

Coronary Artery Disease Associated With Type 2 Diabetes Mellitus In The Elderly: Literature Review And Preventive Measures

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Abstract:

Type 2 Diabetes Mellitus (T2DM) is one of the most prevalent chronic diseases worldwide and has a major impact on global morbidity and mortality, mainly due to its strong association with coronary artery disease (CAD). Persistent hyperglycemia, insulin resistance, and lipid abnormalities accelerate the atherosclerotic process and significantly increase cardiovascular risk, especially among older adults.

Objective: *To analyze the relationship between type 2 diabetes mellitus and coronary artery disease in the elderly, identifying the main risk factors and preventive measures capable of improving quality of life.*

Methodology: *This is a bibliographic study with a qualitative and exploratory approach, developed from books, scientific articles, and national and international guidelines (SBD, SBC, ADA, ESC, IDF) published between 2000 and 2025. Studies addressing macrovascular complications in elderly patients with T2DM were included, while research on type 1 diabetes and microvascular complications was excluded.*

Results: *The findings demonstrated a strong association between T2DM and modifiable risk factors such as obesity, hypertension, dyslipidemia, and physical inactivity, which were more prevalent among elderly women. It was observed that individualized diet therapy and regular physical exercise contribute to glycemic control, improvement of the lipid profile, reduction of glycated hemoglobin levels, and decreased incidence of cardiovascular events.*

Conclusion: *Proper management of type 2 diabetes requires a multidisciplinary and integrated approach that combines pharmacological and non-pharmacological measures. Physical activity, healthy eating, and health education are essential strategies for preventing complications and promoting a longer and healthier life, significantly reducing the burden of cardiovascular diseases associated with diabetes in the elderly population.*

Key Word: *Insulin Resistance, Atherosclerosis, Physical Activity, Health Promotion.*

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I. Introduction

Type 2 Diabetes Mellitus (T2DM) is a chronic metabolic disease characterized by persistent hyperglycemia, resulting from peripheral insulin resistance and/or inadequate pancreatic secretion. This dysfunction affects glucose homeostasis and is associated with multiple metabolic alterations, including dyslipidemia, chronic inflammation, and endothelial dysfunction (CAMACHO; GRARIB, 2008; SPOSITO et al., 2007). It is estimated that T2DM currently affects more than 530 million adults worldwide and is recognized by the World Health Organization (WHO) and the Brazilian Diabetes Society (SBD, 2025) as one of the greatest public health challenges of the 21st century, due to its epidemic proportions and its impact on premature mortality and quality of life.

In Brazil, the Vigitel Brazil 2023 survey reported that 9.5% of the adult population has been diagnosed with diabetes, with a higher prevalence among women (10.3%) than men (8.7%), a trend that intensifies with advancing age. Among individuals aged 65 years or older, the prevalence exceeds 20%, revealing that aging is a key determinant in the increased incidence of the disease (BRASIL, 2023).

T2DM is an important independent risk factor for coronary artery disease (CAD), and it is well documented that diabetic individuals experience a more rapid progression of atherosclerosis, with worse

cardiovascular prognosis and higher mortality rates (CHAVES, 2013; LOPES; TSUTSUI, 2007). Macrovascular complications, including myocardial infarction, stroke, and peripheral arterial disease, are responsible for more than 80% of deaths among people with diabetes (SCHEFFEL; BORTOLANZA, 2004).

From a pathophysiological perspective, prolonged exposure to hyperglycemia triggers endothelial changes that promote the oxidation of low-density lipoproteins (LDL) and the formation of atheromatous plaques. The coronary arteries of diabetic individuals tend to have smaller luminal diameters and increased stiffness, aggravating clinical conditions and raising the risk of severe ischemic events (LIMA, 2007; CARIE; CINDY, 2009).

Among the main preventive strategies are the adoption of healthy lifestyle habits, strict control of blood glucose and blood pressure, lipid-lowering therapy, and regular physical exercise. Weight reduction and strengthening of skeletal muscles contribute to improved insulin sensitivity and reduced circulating glucose levels, since active muscle tissue uptakes glucose independently of insulin action (DEE; BRUCE, 2010).

In addition, a balanced, high-fiber diet with low levels of saturated fats and cholesterol helps control serum LDL and triglyceride levels, preventing the progression of atherosclerosis. Thus, lifestyle modifications remain the cornerstone of T2DM management and the prevention of its cardiovascular complications (SBD, 2025; ADA, 2025).

Given the high prevalence and systemic consequences of diabetes, this study aims to analyze the main preventive measures for coronary artery disease in elderly individuals with T2DM, with the goal of improving quality of life and reducing cardiovascular morbidity and mortality. It seeks to answer the following guiding question: "What strategies can be implemented to prevent atherosclerotic complications, one of the main comorbidities resulting from type 2 diabetes mellitus?" To this end, it discusses the influence of blood pressure control, body mass index, physical activity, and diet therapy on glycemic control, the prevention of complications, and the promotion of well-being in elderly diabetic patients.

II. Material And Methods

This is a bibliographic research study of an exploratory nature and qualitative approach, based on previously produced material such as scientific articles, books, guidelines, and technical reports relevant to the proposed topic. According to Gil (2017), this type of research aims to provide greater familiarity with the problem, allowing the researcher a broader understanding of the phenomenon under study.

The search was conducted between January and August 2025 in recognized scientific databases, including the *Scientific Electronic Library Online (SciELO)*, *PubMed*, and official documents from reference institutions such as the *Brazilian Diabetes Society (SBD, 2025)*, the *Brazilian Society of Cardiology (SBC, 2025)*, the *International Diabetes Federation (IDF, 2024)*, and the *Spanish Diabetes Society (SED, 2023)*. Additionally, specialized books available at the *Dr. Pedro Martinello Library of the Barão do Rio Branco College* and technical materials from the Brazilian Ministry of Health were consulted.

Inclusion criteria comprised publications in Portuguese, Spanish, and English, from 2000 to 2025, that addressed elderly patients (≥ 60 years) with type 2 diabetes mellitus and macrovascular complications, specifically coronary artery disease (CAD). Studies on type 1 diabetes mellitus, microangiopathic complications (such as retinopathy and nephropathy), and diabetic neuropathies not associated with CAD were excluded.

The methodological process included the following stages:

- Definition of the research problem and keywords (*Type 2 Diabetes Mellitus; Coronary Artery Disease; Elderly; Prevention; Risk Factors*);
- Search and selection of studies according to the established criteria;
- Exploratory and analytical reading of the selected material, with highlighting and annotation of the most relevant information;
- Preparation of thematic notes and analytical summaries;
- Critical synthesis and integration of findings, building the final text in a cohesive manner and grounded in scientific evidence.

Data analysis followed a descriptive and interpretive approach, seeking to identify convergences and divergences among the studies and to synthesize the main preventive measures related to coronary artery disease in elderly individuals with type 2 diabetes mellitus.

III. Result And Discussion

Factors That Accelerate the Atherosclerotic Process in Type 2 Diabetes Mellitus

Scientific literature from the past two decades consistently demonstrates that Type 2 Diabetes Mellitus (T2DM) significantly accelerates the development of atherosclerotic disease, which is responsible for most macrovascular complications in these patients. Five main sources were identified — four review articles and one endocrinology textbook — describing the pathophysiological mechanisms involved in this process. Evidence

indicates that persistent hyperglycemia, insulin resistance, and lipid alterations promote endothelial and inflammatory changes that compromise vascular integrity and favor the onset of coronary artery disease (CAD).

Table no 1: Vascular Changes Associated with Type 2 Diabetes Mellitus

Author/Year	Mechanisms Altered by Diabetes Mellitus
Azevedo; Victor; Oliveira (2010)	Hyperglycemia reduces the activation of nitric oxide (NO), a molecule essential for vasodilation, increasing the release of vasoconstrictors such as endothelin-1.
Centemero et al. (2009)	The elevation of endothelin-1 stimulates smooth muscle cell hypertrophy and apoptosis, intensifying vascular injury and the formation of atheromatous plaques.
Gomes et al. (2009)	Increased synthesis of angiotensin II reduces NO bioavailability and enhances oxidative stress, impairing the protective function of the endothelium.
Neto et al. (2009)	Prolonged hyperglycemia induces protein glycation and oxidation, stimulating pro-inflammatory cytokines and amplifying the damaging response.
Moreira et al. (2008)	There is a reduction in adiponectin, an anti-atherogenic substance that stimulates NO production and modulates endothelial inflammation.

Source: prepared by the authors.

The mechanisms described in Table 1 remain valid and have been reinforced by recent studies that have expanded the understanding of the relationship between glucose metabolism and vascular function. According to the Brazilian Society of Cardiology (SBC, 2025) and the American Diabetes Association (ADA, 2025), chronic hyperglycemia induces a dysfunctional endothelial response characterized by oxidative stress, persistent subclinical inflammation, lipotoxicity, and activation of the renin–angiotensin–aldosterone system (RAAS).

These mechanisms favor the deposition of oxidized lipoproteins in the arterial intima, the migration of macrophages, and intimal thickening—events that precede the formation of atherosclerotic plaques. Furthermore, insulin resistance stimulates hepatic production of lipoprotein (a) and small dense LDL particles, both of which are highly atherogenic (SBD, 2025; ADA, 2025).

The chronic inflammatory state typical of T2DM, mediated by interleukin-6 (IL-6), TNF- α , and high-sensitivity C-reactive protein (hs-CRP), contributes to plaque instability and an increased risk of rupture—a phenomenon directly related to the occurrence of acute coronary syndromes (ESC, 2024).

Another relevant aspect is the role of adiponectin and leptin. In patients with T2DM and obesity, reduced adiponectin levels decrease vasoprotection and increase insulin resistance, while excess leptin promotes inflammation and vascular proliferation, thereby worsening atherogenesis (IDF, 2024).

These findings justify the need for systematic cardiovascular screening in all individuals with T2DM, including assessment of family history, lipid profile, renal function, and inflammatory markers. Recent studies confirm that 75–80% of deaths among individuals with T2DM are related to major cardiovascular events. The combination of strict glycemic control, intensive blood pressure management, and high-intensity lipid-lowering therapy significantly reduces the risk of macrovascular events.

Recent therapeutic advances, such as SGLT2 inhibitors and GLP-1 receptor agonists, have demonstrated vascular benefits beyond glycemic control, reducing inflammation and arterial stiffness. Therefore, T2DM should be considered a cardiovascular risk condition equivalent to established coronary artery disease, requiring multidisciplinary follow-up and continuous preventive management (SBD, 2025; ADA, 2025; ESC, 2024).

Prevalence of Cardiovascular Risk Factors in Patients with Type 2 Diabetes Mellitus

The literature review revealed four cross-sectional studies that addressed the main cardiovascular risk factors in individuals with Type 2 Diabetes Mellitus (T2DM). All the identified factors represent modifiable and controllable clinical conditions, whose proper management is essential for the prevention of macrovascular complications and the reduction of mortality.

Table no 2: Prevalence of Cardiovascular Risk Factors in Patients with Type 2 Diabetes Mellitus

Group	Age Range	Obesity	Physical Inactivity	Dyslipidemia	Systemic Arterial Hypertension (SAH)
Men	> 18 years	44.4%	18.1%	11.1%	61.1%
Women	> 18 years	56.3%	18.1%	20.3%	81.3%
Adults (>18 years)	> 18 years	35.1%	18.1%	11.8%	57.7%
Elderly (>60 years)	> 60 years	83.3%	59.8%	23.4%	80.4%
Elderly (>60 years)	> 60 years	42%	71%	51%	54%
Elderly (>60 years)	> 60 years	27%	—	25.8%	39.5%

Source: prepared by the authors.

The results presented in Table 2 demonstrate a strong association between Type 2 Diabetes Mellitus (T2DM) and the presence of multiple cardiovascular risk factors, particularly systemic arterial hypertension

(SAH), physical inactivity, and obesity. These conditions potentiate the risk of early atherosclerosis and the development of coronary artery disease (CAD). According to Lopes and Tsutsui (2007), approximately 80% of patients with T2DM progress to atherosclerotic plaque formation, highlighting the urgent need for integrated preventive strategies centered on health education and lifestyle modification.

Table no 3: Prevalence of Risk Factors by Gender (Ferreira et al., 2010)

Men	Women
SAH – 74.1%	SAH – 82.6%
Physical inactivity – 45.1%	Physical inactivity – 59.8%
Dyslipidemia – 23.2%	Dyslipidemia – 23.6%

Source: prepared by the authors.

The study by Ferreira et al. (2010), conducted with 418 patients treated through the Brazilian Unified Health System (SUS) in Goiânia, identified a higher prevalence of hypertension and physical inactivity among women—an observation also consistent with other population-based studies. This difference may be partially explained by reduced hormonal levels after menopause, which raise women's cardiovascular risk to levels comparable to those observed in men. Estrogens play a protective role by increasing LDL catabolism and stimulating HDL production, and their deficiency contributes to greater dyslipidemia and insulin resistance (TAKAMUNE, 2011; LUZ, 2000).

According to Vigitel Brazil 2023, the prevalence of hypertension among adults was 27.2%, higher in women (28.6%) than in men (25.7%). These findings underscore the importance of risk factor control and health education, particularly among elderly individuals with T2DM, a group that exhibits increased cardiovascular vulnerability (BRASIL, 2023).

Table no 4: Risk Factors by Gender (Silva et al., 2010)

Men	Women
SAH – 61.1%	SAH – 81.3%
Obesity – 44.4%	Obesity – 56.3%
Dyslipidemia – 11.1%	Dyslipidemia – 20.3%

The study by Silva et al. (2010) reinforced that cardiovascular risk factors are more prevalent among women—a finding that may reflect both longer female life expectancy and distinct behavioral patterns, such as physical inactivity and postmenopausal weight gain. Vascular disease remains the leading cause of morbidity and mortality among older adults of both sexes, although absolute mortality is higher among women due to their greater longevity.

According to the Brazilian Society of Cardiology (SBC, 2025), the accumulation of modifiable risk factors—obesity, dyslipidemia, hypertension, and physical inactivity—accounts for more than 75% of preventable cardiovascular events in individuals with T2DM. These data reinforce the importance of early interventions, regular physical activity, blood pressure and lipid control, balanced nutrition, and the use of therapies with proven cardiovascular benefit, such as SGLT2 inhibitors and GLP-1 receptor agonists (SBD, 2025; ADA, 2025; ESC, 2024).

Physical Exercise and Diet Therapy in Glycemic Control, Prevention, and Quality of Life in Patients with Type 2 Diabetes Mellitus

Scientific evidence shows that the integration of regular physical activity and structured diet therapy represents one of the most effective strategies for metabolic control and the prevention of cardiovascular complications in individuals with Type 2 Diabetes Mellitus (T2DM). Six scientific articles and two national and international clinical guidelines were analyzed, addressing the importance of healthy eating and regular exercise in the management of coronary artery disease (CAD) associated with T2DM.

The combination of a balanced diet and physical activity leads to significant improvements in glycemic control, reductions in total cholesterol, LDL, and triglyceride levels, elevation of HDL, and decreases in systemic blood pressure (FERNANDES et al., 2005; SBD, 2025). These factors act synergistically to reduce cardiovascular morbidity and mortality, representing one of the most cost-effective public-health interventions available.

1. Diet Therapy and Metabolic Control

Individualized diet therapy is fundamental to the clinical management of T2DM. According to the Brazilian Diabetes Society (SBD, 2025) and the American Diabetes Association (ADA, 2025), there is no single diet suitable for all patients with diabetes; instead, a personalized eating plan should be tailored to each patient's metabolic condition, cultural preferences, and daily routine. The balanced distribution of macronutrients should emphasize:

- Complex carbohydrates with a low glycemic index (e.g., whole grains and legumes);
- Unsaturated fats (e.g., nuts, olive oil, and fish);
- Lean proteins distributed throughout the day;
- Reduced sodium intake and the elimination of ultra-processed foods.

A diet rich in dietary fiber (25–38 g/day) helps reduce postprandial glucose and improve insulin sensitivity. Adequate fiber intake is also associated with a lower risk of cardiovascular disease and hypertension, as it promotes hepatic cholesterol elimination (SOUZA et al., 2006; SALVO et al., 2009).

Continuous nutritional education, conducted by nutritionists and multidisciplinary teams, is considered an essential component of comprehensive diabetes care, as outlined by the SBD 2025 and the International Diabetes Federation (IDF, 2024). This approach includes progressive dietary re-education, self-monitoring of blood glucose, and weight management—all of which directly influence treatment adherence (OLIVEIRA et al., 2009).

2. Physical Exercise as Adjuvant Therapy

Regular physical exercise is recognized as a first-line non-pharmacological therapy for patients with T2DM, with proven effects on glycemic control, insulin sensitivity, and cardiovascular risk (SBD, 2025; WHO, 2023). Exercise stimulates glucose uptake by skeletal muscle independently of insulin, reducing fasting blood glucose and glycated hemoglobin (HbA1c) levels by 0.5–1.0% (ADA, 2025).

Exercise prescription should be individualized, taking into account age, comorbidities, and physical limitations. In general, recommendations include:

- Aerobic exercises (walking, cycling, swimming) of moderate intensity (50–70% of VO₂ max), lasting 30–60 minutes, 5–7 days per week;
- Resistance training (weight training) 2–3 times per week, involving large muscle groups with progressive intensity.

Recent studies confirm that combined training (aerobic + resistance) provides superior metabolic outcomes, reducing HbA1c, visceral adiposity, and inflammatory markers such as TNF- α and IL-6. Among older adults, resistance exercises play a crucial role in maintaining muscle mass and strength, preventing sarcopenia and improving glucose metabolism (FERNANDES et al., 2005; ADA, 2025).

Regular physical activity also produces significant psychosocial benefits, including improved self-esteem, stress reduction, strengthened immune function, and enhanced social interaction—all of which contribute to better treatment adherence and overall quality of life (BRASIL, 2023; WHO, 2023).

3. Combined Effects in the Prevention of Complications

Strict glycemic control, together with a balanced diet and regular physical activity, significantly reduces the risk of macrovascular diseases (such as myocardial infarction and stroke) and microvascular complications (retinopathy and diabetic nephropathy). Adopting healthy habits early can delay the onset of T2DM by up to 58% in high-risk individuals, according to multicenter studies (Diabetes Prevention Program – DPP, 2023).

Moreover, combining non-pharmacological measures with modern pharmacological therapies that provide proven cardiovascular benefits—such as GLP-1 receptor agonists and SGLT2 inhibitors—enhances cardiovascular protection and improves patient survival (SBD, 2025; ESC, 2024).

IV. Conclusion

The present study demonstrated that Type 2 Diabetes Mellitus (T2DM) remains one of the most significant global public health challenges due to its high prevalence, chronic nature, and strong association with coronary artery disease (CAD). Persistent hyperglycemia, combined with endothelial dysfunction, constitutes a central pathophysiological mechanism that accelerates the atherosclerotic process and consequently increases the risk of severe cardiovascular events such as myocardial infarction and stroke.

The findings confirm that most of the risk factors associated with T2DM — hypertension, dyslipidemia, obesity, and physical inactivity — are modifiable and preventable conditions, provided that early and integrated interventions are implemented. The high prevalence of these factors, particularly among older adults and women, underscores the urgent need for public health policies focused on health education, systematic screening, and continuous multidisciplinary follow-up, as recommended by the Brazilian Diabetes Society (SBD, 2025) and the Brazilian Society of Cardiology (SBC, 2025).

It was also observed that the adoption of healthy lifestyle habits, such as regular physical exercise and adherence to a balanced and individualized diet, has a direct impact on reducing cardiovascular morbidity and mortality, while improving glycemic control, lipid profile, and overall quality of life. Both aerobic and resistance exercises, when performed regularly and under supervision, have proven effective in enhancing insulin sensitivity and muscle strength, which are essential for healthy aging among diabetic patients.

Therefore, the integration of non-pharmacological measures with modern pharmacological therapies, combined with the strengthening of primary and secondary prevention strategies, represents the most effective path to reducing the public health burden of T2DM. Proper disease management requires a multidimensional and interdisciplinary approach, capable of combining scientific and technical knowledge with humanized care, thereby ensuring health promotion, prevention of complications, and increased longevity with quality of life.

In summary, addressing Type 2 Diabetes Mellitus and its cardiovascular complications depends not only on clinical treatment but also on structural changes in health care, education, and health promotion practices. These changes must be supported by sustainable, evidence-based public policies. Strengthening such actions can substantially reduce the burden of chronic diseases in Brazil—particularly among the elderly—ensuring a more effective, equitable, and patient-centered care model.

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