World Journal of Pharmaceutical Sciences
ISSN (Print): 2321-3310; ISSN (Online): 2321-3086
Available online at: https://wjpsonline.com/
Review Article

Type 2 Diabetes Mellitus: Current Trends in Treatment and Prevention

Rajannagari Sushma,[1] Dr. Aneesa,[2]

1, M. Pharmacy, Department of Pharmaceutical Analysis, Malla Reddy College of Pharmacy, Maisammaguda, Secunderabad, Hyderabad, 500100, Medchal District.

2, M. Pharmacy, HOD, Professor, Department of Pharmaceutical Chemistry, Malla Reddy College of Pharmacy, Maisammaguda, Secunderabad, Hyderabad, 500100, Medchal District

Received: 22-06-2026 / Revised Accepted: 27-06-2026 / Published: 02-07-2026

ABSTRACT:

Type 2 diabetes mellitus (T2DM) is a chronic metabolic disorder characterized by hyperglycemia due to insulin resistance and progressive beta-cell dysfunction. It remains one of the major global public health challenges because of its rising prevalence, association with obesity, cardiovascular disease, chronic kidney disease, and long-term microvascular complications. Over the last decade, treatment has shifted from a glucose-centered model to a more comprehensive cardio-renal-metabolic approach, with metformin, sodium-glucose cotransporter 2 inhibitors, glucagon-like peptide-1 receptor agonists, dual incretin agonists, continuous glucose monitoring, and metabolic surgery playing increasingly important roles. Prevention has also advanced through evidence-based lifestyle interventions, weight reduction, targeted use of metformin in high-risk individuals, and broader public health strategies . This review summarizes current trends in the treatment and prevention of T2DM, highlights emerging therapeutic options, and discusses future directions in precision and technology-enabled diabetes care.

Key Words: type 2 diabetes mellitus, GLP-1 receptor agonists, SGLT2 inhibitors, tirzepatide, continuous glucose monitoring, prevention, lifestyle intervention

Introduction:

Type 2 diabetes mellitus is one of the most common noncommunicable diseases worldwide and contributes substantially to premature mortality, disability, and healthcare cost. The disease is strongly linked to obesity, sedentary lifestyle, unhealthy dietary patterns, and social determinants of health. Its prevalence has increased in both developed and developing countries, and India remains one of the major burden areas due to rapid urbanization and lifestyle transitions.

Traditional management focused primarily on lowering blood glucose and HbA1c. However, modern diabetes care emphasizes prevention of cardiovascular disease, kidney disease, obesity-related complications, and hypoglycemia, along with better quality of life. This change has been driven by evidence from large cardiovascular outcome trials and recent guideline updates that prioritize organ protection and individualized care. As a result, the management of T2DM now involves a broader treatment framework that integrates pharmacotherapy, lifestyle change, monitoring technology, and risk reduction strategies.

Epidemiology and disease burden

Address for Correspondence: Rajannagari Sushma, M. Pharmacy, Department of Pharmaceutical Analysis, Malla Reddy College of Pharmacy, Maisammaguda, Secunderabad, Hyderabad, 500100, Medchal District
E-Mail: sushmareddy462002@gmail.com

How to Cite this Article: Rajannagari Sushma, Type 2 Diabetes Mellitus: Current Trends in Treatment and Prevention. World J Pharm Sci 2026; 14(01): 162-169; https://doi.org/10.54037/WJPS.2022.100905

The global burden of T2DM continues to rise and is projected to increase further in coming years. The World Health Organization identifies diabetes as a major cause of blindness, kidney failure, heart attack, stroke, and lower-limb amputation. In adults, T2DM accounts for the vast majority of diabetes cases worldwide. The economic burden includes direct costs of drugs and hospital care, as well as indirect costs from lost productivity and long-term disability.

In India, diabetes care has gained increasing attention through national and regional treatment workflows designed to improve diagnosis, treatment initiation, and complication screening. Despite these efforts, late diagnosis and poor long-term control remain common challenges. Therefore, prevention and early intervention are essential to reduce the growing burden of disease.

Pathophysiology

T2DM develops from the interaction of insulin resistance, progressive beta-cell dysfunction, excess hepatic glucose production, adipose tissue dysfunction, and chronic low-grade inflammation. In the early phase, insulin resistance in skeletal muscle and liver causes increased glucose levels, while pancreatic beta cells initially compensate by increasing insulin secretion. Over time, beta-cell failure develops and hyperglycemia becomes persistent.

Obesity, especially visceral adiposity, plays a central role in the pathogenesis of T2DM. Ectopic fat accumulation in the liver and muscle worsens insulin resistance and accelerates disease progression. This explains why weight loss has become a major therapeutic target, not only for glycemic improvement but also for disease modification and remission in selected patients.

Current pharmacotherapy

Metformin remains the foundational drug in many patients with T2DM because it is effective, safe, inexpensive, and long established in clinical practice. It is particularly useful early in the disease course and is often used as the first pharmacologic step after lifestyle intervention. Although its glucose-lowering effect is moderate, it has favorable metabolic effects and low risk of hypoglycemia

SGLT2 inhibitors are now key agents in T2DM management because they lower glucose and also reduce the risk of heart failure and chronic kidney disease progression. Their benefits extend beyond glycemic control and make them especially valuable in patients with established cardiovascular disease, heart failure, or diabetic kidney disease. This has made them central to modern guideline-based care.

GLP-1 receptor agonists have transformed diabetes treatment because they improve HbA1c, reduce weight, and provide cardiovascular benefit in appropriate patients. These agents are especially helpful in individuals with obesity or high cardiovascular risk. Their role has expanded as treatment goals increasingly include weight reduction and organ protection rather than glucose lowering alone.

Dual incretin therapy, especially tirzepatide, is one of the most important newer advances in T2DM treatment. Tirzepatide acts through glucose-dependent insulinotropic polypeptide and GLP-1 receptor pathways and has shown strong efficacy in reducing HbA1c and body weight. Recent reviews describe it as a major step forward in dual-targeted diabetes and obesity management.

Insulin remains essential for people who do not achieve adequate control with non-insulin agents or who present with marked hyperglycemia, symptomatic catabolism, or advanced disease. In such

cases, insulin therapy must be individualized to reduce hypoglycemia and treatment burden. In practice, insulin is increasingly used alongside other agents rather than as isolated therapy.

Technology in diabetes care

Continuous glucose monitoring is becoming increasingly important in T2DM management. Evidence shows that CGM can improve glycemic control in adults with T2DM compared with self-monitoring of blood glucose, including in people not using intensive insulin regimens. This is especially relevant for treatment adjustment, hypoglycemia reduction, and patient education.

Recent reviews suggest that CGM should be considered more broadly in routine diabetes care, not only in type 1 diabetes or intensive insulin users. It can support individualized feedback, improve adherence, and help clinicians make more timely treatment decisions. Other digital tools, including smartphone applications and remote monitoring, are also expanding the scope of diabetes self-management.

Cardiovascular and renal protection

A major trend in T2DM treatment is the shift toward cardiovascular and kidney protection. This has been driven by large outcome studies showing that some glucose-lowering drugs reduce major adverse cardiovascular events, heart failure hospitalization, and progression of kidney disease. Guidelines now recommend choosing therapy based on comorbidities rather than HbA1c alone. Diabetes

GLP-1 receptor agonists and SGLT2 inhibitors are the main classes driving this change. For many patients, these drugs are preferred because they improve outcomes that matter beyond glucose control. Combination therapy may become more common as evidence grows for additive benefit in selected high-risk patients.

Prevention strategies

Lifestyle intervention remains the most effective strategy to prevent progression from prediabetes to T2DM. The Diabetes Prevention Program and other landmark studies showed that weight loss, reduced caloric intake, and increased physical activity significantly lower diabetes incidence. Among these, structured lifestyle change is usually more effective than drug therapy alone and provides broader health benefits.

Dietary improvement is central to prevention and includes reduced refined carbohydrate intake, better portion control, increased fiber, and healthier fat choices. Physical activity improves insulin sensitivity and helps maintain weight loss. Public health measures such as tobacco control, obesity prevention, and healthier food environments are also essential for long-term prevention.

Metformin has an established role in selected high-risk people with prediabetes, especially those who are younger, obese, or have a history of gestational diabetes. It is useful when lifestyle intervention alone is not sufficient or cannot be maintained. However, lifestyle remains the preferred first approach because it improves multiple cardiometabolic risk factors at once.

Bar Graph: Type 2 Diabetes by Age Group

Approximate global diabetes prevalence (%) by age group based on IDF Diabetes Atlas estimates.

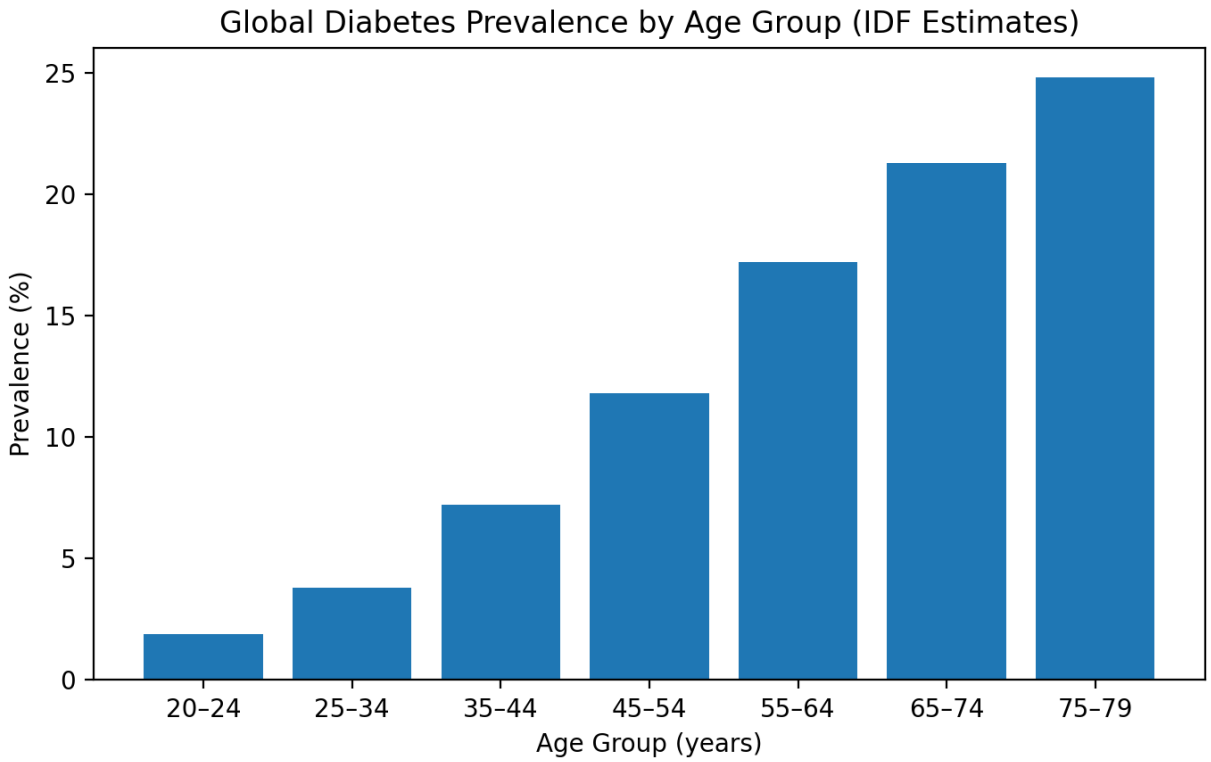

Figure. Diabetes prevalence increases with age and peaks in adults aged 75–79 years.

Major Medications Used in Type 2 Diabetes Mellitus (T2DM)

Drug classes and examples:

Drug Class	Examples	Main Benefits
Biguanides	Metformin	First-line; reduces hepatic glucose production
Sulfonylureas	Glimepiride, Gliclazide, Glipizide	Increase insulin secretion
Meglitinides	Repaglinide, Nateglinide	Postprandial glucose control
Thiazolidinediones (TZDs)	Pioglitazone	Improve insulin sensitivity
DPP-4 Inhibitors	Sitagliptin, Linagliptin, Vildagliptin, Saxagliptin	Low hypoglycemia risk
GLP-1 Receptor Agonists	Semaglutide, Liraglutide, Dulaglutide, Exenatide	Weight loss; CV benefit
Dual GIP/GLP-1 Agonist	Tirzepatide	Marked HbA1c and weight reduction
SGLT2 Inhibitors	Empagliflozin, Dapagliflozin, Canagliflozin, Ertugliflozin	Heart and kidney protection
Alpha-Glucosidase Inhibitors	Acarbose, Miglitol	Delay carbohydrate absorption
Insulin	Glargine, Detemir, Degludec, Lispro, Aspart	Advanced/uncontrolled T2DM

Current Guideline-Preferred Medications

1. Metformin – commonly first-line therapy.
2. SGLT2 inhibitors (Empagliflozin, Dapagliflozin) – cardiovascular and renal protection.
3. GLP-1 receptor agonists (Semaglutide) and Tirzepatide – weight loss and cardiovascular benefit.
4. Insulin – when non-insulin therapy is inadequate or severe hyperglycemia is present.

Obesity and metabolic surgery

Obesity and T2DM are closely linked, and weight loss is now recognized as a core therapeutic target. For selected patients with severe obesity or poorly controlled diabetes, metabolic/bariatric surgery is an effective treatment option. It can improve glycemic control dramatically and may lead to remission in some individuals.

Recent evidence shows that weight-loss surgery provides durable metabolic benefit and better long-term glucose control than standard medical therapy alone in selected patients. This makes surgery an important part of the treatment spectrum for obesity-associated diabetes. It is especially relevant when non-surgical treatments do not achieve sufficient metabolic improvement.

Special populations and individualized care

T2DM is heterogeneous, and treatment should be individualized according to age, obesity status, kidney function, cardiovascular risk, hypoglycemia risk, and access to care. Older adults may need simpler regimens with lower hypoglycemia risk. Patients with kidney disease or heart failure benefit particularly from organ-protective agents such as SGLT2 inhibitors.

The concept of precision medicine is gaining interest in diabetes because not all patients respond equally to the same therapy. Phenotype-based treatment selection, weight-centered care, and risk-based drug choice may improve outcomes. This individualized approach is likely to become increasingly important in future diabetes management.

Challenges in management

Despite recent progress, several barriers still limit optimal diabetes care. These include drug cost, uneven access, treatment inertia, poor adherence, and limited availability of monitoring technology. In many settings, patients still present late with complications, which makes management more difficult.

Another major challenge is the gap between guideline recommendations and real-world practice. Although therapies such as GLP-1 receptor agonists, SGLT2 inhibitors, and CGM are highly effective, they may be underused because of cost or lack of familiarity. Long-term success requires patient education, multidisciplinary care, and stronger public health systems.

Future directions

The future of T2DM care will likely involve earlier intervention, combination therapy, greater use of technology, and a stronger focus on obesity and cardiometabolic risk. Dual incretin therapy, combination SGLT2-GLP-1 strategies, and broader CGM adoption are likely to expand. Digital health and remote monitoring will also become more important as diabetes care becomes more personalized.

Prevention research will continue to focus on sustainable lifestyle change, pharmacologic prevention in high-risk groups, and strategies to reduce obesity at the population level. If these approaches are implemented effectively, the burden of T2DM and its complications can be reduced substantially.

Conclusion

Type 2 diabetes mellitus is a complex and progressive disease that requires more than simple glucose lowering. Current trends in treatment emphasize cardio-renal-metabolic protection, weight reduction, individualized therapy, and technology-enabled monitoring. Prevention remains centered on lifestyle change, with metformin used in selected high-risk individuals and metabolic surgery used for appropriate patients with obesity. A comprehensive strategy combining pharmacotherapy, prevention, public health action, and patient education is essential to reduce the global burden of T2DM.

ACKNOWLEDGEMENT:

The authors are thankful to, Department of Pharmaceutical Analysis, Malla reddy college of Pharmacy, Affiliated to Osmania University, India and Spectrum Pharma Research Solutions, Hyderabad, Telangana, India.

References:

1. *American Diabetes Association Professional Practice Committee. Standards of care in diabetes—2025. Diabetes Care. 2025;48(Suppl 1).*
2. *World Health Organization. Diabetes. 2024.*
3. *International Diabetes Federation. IDF Diabetes Atlas. 11th ed. Brussels: IDF; 2025.*
4. *Davies MJ, Aroda VR, Collins BS, et al. Management of hyperglycemia in type 2 diabetes, 2024. Diabetes Care. 2024.*
5. *Indian Council of Medical Research. Standard treatment workflow: diabetes mellitus type 2. 2024.*
6. *National Institute for Health and Care Excellence. Type 2 diabetes in adults: management (NG28).*
7. *Knowler WC, Barrett-Connor E, Fowler SE, et al. Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. N Engl J Med. 2002;346:393-403.*
8. *Tuomilehto J, Lindström J, Eriksson JG, et al. Prevention of type 2 diabetes mellitus by changes in lifestyle among subjects with impaired glucose tolerance. N Engl J Med. 2001;344:1343-50.*

9. *Pan XR, Li GW, Hu YH, et al. Effects of diet and exercise in preventing NIDDM in people with impaired glucose tolerance. Diabetes Care. 1997;20:537-44.*

10. *Holman RR, Paul SK, Bethel MA, et al. 10-year follow-up of intensive glucose control in type 2 diabetes. N Engl J Med. 2008;359:1577-89.*

11. *Cardiovascular, kidney, and safety outcomes with GLP-1 receptor agonists in type 2 diabetes. PubMed PMID: 39210781. 2024.*

12. *GLP-1 receptor agonists and SGLT2 inhibitors in type 2 diabetes. PubMed PMID: 39342059. 2024.*

13. *Effectiveness of continuous glucose monitoring in type 2 diabetes. PubMed PMID: 39623499. 2024.*

14. *Diabetes technology in people with type 2 diabetes: novel indications. PubMed PMID: 38421505. 2024.*

15. *Tirzepatide: a review in type 2 diabetes. PubMed PMID: 38388874. 2024.*

16. *Tirzepatide for type 2 diabetes. PubMed PMID: 37664792. 2023.*

17. *Semaglutide for type 2 diabetes mellitus: a systematic review. PubMed PMID: 29756388. 2018.*

18. *American Diabetes Association. Prevention or delay of diabetes and associated comorbidities. 2025.*

19. *American Diabetes Association. Obesity and weight management for prevention and treatment of type 2 diabetes. 2025.*

20. *Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. PubMed PMID: 11832527. 2002.*

21. *Monitoring technologies: continuous glucose monitoring, mobile apps, and others. NIH Bookshelf. 2026.*

22. *Weight-loss surgery yields long-term benefits for type 2 diabetes. NIH News. 2026.*

23. *Treatment of type 2 diabetes in patients with obesity: a review. PubMed PMID: 39919872. 2025.*

24. *Effectiveness and safety of combining SGLT2 inhibitors and GLP-1 agonists in type 2 diabetes. PubMed PMID: 41117973. 2026.*

25. *Treatment outcomes and safety profile of SGLT2 inhibitors versus GLP-1 agonists in type 2 diabetes mellitus. PubMed PMID: 40900212. 2025.*

26. *National Institute for Health and Care Excellence. Cardiovascular risk reduction in type 2 diabetes. 2024.*

27. *Indian Council of Medical Research. Diabetes mellitus type 2 treatment workflow. 2024.*

28. *World Health Organization. Management of diabetes. 2025.*

29. *The use of metformin for type 2 diabetes prevention: observational multicenter study from Saudi Arabia. Front Public Health. 2022.*

30. *Metformin vs. lifestyle changes for prevention of type 2 diabetes mellitus in patients with prediabetes. Am Fam Physician. 2023.*

31. *Diabetes technology in people with type 2 diabetes: novel indications. PubMed PMID: 38421505. 2024.*

32. *Continuous glucose monitoring in adults with type 2 diabetes. PubMed PMID: 38363342. 2024.*