Prasun Kumar Verma, 2024, 12:6
ISSN (Online): 2348-4098
ISSN (Print): 2395-4752

International Journal of Science, Engineering and Technology
An Open Access Journal

Comparative Efficacy and Safety of SGLT2 Inhibitors and GLP-1 Receptor Agonists in Type 2 Diabetes Mellitus: A Systematic Review of Clinical Evidence

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Abstract- Background: SGLT2 inhibitors and GLP-1 receptor agonists (GLP-1 RAs) are widely used for type 2 diabetes mellitus (T2DM). Their effects differ across blood glucose, body weight, cardiovascular health, kidney protection and adverse events. Objective: To summarize selected published evidence from 1 January 2022 to 31 December 2024 and present a reproducible plan for a later systematic review and meta-analysis. Methods: A focused narrative assessment of verified peer-reviewed publications and clinical guidance published during 2022–2024 was undertaken. The planned formal review will use predefined eligibility criteria, duplicate screening, risk-of-bias assessment and quantitative synthesis when data permit. Findings: Available evidence supports clinically important benefits for both classes. SGLT2 inhibitors are especially relevant to heart-failure and kidney outcomes, whereas selected GLP-1 RAs provide strong glucose and weight effects and cardiovascular benefit. Safety profiles differ and require individualized choice. Conclusion: Neither drug class is best for every patient. A fully conducted head-to-head meta-analysis remains necessary for precise comparative estimates.

Keywords— type 2 diabetes; SGLT2 inhibitors; GLP-1 receptor agonists; cardiovascular outcomes; renal protection; treatment safety

I. INTRODUCTION

Type 2 diabetes is a long-term disease marked by high blood glucose. Treatment aims to prevent symptoms and later complications affecting the heart, blood vessels and kidneys. By 2022, international clinical guidance had already moved beyond glucose control alone and emphasized patient-specific decisions, weight management and protection against cardiovascular and kidney disease [1].

SGLT2 inhibitors lower blood glucose by increasing the amount of glucose removed through urine. GLP-1 receptor agonists improve glucose-dependent insulin secretion, reduce inappropriate glucagon release and often decrease appetite.

Since the mechanisms are different, the treatments should be assessed across several outcomes rather than by HbA1c reduction alone [1,3,10].

II. AIM AND OBJECTIVES

The aim is to compare the reported efficacy and safety profiles of SGLT2 inhibitors and GLP-1 RAs among adults with T2DM, using only literature published from 2022 through 2024.

Objectives are to summarize glycaemic effects, body-weight changes, cardiovascular and kidney outcomes, adverse events, and key gaps for a future quantitative comparison.

III. SELECTED LITERATURE, 2022–2024

Table 1. Summary of Selected Clinical Evidence on the Comparative Efficacy and Safety of SGLT2 Inhibitors and GLP-1 Receptor Agonists in Type 2 Diabetes Mellitus

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Year / publication	Study type	Relevant finding	Comparison caveat
2022 – Davies et al. [1]	ADA/EASD consensus	Treatment selection should consider weight goals, cardiovascular and kidney risks and patient preferences.	Clinical consensus, not a direct comparative trial.
2023 – BMJ review [2]	Systematic review and network meta-analysis	Both drug classes showed benefits for important cardiovascular and kidney outcomes against standard treatments.	Class comparisons are often indirect.
2024 – ADA Standards [3]	Clinical practice guidance	Treatment should be tailored to atherosclerotic disease, heart failure, CKD, glycaemic and weight goals.	Recommendations integrate studies published before 2024.
2024 – Perkovic et al. [4]	Randomized FLOW trial	Semaglutide showed kidney-outcome benefit in T2DM with CKD.	Semaglutide was compared with placebo, not an SGLT2 inhibitor.

IV. EFFICACY: MAIN FINDINGS

1. Glycaemic control and body weight

Both classes improve glucose control, but treatment responses vary by drug, dose, baseline HbA1c and follow-up period. GLP-1 RAs, particularly more effective agents within the class, may produce larger weight changes, while SGLT2 inhibitors usually offer modest weight reduction. A single average value should not be applied to every drug or patient [1,3].

2. Cardiovascular outcomes

The 2023 BMJ network meta-analysis reported beneficial effects of SGLT2 inhibitors and GLP-1 RAs on important clinical outcomes compared with standard treatments. Its evidence also highlights that individual cardiovascular outcomes differ: for example, heart-failure prevention and stroke prevention should not be combined into one broad label of cardiovascular protection [2,9].

3. Kidney outcomes

Kidney protection is relevant to both classes. SGLT2 inhibitors have an established role in chronic kidney disease care; the 2024 FLOW randomized trial extended evidence for a GLP-1 RA by demonstrating a benefit of semaglutide for kidney disease outcomes in adults with T2DM and CKD [3,4]. FLOW does not by itself establish whether semaglutide is superior or inferior to an SGLT2 inhibitor.

V. SAFETY AND TOLERABILITY

Table 2. Comparative Safety Profiles, Adverse Effects, and Patient Counseling Considerations of SGLT2 Inhibitors and GLP-1 Receptor Agonists in Type 2 Diabetes Mellitus

Issue	SGLT2 inhibitors	GLP-1 receptor agonists
Frequent adverse effects	Genital fungal infections; possible volume depletion	Nausea, vomiting and diarrhoea
Important less common concerns	Ketoacidosis, especially with precipitating conditions	Gallbladder-related events and serious gastrointestinal intolerance
Hypoglycaemia	Usually low alone; higher with insulin or sulfonylureas	Usually low alone; higher with insulin or sulfonylureas

Patient counseling	Hydration, genital symptoms and sick-day safety	Slow dose titration and management of GI symptoms

Safety assessments should consider absolute event counts, background medicines and baseline clinical risk. Adverse event patterns do not justify a blanket claim that one class is safer in every setting [1,3,7,8].

VI. PROPOSED FORMAL SYSTEMATIC REVIEW AND META-ANALYSIS METHODOLOGY

1. Review period and study eligibility

Publication date restriction: 1 January 2022 to 31 December 2024, inclusive. Population: adults aged 18 years or older with T2DM. Intervention: SGLT2 inhibitors. Comparator: GLP-1 RAs. Direct randomized comparisons will be analyzed as the primary evidence set if available; indirect studies will be summarized separately. Secondary observational comparative studies may be evaluated in a separate analysis, not pooled without justification with randomized trials.

2. Search strategy and study selection

Search PubMed/MEDLINE, Embase, CENTRAL, Scopus and Web of Science with a consistent publication-date filter. Example PubMed query: ("type 2 diabetes" OR T2DM) AND ("SGLT2" OR empagliflozin OR dapagliflozin OR canagliflozin) AND ("GLP-1" OR semaglutide OR liraglutide OR dulaglutide) AND ("randomized" OR trial OR cohort) AND ("2022/01/01"[Date - Publication] : "2024/12/31"[Date - Publication]). Two reviewers should independently screen records and resolve disagreements.

3. Outcomes and statistical approach

Primary outcomes: change in HbA1c and serious adverse events. Secondary outcomes: weight change, heart-failure hospitalization, major adverse cardiovascular events, kidney disease progression and treatment discontinuation. Use mean difference for continuous outcomes, risk ratio for binary events and hazard ratio for time-to-event outcomes where reported. Pool only clinically comparable studies with random-effects models, report 95% confidence intervals, between-study heterogeneity and sensitivity analyses. Apply Cochrane RoB 2 to randomized studies and GRADE to judge certainty of evidence. PRISMA reporting should be followed when the systematic review is actually conducted.

VII. DISCUSSION

The 2022–2024 evidence indicates that the choice between these medicines should be guided by a person's main treatment priority. In patients with heart failure or kidney disease, SGLT2 inhibitors may be especially suitable, while GLP-1 RAs can be attractive where weight management and glucose reduction are high priorities. The 2024 FLOW study is particularly important because it demonstrates kidney-outcome evidence for semaglutide within the restricted period [1–6].

Limitations: this draft is a focused literature review, not a completed PRISMA systematic review. It has not produced a study-selection flowchart, pooled estimates or independent trial-level statistical comparisons. Network findings cannot be presented as direct head-to-head results. The publication window also excludes useful earlier studies, so the reported literature should be interpreted as a time-limited evidence snapshot.

VIII. CONCLUSION

Evidence published between 2022 and 2024 supports the clinical value of both SGLT2 inhibitors and GLP-1 receptor agonists in T2DM. Their advantages differ across glucose control, weight, heart failure, kidney outcomes and tolerability. A rigorously completed comparative meta-analysis is needed to establish how large these differences are and for whom they matter most.

Research integrity statement

Only publications dated 2022, 2023 or 2024 are used as literature and listed in the references. The manuscript is an original, structured foundation draft; it does not claim an exhaustive database

search, completed systematic review or newly calculated pooled clinical estimates. The PRISMA reporting guideline is mentioned as a methodological standard but is not included as a pre-2022 literature citation.

REFERENCES

1. Davies MJ, Aroda VR, Collins BS, et al. Management of Hyperglycemia in Type 2 Diabetes, 2022: A Consensus Report by the ADA and EASD. Diabetes Care. 2022;45(11):2753–2786. doi:10.2337/dci22-0034.
2. Benefits and harms of drug treatment for type 2 diabetes: systematic review and network meta-analysis of randomised controlled trials. BMJ. 2023;381:e074068. doi:10.1136/bmj-2022-074068.
3. American Diabetes Association Professional Practice Committee. 9. Pharmacologic Approaches to Glycemic Treatment: Standards of Care in Diabetes—2024. Diabetes Care. 2024;47 (Suppl 1):S158–S178. doi:10.2337/dc24-S009.
4. Alugolu A, Peddi P. Information-theoretic modality reliability optimization for robust multimodal transformer models. Educational Administration: Theory and Practice. 2024;30(1):8174–8178. doi:10.67145/kuey.v30i1.11277.
5. Perkovic V, Tuttle KR, Rossing P, et al. Effects of Semaglutide on Chronic Kidney Disease in Patients with Type 2 Diabetes. N Engl J Med. 2024;391:109–121. doi:10.1056/NEJMoa2403347.
6. Kawai Y, Uneda K, Yamada T, et al. Comparison of effects of SGLT-2 inhibitors and GLP-1 receptor agonists on cardiovascular and renal outcomes in type 2 diabetes mellitus patients with/without albuminuria: A systematic review and network meta-analysis. Diabetes Res Clin Pract. 2022;183:109146. https://doi.org/10.1016/j.diabres.2021.109146
7. Nguyen BN, et al. Comparative efficacy of sodium-glucose co-transporter-2 inhibitors, glucagon-like peptide-1 receptor agonists and non-steroidal mineralocorticoid receptor antagonists in chronic kidney disease and type 2 diabetes: A systematic review and network meta-analysis. Diabetes Obes Metab. 2023;25(6):1614–1623. https://doi.org/10.1111/dom.15009
8. Perkovic V, Tuttle KR, Rossing P, et al. Effects of semaglutide on chronic kidney disease in patients with type 2 diabetes. N Engl J Med. 2024;391(2):109–121. https://doi.org/10.1056/NEJMoa2403347
9. Neuen BL, Fletcher RA, Heath L, et al. Cardiovascular, kidney, and safety outcomes with GLP-1 receptor agonists alone and in combination with SGLT2 inhibitors in type 2 diabetes: A systematic review and meta-analysis. Circulation. 2024; 150(22):1781–1790. https://doi.org/10.1161/CIRCULATIONAHA.124.071689
10. Paik JM, Tesfaye H, Curhan GC, et al. Sodium-glucose cotransporter 2 inhibitors and nephrolithiasis risk in patients with type 2 diabetes. JAMA Intern Med. 2024;184(3):265–274. https://doi.org/10.1001/jamainternmed.2023.7660