

# Use of Insulin Analogues Provides Greater Benefit in Preventing Microvascular Complications in People With Type 2 Diabetes Than Human Insulin: A Literature Review



TBIOMD 492

## Introduction

- In 2019, nearly half a billion people were living with diabetes, with type 2 diabetes (Saeedi et al. 2019). The increased number of people with type 2 diabetes has made the disease the biggest health challenge of the 21<sup>st</sup> century.
- Uncontrolled diabetes leads to macro and microvascular complications.
- These complications include, but are not limited to, heart disease, high blood pressure, diabetic retinopathy, nephropathy, and neuropathy
- Insulin is part of the diabetes management tools. Human insulin and insulin analogues are all used in diabetes management.
- Insulin analogues provide flexible dosing options than human insulin, but it is not clear if this leads to better prevention of complications.

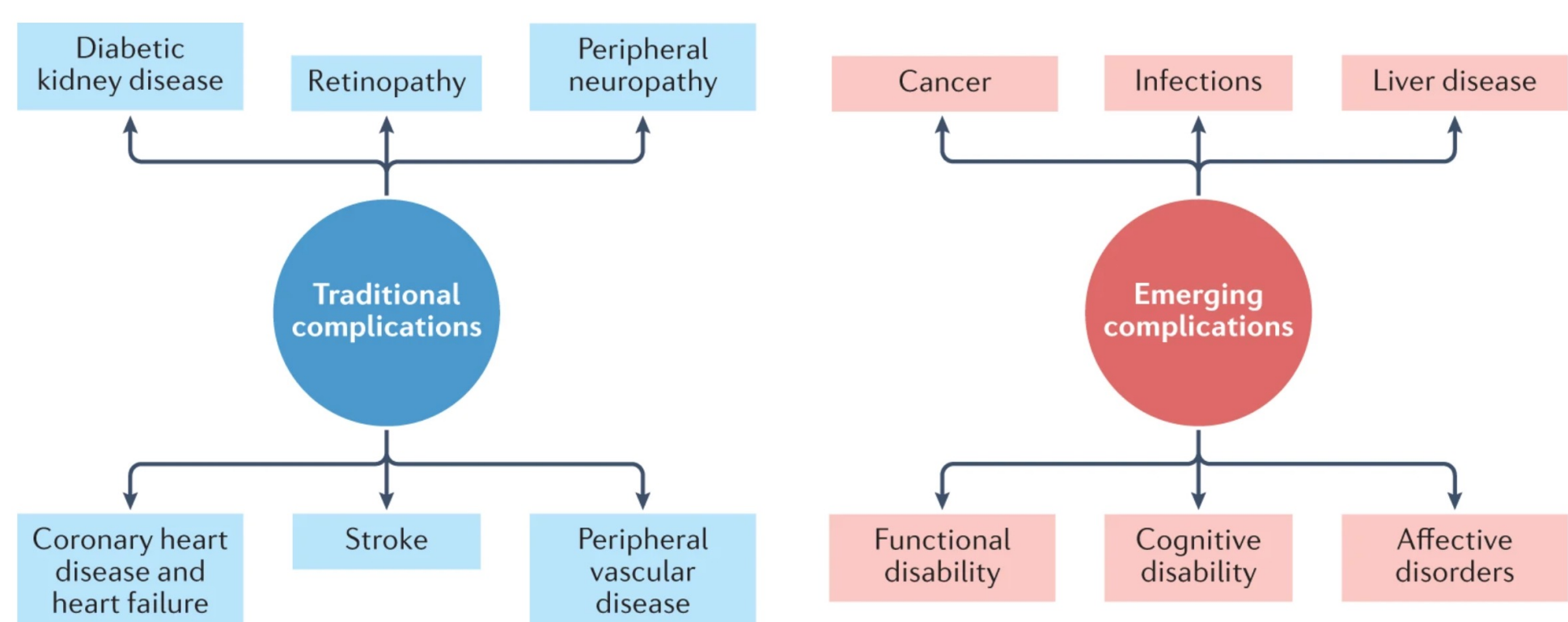


Figure 1. Common and Developing Complications Associated With Diabetes Mellitus.

The figure lists the traditional and emerging complications associated with diabetes. Complications most commonly arise after sufficient diabetes control (Tomic et al. 2022).

## Objectives

- This review examines whether insulin analogs or human insulin are more effective at preventing microvascular complications in type 2 diabetes, specifically retinopathy, nephropathy, and neuropathy, by analyzing their pharmacokinetic and pharmacodynamic advantages.

## Methods

- Reviewed scholarly articles from PubMed, Google Scholar, ScienceDirect, and more.

## Results

- Current literature suggests that different insulin analogues are comparable to human insulin in reducing hyperglycemia (HbA1c) and microvascular complications in people with type 2 diabetes.
- However, analogues may help people with type two diabetes achieve glycemic targets safer than human insulin, because analogues have more predictable and controllable pharmacokinetic and pharmacodynamic profiles. Pharmacokinetics refers to how quickly insulin enters and leaves the bloodstream, while pharmacodynamics refers to how strongly and for how long it lowers blood glucose.
- Rapid-acting analogues such as lispro have faster action and shorter duration on blood glucose than human insulin. Allowing dosing closer to meals and better control of postprandial glucose excursion.

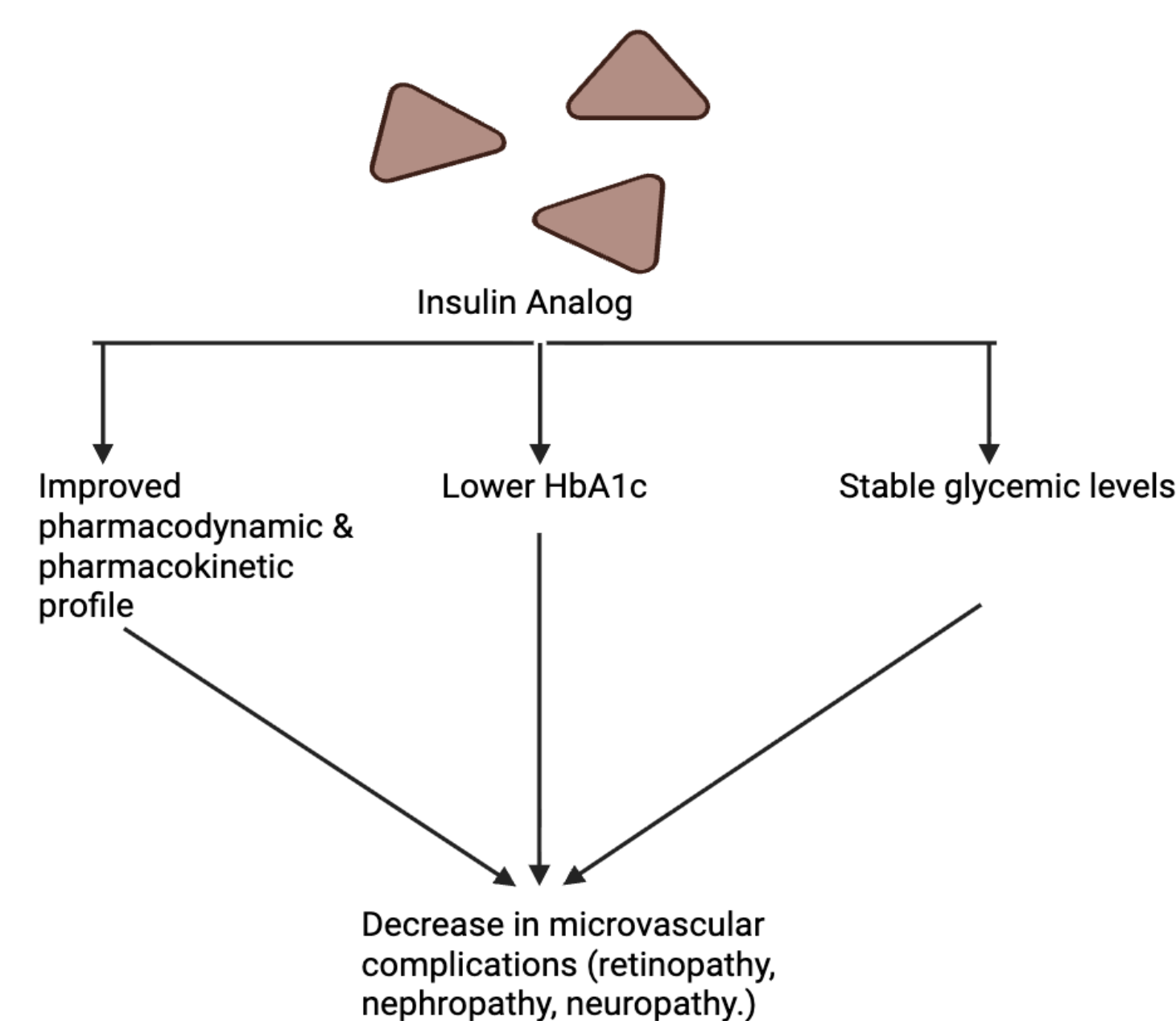


Figure 2. Results Of Insulin Analog Use Significantly Improve Diabetic Control. The figure compares the improvements that come with the use of insulin analogs. Improvements include the pharmacodynamic & pharmacokinetic profiles, HbA1c, and glycemic levels.

- Raslova et al. (2004) compared people with type 2 diabetes using a randomized form of insulin analogues or human insulin form, revealing a 38% lower chance of nocturnal hypoglycemia in those who use insulin analogues.

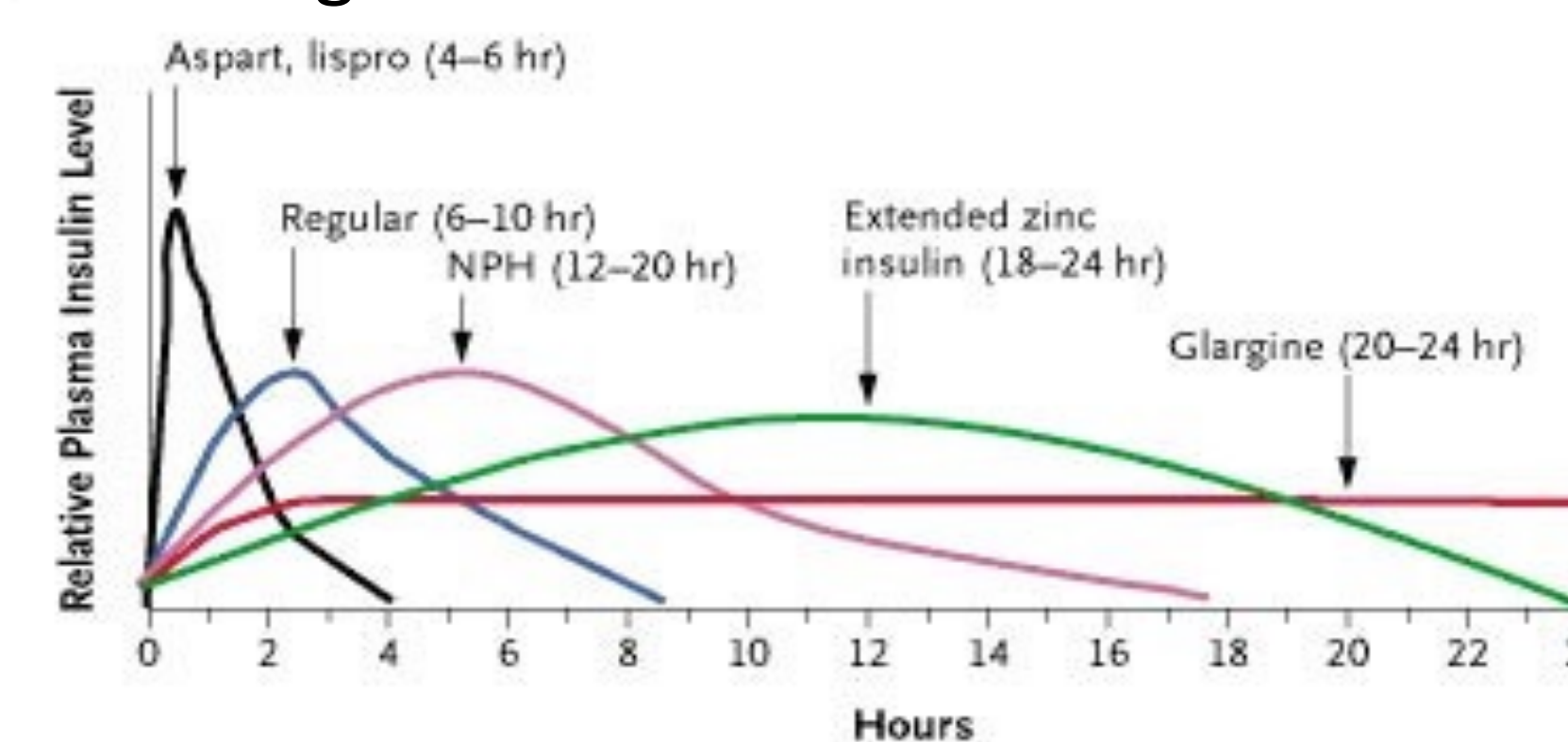


Figure 3. Duration of Most Used Insulin Forms. The durations of different insulin forms vary relative to plasma levels over time. The most common insulin analog, Glargine, has the longest duration (Hirsch 2005).

## Discussion

- Insulin analogues cost more than human insulin but they have pharmacokinetic and pharmacodynamic profile than human insulin
- There is a need for more clinical data to investigate whether the better pharmacodynamic and pharmacokinetics translate to better clinical outcomes
  - Lesser macrovascular complications
  - Lesser microvascular complications
- Current data are suggestive of benefit but the evidence is uncertain

## Conclusion

- The overall use of insulin analogs provides disease control and better titration of treatment in people with diabetes and is the best option when insulin is necessary.
- There is limited data on benefits in preventing complications
- However, the reliance on insulin analogs should not be the sole focus in type 2 diabetes care, as the majority of type 2 diabetes cases can be prevented through diet and lifestyle modification

## Future Directions

- Reliance on insulin analogs should not be the sole focus in type 2 diabetes care, as the majority of type 2 diabetes cases can be prevented through diet and lifestyle modification. Adoption of a healthy diet and lifestyle requires not only behavioral changes, but also changes in food and social environments (Hu 2011).

Physical activity and sedentary lifestyle and diabetes risk in the NHS

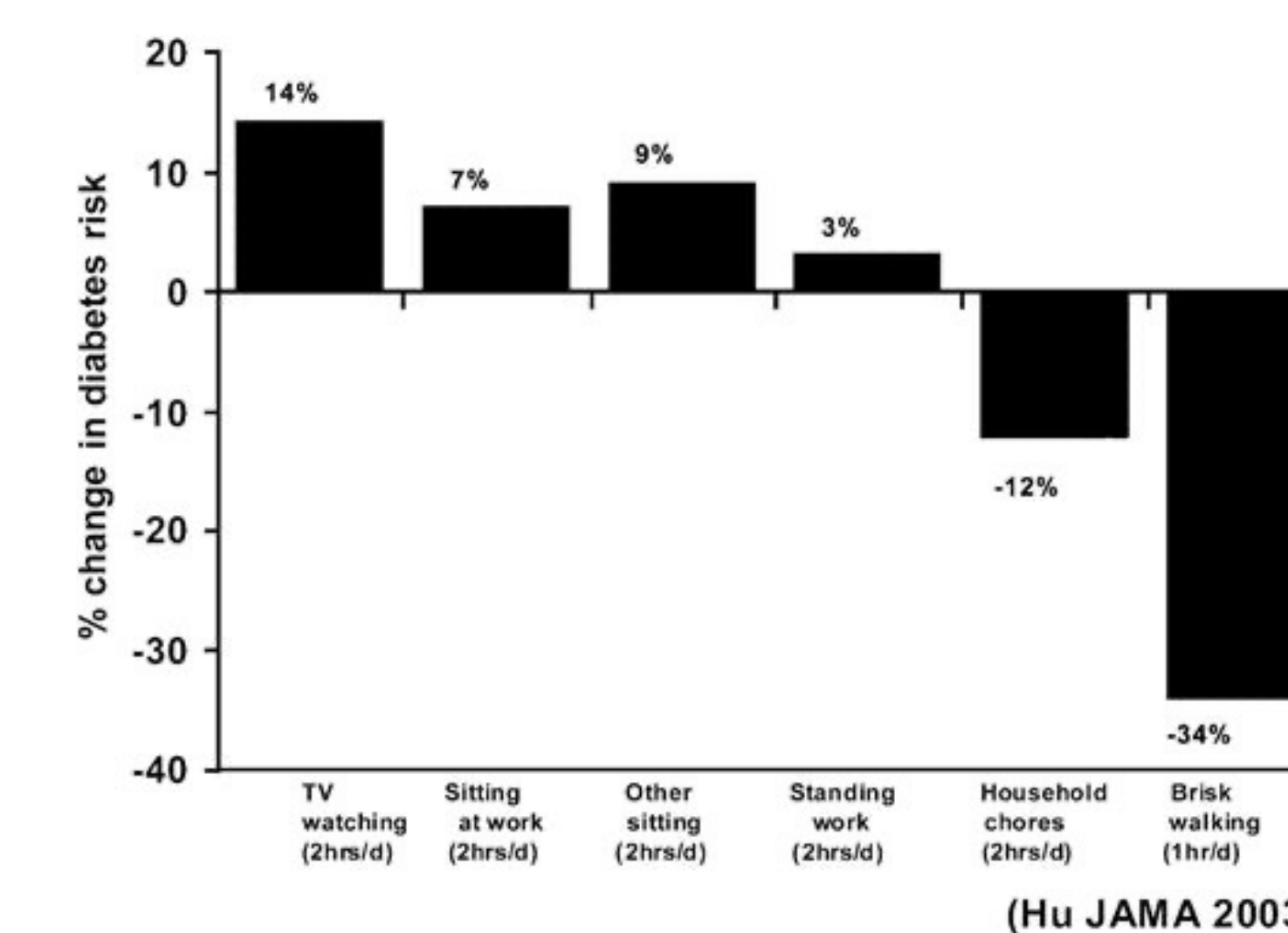


Figure 4. Lifestyle Choices Impacting Diabetes Risk.

Various common lifestyle activities that increase/decrease chances of diabetes (Hu 2011).

## Acknowledgments

- I would like to thank Dr. Chivese for mentoring me and helping guide my research on diabetes. I would also like to thank Dr. Heller for all her help in turning my research into a poster.

## References

