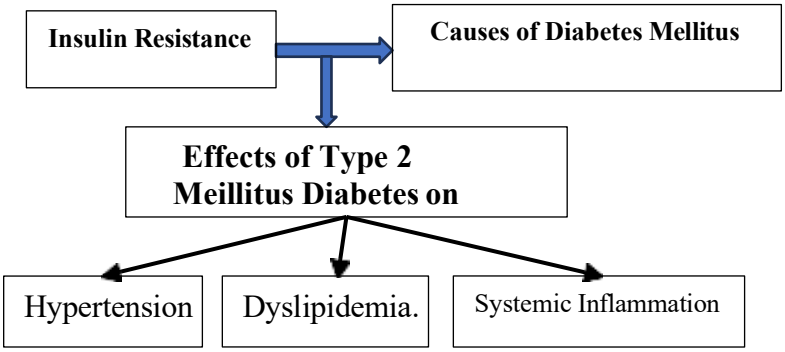

Figure 1. The relationship between insulin resistance and cardiovascular disease

Figure 1. describes the main pathophysiological pathways that explain the relationship between insulin resistance, type 2 diabetes mellitus, and cardiovascular complications. In

the early stages, insulin resistance is shown to be a central factor that triggers metabolic disorders. This condition causes a decrease in the peripheral tissue's response to insulin, so the body needs higher insulin levels to maintain glucose homeostasis. When this compensation fails, it will develop into type 2 diabetes mellitus (Zhao et al., 2023). Furthermore, type 2 diabetes mellitus is depicted as having a direct effect on the cardiovascular system, which is shown by the central box on the diagram. Chronic hyperglycemia and persistent insulin resistance contribute to a wide range of pathophysiological changes, including endothelial dysfunction, oxidative stress, activation of inflammatory pathways, as well as lipid metabolism disorders. These processes play an important role in accelerating atherosclerosis and increasing the risk of cardiovascular disease (Hayden, 2023). From the main box, the diagram shows three main pathways of cardiovascular complications, namely hypertension, dyslipidemia, and systemic inflammation. Hypertension in diabetic patients is associated with increased stiffness of blood vessels and impaired vascular regulation due to endothelial dysfunction. Dyslipidemia is characterized by an increase in triglycerides, a decrease in HDL cholesterol, and an increase in atherogenic LDL particles, all of which accelerate the formation of atherosclerotic plaques. Meanwhile, chronic systemic inflammation reflects the activation of proinflammatory cytokines that exacerbate vascular damage and increase the risk of acute cardiovascular events(Tian et al., 2022). Overall, this image confirms that type 2 diabetes mellitus is not just a glycemic disorder, but is a systemic condition that involves a complex interaction between metabolic and vascular factors. The pathways shown in the diagram support the findings of various studies stating that a combination of insulin resistance, dyslipidemia, hypertension, and systemic inflammation are the main mechanisms underlying the high burden of cardiovascular disease in diabetic patients. Thus, a comprehensive and multifactorial approach to diabetes management is very important to lower the risk of cardiovascular complications. The following explains the correlation between diabetes and hypertension, systemic inflammation and dyslipidemia, as well as their effects on cardiovascular.

1. Correlation between Diabetes and Hypertension and Their Effects on Cardiovascular
   Hypertension is a very common comorbidity among people with diabetes mellitus, which is said to be twice as common in people with diabetes than in non-diabetic individuals. It has also been shown that hypertension in diabetics is associated with an accelerated development of microvascular (retinopathy, nephropathy, and neuropathy) and macrovascular (atherosclerosis) complications. Macrovascular disease is the leading cause of death in patients with type 2 diabetes mellitus (Ahmed et al., 2024). Hypertension and type 2 diabetes are lifestyle-related diseases that are common worldwide. By 2025, the World Health Organization (WHO) World Health Organization, (2025) Treat high blood pressure and hyperglycemia as serious problems and report obesity as a major problem. According to IDF data (International Diabetes Federation) in 2025, Indonesia is still among the five countries with the highest number of diabetics with 19.5 million adult diabetics (20-79 years old) in 2021 and is predicted to remain ranked 5th out of 10 countries in the world with the number of adult diabetics (20-79 years) of 28.6 million in 2045 (Executive Board of the Indonesian Endocrinology Association (PERKENI), 2024). Type 2 diabetes is the leading cause of cardiovascular disease and death, with a 27% higher mortality rate compared to the non-diabetic group. In addition, among the elderly over 80 years old, people with type 2 diabetes have a 4.3 times higher mortality rate compared to people with other diseases such as congestive heart failure (Rosengren, 2023). The occurrence

of hyperglycemia causes damage to the walls of large blood vessels and peripheral blood vessels. Hyperglycemia can also increase blood viscosity which will then cause an increase in blood pressure or hypertension and result in ischemic stroke (Balqis et al., 2022). The main factors of hypertension and type 2 diabetes include age, gender, smoking, exercise, family history, eating habits, body mass index (BMI), and waist circumference. In particular, obesity in terms of BMI (Body Mass Index) is the main cause of this disease; Therefore, with an emphasis on sustainable weight management, research is being actively conducted. However, some studies suggest that type 2 diabetes can occur due to metabolic syndrome even with a normal BMI and waist circumference(Hernandez-Vila, 2015). Adults with type 2 diabetes and poor glycemic control are at higher risk of developing microvascular complications involving the kidneys that are exacerbated by comorbid hypertension. In the U.S. and Puerto Rico, more than 116,000 adults began treatment for end- stage renal disease (ESRD) in 2009, and the two main causes are diabetes and hypertension, with ESRD incidence rates increasing among African-American, Native American, and Hispanic populations. Data from the UK Prospective Diabetes Study (UKPDS) and other adult studies have discussed the impact of intensive treatment of hyperglycemia and hypertension on the development and progression of diabetic nephropathy (Wali et al., 2022). In India, although the overall hypertension rate among patients with T2DM in a study by Tharkar et al., (2010) is 39%, the prevalence in urban areas is 63.2% and the prevalence in rural areas is 36.8%. The prevalence of hypertension among adults of the general population in urban India ranges from 20% to 40% and in rural areas from 12% to 17%. Therefore, the location-based hypertension rates reported by Tharkar et al are consistent with the expectation that hypertension rates are 1.5–3.0 times higher in people with T2DM compared to those without diabetes (Tharkar et al., 2010). Cardiovascular complications are the leading cause of death in diabetic patients. Dyslipidemia and hypertension are major risk factors that contribute to cardiovascular disease (Alam & Aijaz, 2024). Hypertension is a major independent risk factor for coronary artery disease, stroke, heart failure, and kidney failure. One in every 3 American adults or about 67 million adults (31%) suffers from hypertension. A person over the age of 55 has a 90% lifetime risk of developing hypertension. Hypertension accounts for 18% of cardiovascular disease deaths in Western countries [13](Wali et al., 2022).

2. Correlation between Diabetes and Systemic Inflammation and Its Effects on Cardiovascular

   One of the main parameters in monitoring glucose control in people with type 2 diabetes mellitus is HbA1c. This parameter is formed through the process of glycation, which is the attachment of glucose to hemoglobin molecules whose value will increase along with the increase in glucose levels in the last 2-3 months (Seo & Shin, 2021). In addition to hyperglycemia, type 2 diabetes mellitus is also closely related to chronic inflammation of peripheral tissues such as fat, liver, and muscle tissues (Executive Board of the Indonesian Endocrinology Association (PERKENI), 2024). One of the biomarkers of inflammation that often increases is C-Reactive Protein (CRP), which is a protein produced by the liver in response to inflammation in the body, where the level will increase when the body experiences inflammation (Zahrani et al., 2025). Based on research Zahrani et al., (2025) showed that the majority of respondents with diabetes had poor glycemic control, reflected in uncontrolled HbA1c levels. In addition, strong indications of low-degree systemic inflammation were found, which

was indicated by high CRP levels in most patients. The results of the correlation test showed a significant relationship between CRP levels and HbA1c in patients with type 2 diabetes mellitus. The higher the HbA1c level which is reflected in the high HbA1c, the higher the CRP level which indicates an inflammatory process in the body. These findings are in line with the concept that chronic hyperglycemia can trigger oxidative stress, damage to endothelial function, as well as the activation of proinflammatory cytokines, which ultimately increases the production of CRP by the liver (Stanimirovic et al., 2022). Elevated CRP levels in people with type 2 diabetes mellitus are closely related to systemic inflammation triggered by complications due to chronic hyperglycemia. The hyperglycemia condition causes mitochondrial dysfunction and increased production of Reactive Oxygen Species (ROS), which triggers oxidative stress as well as damage to blood vessels. In addition, the activation of biochemical pathways such as the aldose reductase pathway, the formation of Advanced Glycation End-products (AGEs), and protein kinase C (PKC) activation products also promote the expression of proinflammatory genes through NF-κB activation. Activation of NF-κB then increases levels of inflammatory cytokines such as IL-6 and TNF-α, which further stimulates the liver to produce higher amounts of CRP in response to ongoing systemic inflammation (Chandra & Fatoni, 2021).

3. Correlation between Diabetes and Insulin Resistance and Its Effects on Cardiovascular Dyslipidemia is a metabolic disorder in fat in which there is an increase or decrease in fat in blood plasma. Fractional abnormalities that occur in fats are such as an increase in total cholesterol levels, LDL (Low Density Lipoprotein), triglycerides, and a decrease in HDL (High Density Lipoprotein) cholesterol To diagnose dyslipidemia, it can be done by conducting a laboratory examination (Raid, 2019). In general, dyslipidemia is divided into two, namely primary dyslipidemia, which is the incidence due to genetic disorders Secondary dyslipidemia is interpreted as the result of another disease. (Putri, 2021). In 2017, according to the WHO, there was a global prevalence of increased total cholesterol in adults which was around 39% (37% for men and 40% for women). Based on Riskesdas, (2018) 31% of the population aged ≥15 years experienced total cholesterol abnormalities, the NF-kB cytokines that occurred induced an acute phase called low-degree inflammation which became part of the activity of the innate immune system related to the pathogenesis of type 2 DM then complications occurred, namely dyslipidemia, and atherosclerosis. Proinflammatory cytokines that act as stress inducers in the endoplasm that can increase insulin metabolism and in type 2 diabetes which are characterized by decreased insulin production and resistance (Fink et al., 2019). Diabetic dyslipidemia can result in disruption of the hormone insulin in the pancreas which plays an important role for the metabolism of carbohydrates, lipids, and proteins, disorders that occur in insulin will result in metabolic consequences, namely an imbalance in blood sugar levels and lipid levels in the body (Parim et al., 2019). The occurrence of diabetes dyslipidemia is characterized by several of them, namely trigeliseride, decreased HDL levels and increased LDL cholesterol or slightly normal(Silva et al., 2022). There is a formulation of the problem, namely whether there is an NF-kB relationship in diabetic dyslipidemia and the purpose of this study is to identify and analyze.

CONCLUSION

Based on the results of *the literature review* that has been analyzed, it can be concluded that diabetes mellitus, especially type 2 diabetes mellitus, has a very close and complex

relationship with cardiovascular disease. Diabetes plays a major risk factor for cardiovascular disease through various pathophysiological mechanisms, including insulin resistance, dyslipidemia, hypertension, and chronic systemic inflammation. The combination of these factors accelerates the process of atherosclerosis which is the main cause of cardiovascular events such as coronary heart disease, heart failure, and ischemic stroke. Findings from various studies show that the risk of cardiovascular disease in people with diabetes increases significantly, even in individuals with a normal body mass index. This confirms that diabetes itself is an independent determinant of the occurrence of cardiovascular disorders. In addition, low-grade systemic inflammation characterized by increased levels of inflammatory biomarkers such as C-Reactive Protein (CRP) has been shown to correlate with poor glycemic control and contribute to endothelial dysfunction and vascular damage. The literature also confirms that diabetes management approaches that focus only on glycemic control are not enough to optimally lower cardiovascular risk. Multifactorial management strategies that include blood pressure, lipid profile, weight, and lifestyle modification have been shown to be more effective in lowering cardiovascular events. In addition, the use of modern antidiabetic drugs such as SGLT-2 inhibitors and GLP-1 receptor agonists shows significant cardioprotective benefits, although their utilization in clinical practice is still not optimal. Thus, a comprehensive, sustainable, and multidisciplinary collaboration-based approach is needed in the management of diabetic patients to prevent cardiovascular complications. The role of health workers, especially nurses, as well as the active involvement of patients and families is critical in improving therapy adherence and quality of life for diabetic patients. The results of *this literature review* are expected to be the basis for the development of more effective prevention and intervention strategies in reducing the burden of cardiovascular disease in patients with diabetes mellitus.

REFERENCES

Ahmed, A., Hezam, M., Basheer, H., Shaghdar, M., & Chen, L. (2024). The connection between hypertension and diabetes and their role in heart and kidney disease development. *Journal of Research in Medical Sciences*, *29*(22), 1–8. https://doi.org/10.4103/jrms.jrms

Alam, S., & Aijaz, M. (2024). Complications of Cardiovascular Disease: The Impact of Diabetes, Dyslipidemia, and Metabolic Disorders. *World Journal of Pharmaceutical Research*, *13*(21), 321–356. https://doi.org/10.20959/wjpr202421-34375

An, Y., Xu, B., Wan, S., Ma, X., Long, Y., Xu, Y., & Jiang, Z. (2023). The role of oxidative stress in diabetes mellitus-induced vascular endothelial dysfunction. *Cardiovascular Diabetology*, *22*(237), 1–17. https://www.cureus.com/articles/179078-exploring-the-complex-connection-between-diabetes-and- cardiovascular-disease-analyzing-approaches-to-mitigate-cardiovascular-risk-in-patients-with- diabetes.pdf

Balqis, B., Sumardiyono, & Handayani, S. (2022). The Relationship Between Hypertension Prevalence and DM Prevalence and Stroke Prevalence in Indonesia (Riskesdas Data Analysis and Health Profile 2018). *Journal of Public Health*, *10*(3), 379–384. https://doi.org/10.14710/jkm.v10i3.33243

Brown, O. I., Drozd, M., Mcgowan, H., Giannoudi, M., Conning- rowland, M., Gierula, J., Straw, S., Wheatcroft, S. B., Bridge, K., Roberts, L. D., Levelt, E., Ajjan, R., Griffin, K. J., Bailey, M. A., Kearney,

M. T., & Cubbon, R. M. (2023). Relationship Between Diabetes , Obesity , and Cardiovascular Disease Phenotypes : A UK Biobank Cohort Study. *Diabetes Care: American Diabetes Association*, *46*(8), 1531–1540. https://doi.org/https://doi.org/10.2337/dc23-0294

Chandra, H. K., & Fatoni, A. Z. (2021). The Role of C-Reactive Protein (CRP) in Sepsis Patients in the Intensive Care Unit (ICU). *Journal of Anaesthesia and Pain*, *2*(1), 1–10. https://doi.org/https://doi.org/10.21776/ub.jap.2021.002.01.01

Fink, A., Fach, E., & Schröder, S. L. (2019). ' Learning to shape life ' – a qualitative study on the challenges posed by a diagnosis of diabetes mellitus type 2. *International Journal for Equity in Health*, *18*(19), 1–11. https://doi.org/https://doi.org/10.1186/s12939-019-0924-3

Hayden, M. R. (2023). Overview and New Insights into the Metabolic Syndrome : Risk Factors and Emerging Variables in the Development of Type 2 Diabetes and Cerebrocardiovascular Disease. *Medicine*, *59*(3), 1–46. https://doi.org/https://www.mdpi.com/1648-9144/59/3/561

Hernandez-Vila, E. (2015). A Review of the JNC 8 Blood Pressure Guideline. *Cardiovascular Disease in Women*, *42*(3), 226–228. https://doi.org/http://dx.doi.org/10.14503/THIJ-15-5067

International Diabetes Federation. (2025). *IDF Diabetes Atlas 2025* (11th ed.). International Diabetes Federation. https://diabetesatlas.org/resources/idf-diabetes-atlas-2025/

Jyotsna, F. N. U., Ahmed, A., Kumar, K., Kaur, P., & Chaudhary, M. H. (2023). Exploring the Complex Connection Between Diabetes and Cardiovascular Disease : Analyzing Approaches to Mitigate Cardiovascular Risk in Patients With Diabetes. *Cureus*, *15*(8). https://doi.org/10.7759/cureus.43882

Lim, J., Choi, Y. J., Kim, B. S., Rhee, T. M., Lee, H. J., & Han, K. Do. (2023). Comparative cardiovascular outcomes in type 2 diabetes patients taking dapagliflozin versus empagliflozin : a nationwide population
- based cohort study. *Cardiovascular Diabetology*, *22*(188), 1–10. https://doi.org/10.1186/s12933-023- 01911-7

Maida, C. D., Daidone, M., Pacinella, G., Norrito, R. L., Pinto, A., & Tuttolomondo, A. (2022). Diabetes and Ischemic Stroke : An Old and New Relationship an Overview of the Close Interaction between These Diseases. *International Journal of Molecular Sciences*, *23*(2397), 1–28. https://doi.org/https://doi.org/10.3390/ijms23042397

Nair, R., Mody, R., Yu, M., Cowburn, S., Konig, M., & Prewitt, T. (2022). Real-World Treatment Patterns of Glucose-Lowering Agents Among Patients with Type 2 Diabetes Mellitus and Cardiovascular Disease or At Risk for Cardiovascular Disease : An Observational , Cross- Sectional , Retrospective Study. *Diabetes Therapy*, *13*(11), 1921–1932. https://doi.org/10.1007/s13300-022-01320-1

Parim, B., Sathibabu Uddandrao, V. V., & Saravanan, G. (2019). Diabetic cardiomyopathy: molecular mechanisms, detrimental effects of conventional treatment, and beneficial effects of natural therapy. *Heart Failure Reviews*, *24*(2), 279–299. https://doi.org/10.1007/s10741-018-9749-1

Executive Board of the Indonesian Endocrinology Association (PERKENI). (2024). Guidelines for the Management and Prevention of Type 2 Diabetes Mellitus in Indonesia in 2024. In PB Perkeni (Ed.), *Pb Perkeni*. https://pbperkeni.or.id/wp-content/uploads/2025/08/DMT2-2024-Protected.pdf

Riskesdas. (2018). Riskesdas Report 2018 Ministry of Health of the Republic of Indonesia. In *National Report of Riskesdas 2018* (Vol. 53, Issue 9, pp. 154–165). http://www.yankes.kemkes.go.id/assets/downloads/PMK No. 57 of 2013 concerning PTRM.pdf

Rosengren, A. (2023). Cardiovascular outcomes in type 1 and type 2 diabetes. *Diabetology*, *66*, 425–437. Samuel, V. T., & Shulman, G. I. (2019). Non-Alcoholic Fatty Liver Disease as a Nexus of Metabolic and Hepatic Diseases. *Cell Metabolism*, *27*(1), 22–41. https://doi.org/10.1016/j.cmet.2017.08.002.Non- Alcoholic

Seo, Y., & Shin, H. (2021). Relationship between hs-CRP and HbA1c in Diabetes Mellitus Patients : 2015- 2017 Korean National Health and Nutrition Examination Survey. *Chonnam Medical Journal*, *57*(1), 62–67. https://doi.org/https://doi.org/10.4068/cmj.2021.57.1.62

Silva, M. L., Bernardo, M. A., Singh, J., & Mesquita, M. F. De. (2022). Cinnamon as a Complementary Therapeutic Approach for Dysglycemia and Dyslipidemia Control in Type 2 Diabetes Mellitus and Its Molecular Mechanism of Action : A Review. *Nutrients*, *14*(2773). https://doi.org/https://doi.org/10.3390/nu14132773

Stanimirovic, J., Radovanovic, J., Banjac, K., Obradovic, M., Essack, M., Zafirovic, S., Gluvic, Z., Gojobori, T., & Isenovic, E. R. (2022). Review Article Role of C-Reactive Protein in Diabetic Inflammation. *Mediators of Inflammation*, *2022*. https://doi.org/10.1155/2022/3706508

Tang, S., An, X., Sun, W., Jiang, L., Zhao, X., Gao, Q., & Ji, H. (2024). Parallelism and non-parallelism in diabetic nephropathy and diabetic retinopathy. *Frontiers in Endocrinology*, *15*(2024), 1–16. https://doi.org/10.3389/fendo.2024.1336123

Tharkar, S., Devarajan, A., Kumpatla, S., & Viswanathan, V. (2010). The socioeconomics of diabetes from a developing country: A population based cost of illness study. *Diabetes Research and Clinical Practice*, *89*(3), 334–340. https://doi.org/10.1016/j.diabres.2010.05.009

Tian, X., Zuo, Y., Chen, S., Zhang, Y., Zhang, X., Xu, Q., Wu, S., & Wang, A. (2022). Hypertension, Arterial Stiffness, and Diabetes: a Prospective Cohort Study. *Hypertension*, *79*(7), 1499–1508. https://doi.org/10.1161/HYPERTENSIONAHA.122.19256

Wali, M., Ahmad, H., & Daud, M. (2022). Prevalence of hypertension in Type-2 diabetes mellitus. *Annals of Medicine and Surgery*, *78*(May), 103758. https://doi.org/10.1016/j.amsu.2022.103758

World Health Organization. (2025). *Global report on hypertension 2025*. World Health Organization. https://journals.lww.com/jrms/fulltext/2024/04290/the_connection_between_hypertension_and_diabete s.4.aspx?context=latestarticles

Zahrani, A. H., Abror, Y. K., & Marliana, N. (2025). Correlation of C-Reactive Protein (CRP) Levels with Hemoglobin A1c (Hba1c) Levels in Patients with Type 2 Diabetes Mellitus. *Journal of Synthesis of Applied Science Research and Its Analysis*, *6*(2), 215–223. https://doi.org/https://doi.org/10.56399/jst.v6i2.314

Zhang, Y., Liu, C., Xu, Y., Wang, Y., & Dai, F. (2023). The management correlation between metabolic index , cardiovascular health , and diabetes combined with

cardiovascular disease. *Frontiers in Endocrinology*, *13*(2022), 1–17. https://doi.org/10.3389/fendo.2022.1036146

Zhao, X., An, X., Yang, C., & Sun, W. (2023). The crucial role and mechanism of insulin resistance in metabolic disease. *Frontiers in Endocrinology*, *28*(425), 1–24. https://doi.org/10.3389/fendo.2023.1149239