



# Metformin Therapy and Its Role in Reducing Insulin Resistance in Type 2 Diabetes

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## DESCRIPTION

Metformin is one of the most widely prescribed oral medications for type 2 diabetes, and it has played a pivotal role in managing this chronic disease for decades. Originally derived from the French plant, which was used in medieval Europe for its glucose-lowering effects, metformin belongs to a class of drugs known as biguanides. Despite its long history, its mechanism of action was not fully understood until more recent research helped illuminate how it works at the cellular level to lower blood sugar levels.

The primary function of metformin is to reduce hepatic glucose production, meaning it limits the amount of glucose the liver releases into the bloodstream. This is crucial in people with type 2 diabetes, who often have elevated hepatic glucose output. Metformin also increases insulin sensitivity, enhancing the uptake of glucose by muscles and fat tissues. Unlike many other diabetes medications, it does not stimulate insulin secretion from the pancreas, which significantly lowers the risk of hypoglycemia a common side effect of other glucose-lowering drugs.

Metformin's efficacy, safety profile and low cost make it a first-line therapy for type 2 diabetes. In clinical practice, it is often the first medication prescribed upon diagnosis, especially when lifestyle interventions such as diet and exercise alone are insufficient to control blood glucose levels. Its benefits extend beyond glucose control; metformin has been associated with modest weight loss or at least weight neutrality, which is especially valuable since obesity often coexists with type 2 diabetes. Additionally, it may contribute to modest improvements in lipid profiles, further reducing cardiovascular risk.

Metformin is frequently used to reduce insulin resistance, which is a common underlying factor in the disorder. It can help restore normal menstrual cycles and improve fertility in some patients. Preliminary studies also suggest that metformin may have a protective effect against certain cancers, including breast and colorectal cancer,

though these findings require further confirmation through long-term randomized controlled trials. Perhaps most intriguingly, some studies have proposed that metformin could have longevity-enhancing properties. Ongoing research in this area seeks to determine whether the drug might delay age-related diseases and extend lifespan in humans.

These side effects are usually transient and can often be managed by taking the drug with meals or using extended-release formulations. A rare but serious adverse effect is lactic acidosis, a condition where lactic acid builds up in the bloodstream, which can be fatal if not treated promptly. However, this complication is extremely rare and usually occurs only in people with significant renal impairment or other predisposing conditions. For this reason, kidney function must be assessed before starting metformin and monitored regularly during treatment. Metformin is available in both immediate-release and extended-release formulations, and it is generally taken once or twice daily depending on the dose and patient tolerance. However, it should be used with caution in patients with chronic kidney disease and avoided entirely in those with significantly reduced kidney function.

## CONCLUSION

The global health community continues to value metformin not only for its effectiveness in managing diabetes but also for its broader implications in metabolic health. As research continues to evolve, the full scope of metformin's benefits and mechanisms may become even more apparent. Whether in combating insulin resistance, aiding in the treatment of PCOS, or offering a possible pathway to healthy aging, metformin remains one of the most important and versatile drugs in modern medicine. Because it is excreted unchanged in the urine, it is not metabolized by the liver, which minimizes drug-drug interactions and makes it a viable option for many patients who are taking other medications.

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**Received:** 24-Feb-2025, Manuscript No. DCRS-25-29085; **Editor assigned:** 26-Feb-2025, PreQC No. DCRS-25-29085 (PQ); **Reviewed:** 12-Mar-2025, QC No. DCRS-25-29085; **Revised:** 19-Mar-2025, Manuscript No. DCRS-25-29085 (R); **Published:** 26-Mar-2025, DOI: 10.35841/2572-5629.25.10.237

**Citation:** Harrison A (2025). Metformin Therapy and Its Role in Reducing Insulin Resistance in Type 2 Diabetes. Diabetes Case Rep. 10:237.

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