

Innovations and Breakthroughs in Diabetes Treatment

Hyejin Shin*

Department of Pharmacy, Pusan National University, Busan, Korea

ABOUT THE STUDY

Insulin is a critical hormone that plays a vital role in the regulation of blood sugar levels in the human body. It serves as a lifeline for individuals with diabetes, a chronic condition characterized by either a lack of insulin production or the body's inability to effectively use the insulin it produces. This article aims to explore the importance of insulin, its mechanism of action, various types of insulin available, and its impact on diabetes management. Insulin, produced by beta cells in the pancreas, is responsible for facilitating the uptake and utilization of glucose by the body's cells. Glucose, derived from the digestion of carbohydrates in food, is the primary source of energy for the body. When insulin is absent or insufficient, glucose cannot enter the cells, resulting in elevated blood sugar levels, a condition known as hyperglycemia.

Types of insulin

There are several types of insulin available; each designed to meet specific needs and requirements. These include:

Rapid-acting insulin: This type of insulin begins working within 15 minutes after injection, reaching its peak effectiveness within 1 to 2 hours. It helps control post-meal blood sugar spikes and is commonly used in combination with longer-acting insulins.

Short-acting insulin: Similar to rapid-acting insulin, short-acting insulin starts working within 30 minutes after injection, peaking in effectiveness after 2 to 3 hours. It typically lasts for 3 to 6 hours and is often used before meals to manage blood sugar levels.

Intermediate-acting insulin: It takes longer to begin working, typically starting to lower blood sugar levels within 2 to 4 hours after injection. It reaches its peak effectiveness in 4 to 12 hours and lasts for about 12 to 18 hours, making it suitable for managing blood sugar levels throughout the day.

Long-acting insulin: This insulin has a slow onset, usually taking several hours to begin working. However, it provides a consistent level of insulin over an extended period, lasting for up to 24 hours. It helps maintain basal insulin levels and is often used in combination with rapid- or short-acting insulins.

Premixed insulin: This type of insulin combines rapid- or short-acting insulin with intermediate-acting insulin. It simplifies the insulin regimen by reducing the number of injections required throughout the day.

Insulin administration

Insulin can be administered *via* various methods, including injections, insulin pumps, and inhalation devices. The most common method is subcutaneous injection, where insulin is injected into the fatty layer just beneath the skin. Injection sites commonly include the abdomen, thighs, buttocks, and upper arms. Insulin pumps, small devices worn on the body, deliver a continuous supply of insulin through a catheter placed under the skin. Inhalation devices, although less common, deliver insulin through the lungs.

Impact of insulin on diabetes management

Insulin is a cornerstone of diabetes management and has a profound impact on the well-being and quality of life for individuals with diabetes. Its primary role is to regulate blood sugar levels, preventing hyperglycemia and hypoglycemia (low blood sugar). By maintaining optimal blood sugar control, insulin helps reduce the risk of long-term complications associated with diabetes, such as cardiovascular disease, kidney damage, nerve damage, and eye problems. Beyond blood sugar regulation, insulin therapy offers flexibility and customization to fit an individual's specific needs. Different insulin regimens and delivery methods allow for personalized treatment plans, considering factors like lifestyle, activity level, and dietary habits. This individualized approach helps individuals with diabetes achieve better glycemic control and improves their overall well-being. Insulin also plays a crucial role in managing gestational diabetes, a type of diabetes that occurs during pregnancy. It helps maintain stable blood sugar levels in pregnant women, ensuring the health of both the mother and the developing baby.

Challenges and future developments

Despite the significant advancements in insulin therapy, challenges persist in achieving optimal diabetes management.

Correspondence to: Hyejin Shin, Department of Pharmacy, Pusan National University, Busan, Korea, Email: Shinjin51@gmail.com

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Insulin administration requires regular self-monitoring of blood sugar levels, precise dosing, and adherence to treatment plans. Some individuals may struggle with injection-related anxieties or difficulties in achieving consistent glycemic control. In recent years, research has focused on developing more advanced forms of insulin to enhance convenience and effectiveness. For instance, rapid-acting insulins with faster onset and shorter duration have been introduced, mimicking the natural insulin response more closely. Additionally, technologies such as closed-loop systems (artificial pancreas) that combine continuous glucose

monitoring and insulin delivery are being explored, aiming to automate insulin administration and improve glycemic control. Insulin remains the lifeline for diabetes management, playing a crucial role in regulating blood sugar levels and preventing complications. With various types and administration methods available, insulin therapy provides personalized treatment options for individuals with diabetes. By embracing these advancements and ensuring access to insulin for all individuals in need, can improve the lives of millions and work towards a world where diabetes is effectively managed and its burden minimized.