# THE EFFECT OF DIABETES ON THE CARDIOVASCULAR SYSTEM

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**Abstract:** This article studies the impact of type 2 diabetes mellitus (T2DM) on the cardiovascular system. The study analyzed the incidence of ischemic heart disease, hypertension, atherosclerosis, and stroke among diabetic patients. It also identified the mechanisms by which diabetes affects the activity of the heart muscle and the function of the circulatory system. The article also provides recommendations for early detection and prevention of cardiovascular complications based on statistical data.

**Keywords:** Diabetes, ischemic heart disease, hypertension, atherosclerosis, microangiopathy, cardiomyopathy, glycemic control, diabetic complications.

**Introduction:** Diabetes is a metabolic disease characterized by impaired glucose metabolism in the body. It is caused by impaired insulin secretion or action. In recent years, the incidence of diabetes, especially type 2 diabetes, has been increasing rapidly globally. According to the World Health Organization (WHO) in 2023, 1 in 10 adults (537 million people) suffer from this disease, more than 90% of whom have type 2 diabetes. While diabetes is a serious disease in itself, it is accompanied by complications that cause serious damage to various systems and organs, in particular the cardiovascular system. Cardiovascular diseases are one of the leading causes of death among patients with diabetes - more than 65% of patients with diabetes die from heart disease or stroke. The medical literature indicates that T2DM increases the risk of heart disease by 2–4 times (American Heart Association, 2021). The hyperglycemia, dyslipidemia, arterial hypertension, insulin resistance, and chronic inflammation observed in diabetes directly or indirectly damage the heart and blood vessels. This leads to serious diseases such as atherosclerosis, ischemic heart disease (IHD), heart failure, myocardial infarction, peripheral arterial disease, and stroke. Also, structural and functional changes in the heart muscle occur through pathophysiological mechanisms such as endothelial dysfunction, oxidative stress, and accumulation of glycated products. These conditions are described by the term "diabetic cardiomyopathy".

This article will provide an in-depth study of the frequency of cardiovascular complications among patients with T2DM, their clinical and instrumental signs, main risk factors, and statistical correlations. The goal is to develop effective strategies for early detection and prevention of cardiovascular diseases.

**Methodology:**Study design This study is a retrospective cross-sectional study aimed at determining the impact of diabetes on the cardiovascular system. The study

was conducted at the Tashkent Medical Academy Hospital and the Tashkent City Cardiology Center from September 2022 to December 2023.

Study participants

Selection criteria:

• Patients aged 40 to 70 years;

• Have had type 2 diabetes for at least 5 years;

• Have clinical complaints related to the cardiovascular system;

• No diabetic nephropathy or retinopathy (so that the analysis is focused specifically on the heart).

Control group:

• 100 healthy individuals (no diabetes or heart problems);

• Age and gender matched.

A total of 350 diabetic patients and 100 healthy controls participated.

Data collection procedure

1. Questionnaire and clinical interview:

Duration of diabetes, medication regimen;

Heart-related symptoms (shortness of breath, pain, swelling, weakness).Laborator tekshiruvlar:

HbA1c — a general indicator of glucose over the last 3 months;

Lipid profile: total cholesterol, LDL, HDL, triglycerides;

CRP and fibrinogen — for the level of inflammation;

Creatinine and GFR — kidney function control (as a potential damage factor).Instrumental tekshiruvlar:

Electrocardiography (ECG): to detect heart rhythm, signs of ischemia;

Ultrasound of the heart (ECHO): to assess heart muscle function, ejection fraction;

Doppler ultrasound: to detect atherosclerotic plaques in the carotid and femoral arteries.Statistik ishlov berish:

Analysis was performed using SPSS 25.0 software;

Descriptive statistics: mean, variance, percentages;

Correlation analysis (Pearson and Spearman tests): relationship between HbA1c, lipids, and heart disease;

A value of $p < 0.05$ was considered statistically significant.

Ethical standards:

All participants provided written informed consent prior to participation in the study;

The study was approved by the Ethics Committee of the Tashkent Medical Academy.

**Results and analysis:** Cardiovascular problems in diabetic patients:

| Type of disease | Diabetic patients (%) | Healthy control group (%) |
|---|---|---|
| Ischemic heart disease (IHD)) | 49% | 12% |
| Hypertension | 63% | 28% |
| Dyslipidemia | 55% | 18% |
| Heart failure | 26% | 6% |
| Atherosclerotic changes | 37% | 9% |

Pathophysiological mechanisms:

• Diabetic hyperglycemia leads to endothelial cell dysfunction.

• Insulin resistance increases lipotoxicity, causing remodeling of the heart muscle.

• Dyslipidemia - "bad" cholesterol (LDL) increases, narrowing the arteries.

Correlation results:

• There is a positive correlation between HbA1c levels and ischemic heart disease ($r = 0.62$, $p < 0.01$).

• A strong association was also found between the level of dyslipidemia and the risk of heart failure.

**Conclusion:** The results of the study showed that type 2 diabetes has a profound and multifaceted impact on the cardiovascular system. Among diabetic patients, the incidence of CVD, hypertension, dyslipidemia, and heart failure is significantly higher. This is due to hyperglycemia, insulin resistance, and impaired lipid metabolism.

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