



## **INSULIN AND BLOOD GLUCOSE HOMEOSTASIS: MODERN PERSPECTIVES**

*Xamidov A.A.*

*Clinical Residency Resident, Department of Clinical Laboratory Diagnostics,  
Bukhara State Hematology Medical Institute, Bukhara, Uzbekistan*

*Khamidova D.A.*

*Samarkand State Medical University, Samarkand, Uzbekistan*

**Abstract:** Insulin is a key regulatory hormone responsible for maintaining blood glucose homeostasis through its effects on carbohydrate, lipid, and protein metabolism. Impairment of insulin secretion or action results in dysregulation of glucose balance and contributes to the development of metabolic disorders, particularly diabetes mellitus. Recent scientific advances have provided new insights into insulin signaling pathways, insulin resistance, and the complex interaction between metabolic tissues. This thesis summarizes modern perspectives on insulin function, mechanisms of glucose regulation, and current therapeutic strategies aimed at improving glycemic control.

**Keywords:** insulin, glucose homeostasis, insulin resistance, diabetes mellitus, metabolism.

### **Introduction**

Blood glucose homeostasis is a fundamental physiological process that ensures a constant supply of energy to tissues, especially the brain. Insulin, secreted by pancreatic  $\beta$ -cells, plays a central role in regulating glucose uptake, utilization, and storage. Under normal conditions, insulin maintains plasma glucose levels within a narrow physiological range. However, disturbances in insulin production or cellular sensitivity lead to chronic hyperglycemia, which is associated with significant morbidity and mortality worldwide.

### **Aim of the Study**

The aim of this thesis is to analyze modern scientific perspectives on insulin-mediated regulation of blood glucose homeostasis and to assess current understanding of insulin resistance and its clinical significance.

### **Materials and Methods**



This study is based on a comprehensive review of contemporary scientific literature, including original research articles, clinical trials, and review papers published in peer-reviewed journals. Electronic databases such as PubMed, Scopus, and Google Scholar were used to identify relevant sources related to insulin physiology, glucose metabolism, and diabetes management.

### **Results and Discussion**

Modern research has revealed that insulin exerts its metabolic effects primarily through activation of the insulin receptor and downstream signaling pathways, including the phosphoinositide 3-kinase (PI3K)/Akt pathway. This signaling cascade promotes glucose transporter (GLUT4) translocation to the cell membrane, facilitating glucose uptake in muscle and adipose tissues.

Insulin resistance, a condition characterized by reduced responsiveness of target tissues to insulin, is a major pathogenic factor in type 2 diabetes mellitus. Factors such as obesity, chronic inflammation, oxidative stress, and genetic predisposition contribute to the development of insulin resistance. Recent therapeutic approaches focus on improving insulin sensitivity, modulating incretin hormones, and applying personalized medicine strategies to optimize glycemic control.

### **Conclusion**

Insulin plays a pivotal role in the maintenance of blood glucose homeostasis, and disturbances in its function are central to the pathogenesis of metabolic diseases. Advances in molecular and clinical research have significantly enhanced understanding of insulin action and resistance. Continued investigation into insulin signaling mechanisms is essential for the development of more effective preventive and therapeutic strategies for diabetes mellitus.

### **References**

1. Saltiel A.R., Kahn C.R. Insulin signalling and the regulation of glucose and lipid metabolism. *Nature*. 2001;414:799–806.
2. DeFronzo R.A., Ferrannini E. Insulin resistance: a multifaceted syndrome. *Diabetes Care*. 1991;14(3):173–194.
3. American Diabetes Association. Classification and diagnosis of diabetes. *Diabetes Care*. 2023;46(Suppl 1):S19–S40.
4. Petersen M.C., Shulman G.I. Mechanisms of insulin action and insulin resistance. *Physiol Rev*. 2018;98(4):2133–2223.
5. Rorsman P., Ashcroft F.M. Pancreatic  $\beta$ -cell electrical activity and insulin secretion. *Nat Rev Endocrinol*. 2018;14:406–420.