

# Metformin: A Brief Research Review

## Abstract

Metformin is one of the most widely prescribed first-line medications for Type 2 Diabetes Mellitus (T2DM). It improves insulin sensitivity, reduces hepatic glucose production, and shows additional benefits in weight management and cardiovascular health. This paper summarizes its mechanism, clinical effectiveness, safety profile, and emerging non-diabetic applications.

## Introduction

Metformin, a biguanide compound, has been used for more than six decades as a primary treatment for T2DM. It is considered the gold standard therapy due to its efficacy, low cost, and strong safety record. Recent research also explores its potential role in aging, cancer prevention, and metabolic disorders.

## Mechanism of Action

Metformin works by reducing hepatic gluconeogenesis, increasing insulin sensitivity, improving gut microbiome function, and activating the AMPK pathway. These mechanisms help lower blood glucose without causing hypoglycemia.

## Clinical Effectiveness

Metformin lowers HbA1c by 1–1.5% on average, supports modest weight reduction, reduces cardiovascular risk, and is effective alone or in combination with other therapies.

## Safety & Side Effects

Common side effects include gastrointestinal discomfort and potential vitamin B12 deficiency. Lactic acidosis is extremely rare and mainly affects patients with severe kidney or liver impairment.

## Emerging Research

Studies suggest possible roles in anti-aging, cancer prevention, PCOS management, and obesity treatment, though these uses remain investigational.

## Conclusion

Metformin remains a cornerstone therapy for Type 2 Diabetes due to its strong safety profile, affordability, and broad metabolic benefits. Ongoing research continues to expand its potential scope.