

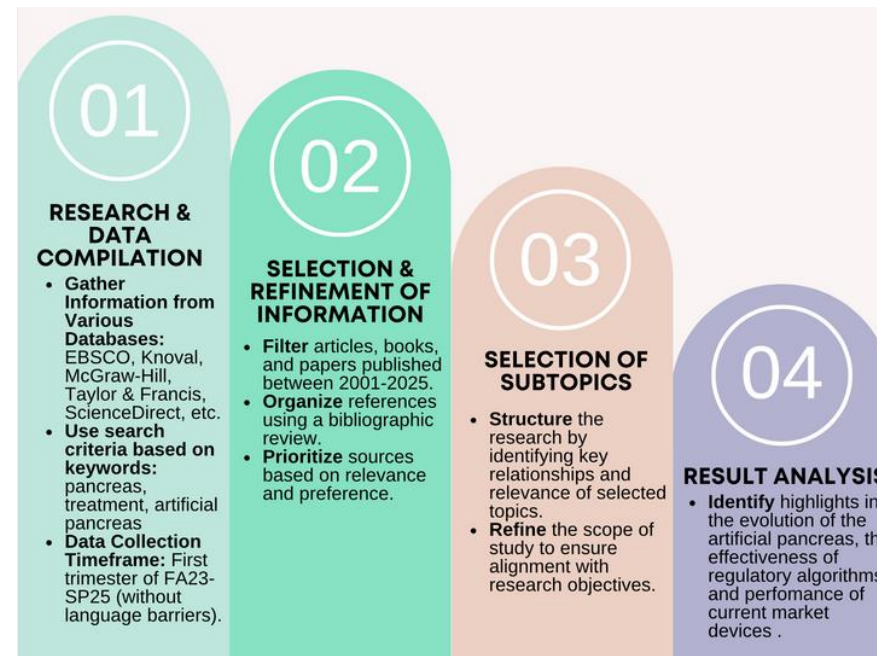
ABSTRACT

The artificial pancreas represents a revolution in modern medicine. This system combines sensors, algorithms, and insulin pumps to automatically regulate blood glucose levels. In this poster, we explore its history, the current devices on the market, and potential future innovations that could improve the quality of life for millions of people.

INTRODUCTION

Tissue engineering has emerged as a key discipline within regenerative medicine, aiming to restore biological functions through the design of biomedical solutions that integrate advanced materials and innovative strategies. In this context, the development of the artificial pancreas represents a fundamental technological milestone for the treatment of type 1 diabetes, a disease that compromises the pancreas's ability to regulate blood glucose levels. These systems combine continuous glucose monitors (CGMs), insulin pumps, and computational algorithms that mimic the natural endocrine response, significantly reducing the daily management burden for patients. At the same time, the use of biomaterials in tissue engineering has proven essential in creating functional structures that support the regeneration of damaged tissues. Modern biomaterials possess properties such as biocompatibility, biodegradability, and mechanical strength, making them key components in advanced medical applications. These characteristics are also applicable in the design of devices like the artificial pancreas, where interaction with tissues and bodily fluids requires materials with safe and controlled responses. The convergence between tissue engineering and automated glycemic control systems marks a new stage in personalized medicine, focused on improving quality of life and extending life expectancy for patients with pancreatic dysfunction.

METHODOLOGY



ANALYSIS AND RESULTS

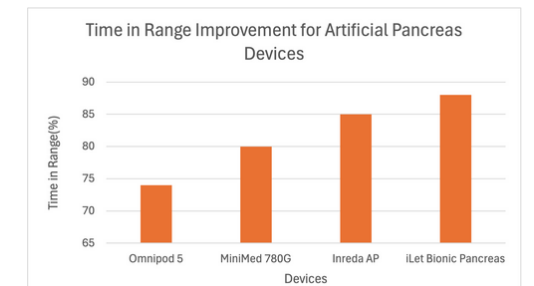


Figure 6. Graphic Representation of Time in Range for Artificial Pancreas

The development of the artificial pancreas has significantly evolved, transitioning from manual insulin pumps to fully automated closed-loop systems that adjust insulin delivery in real time. Advances in continuous glucose monitoring (CGM) sensors and regulatory algorithms, such as PID, MPC, and Fuzzy Logic, have improved glucose control, reducing the risk of hypoglycemia. Current market devices, including Omnipod 5, MiniMed 780G, Inreda AP, and iLet Bionic Pancreas, offer innovative features that enhance patient autonomy and quality of life. Studies show that hybrid closed-loop systems (HCLs) improve time-in-range (TIR) and minimize glucose fluctuations. Future innovations focus on longer-lasting sensors, needle-free insulin pumps, and AI-driven insulin regulation, paving the way for more precise and personalized diabetes management. Despite challenges such as cost and accessibility, artificial pancreas technology continues to advance, offering promising solutions for individuals with pancreatic dysfunction.

DATA

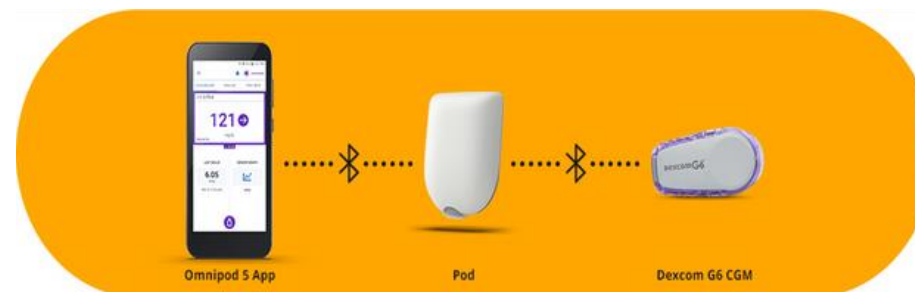


Figure 3. Representation of the Omnipod 5, the mobile application and the CGM

CONCLUSIONS

In recent years, significant advances have been made in artificial pancreas research, revolutionizing the management of diabetes and other pancreatic disorders. This is a continuously evolving field with ongoing innovations aimed at enhancing glucose regulation and patient outcomes. Today, a functional artificial pancreas is already available, utilizing advanced algorithms, sensors, and insulin delivery systems to mimic the natural function of the pancreas. These developments have significantly improved the life expectancy and quality of life for individuals with pancreatic dysfunction, reducing the burden of daily glucose monitoring and insulin administration. As technology continues to advance, future improvements are expected to further refine these systems, making them more accessible, efficient, and responsive to individual patient needs.

FUTURE WORK

Research in artificial pancreas technology focuses on hormone improvements, such as amylin analogs, and more precise, long-lasting sensors for better glucose detection. Additionally, needle-free insulin pumps and AI-driven algorithms are being developed to enhance comfort and optimize real-time diabetes management.

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OBJECTIVES

Explain the function of the pancreas and its relationship with glucose regulation in the body.

Analyze the advancements in the history of the artificial pancreas and its impact on diabetes treatment.

Compare the main artificial pancreas devices on the market and the algorithms that regulate them.

Figure 1. Artistic Representation of the Pancreas



Figure 2. Timeline on Advances in Diabetes Treatment



Figure 4. MINIMED™ 780G



Figure 5. INREDA AP®