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DIABETES AND PARKINSON'S DISEASE: EVIDENCE OF THE RELATIONSHIP

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Abstract: Diabetes mellitus and Parkinson's disease are among the most pressing problems of modern medicine, negatively affecting the quality of life of millions of people. While diabetes is a metabolic disease characterized primarily by elevated blood glucose levels [1], Parkinson's disease is a chronic neurodegenerative disease of the central nervous system, mainly manifested by movement disorders [2]. Recent studies have shown that there is a correlation between these two common diseases [3, 4], which raises the need for a deeper study of their pathogenesis and treatment strategies. This thesis reviews the main features of diabetes mellitus and Parkinson's disease, the evidence indicating their association, and the potential mechanisms of this association.

Keywords: Diabetes, Parkinson's disease, Neurodegenerative diseases, Insulin resistance, Oxidative stress, Alpha-synuclein, Mitochondrial dysfunction

1. Diabetes: An Overview

Diabetes is divided into two main types: type 1 diabetes and type 2 diabetes. In type 1 diabetes, the pancreas stops producing insulin, while in type 2 diabetes, the body becomes resistant to insulin or cannot produce enough insulin. In both cases, blood glucose levels rise, which can damage various organs and systems. Common symptoms of diabetes include

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frequent urination, thirst, hunger, fatigue, and weight loss. Long-term complications include damage to the eyes, kidneys, cardiovascular system, and nervous system [1].

2. Parkinson's Disease: Key Features

Parkinson's disease is characterized by the loss of dopamine-producing neurons in the substantia nigra of the brain. The loss of these neurons results in a deficiency of the neurotransmitter dopamine, which plays a key role in controlling movement. The main symptoms of Parkinson's disease include tremor, rigidity, slowness of movement (bradykinesia), and balance problems. As the disease progresses, speech, swallowing, and cognitive functions may also be impaired. Parkinson's disease is a neurodegenerative disease that occurs primarily in old age, and its exact causes are not fully understood, but genetic factors, environmental influences, and oxidative stress are thought to play a role [2].

3. The Relationship Between Diabetes and Parkinson's Disease

Epidemiological studies conducted in recent years have shown that patients with diabetes are at increased risk of developing Parkinson's disease compared to controls. Similarly, some patients with Parkinson's disease have been shown to have impaired glucose metabolism, i.e., a predisposition to diabetes [4]. The association between these two diseases may be explained by a number of common pathophysiological mechanisms.

3.1. Insulin Resistance and Neurodegeneration

Insulin plays an important role not only in controlling blood glucose levels but also in brain function. Insulin acts as a neurotrophic factor in the brain and supports the survival and function of neurons. The insulin resistance seen in diabetes can also occur in the brain and lead to impaired insulin signaling. These impairments can lead to neuronal damage and neurodegenerative processes, which may contribute to the development of Parkinson's disease [5].

3.2. Oxidative Stress and Inflammation

Oxidative stress and chronic inflammation play important roles in the pathogenesis of diabetes and Parkinson's disease. High blood glucose levels can exacerbate oxidative stress and lead to cellular damage [5]. Similarly, oxidative stress and neuroinflammation are also observed in Parkinson's disease [6]. These common mechanisms may enhance the effects of both diseases and accelerate their progression [3, 4].

3.3. Mitochondrial Dysfunction

Mitochondria are the energy-producing centers of cells. Mitochondrial dysfunction is observed in diabetes and Parkinson's disease. In diabetes, high glucose levels can increase oxidative stress in mitochondria, leading to their dysfunction [5]. In Parkinson's disease, mitochondrial dysfunction can lead to the death of dopamine-producing neurons [7]. This common disruption of energy metabolism may contribute to the development of both diseases [3, 4].

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3.4. Alpha-Synuclein and Glucose Metabolism

Alpha-synuclein is a key feature of Parkinson's disease, and its accumulation in the brain leads to neuronal degeneration. Recent studies have shown that the metabolism and accumulation of alpha-synuclein may be linked to glucose metabolism. Changes in glucose levels in diabetes may affect the accumulation of alpha-synuclein and increase the risk of developing Parkinson's disease [6].

Conclusion

In conclusion, there is a clear association between diabetes and Parkinson's disease, supported by epidemiological data and shared pathophysiological mechanisms. Factors such as insulin resistance, oxidative stress, inflammation, mitochondrial dysfunction, and impaired alpha-synuclein metabolism may explain the interaction between these two diseases. Continued research in this area will help develop strategies for the prevention, early diagnosis, and effective treatment of diabetes and Parkinson's disease. Co-management of these two diseases is important to improve the overall health and quality of life of patients.

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