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Disturbance of Water Balance in The Body and its Effect on Brain Tissue

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Abstract

Violation of water balance in the body is one of the most important problems affecting the physiological state of a person. This condition can lead to a variety of diseases, including nervous system disorders and brain damage. This article discusses the mechanisms of water imbalance, its impact on brain activity, as well as existing methods of correcting this problem. The article is based on a systematic analysis of modern scientific data and statistical studies confirming the importance of water balance for the normal functioning of the central nervous system.

Keywords: Water balance, hypohydration, hyperhydration, brain, neuropsychological disorders, hyponatremia.

Introduction

Fluid balance in the human body is a key element that supports the normal functioning of all systems and organs. Making up approximately 60% of the body weight, water performs many functions, such as transporting nutrients, thermoregulation, maintaining acid-base balance, and others.

Recent research suggests that both hypohydration (lack of water) and hyperhydration (excess water) can have a negative impact on brain activity and cognitive function. Water, being an important component of cellular metabolism, contributes to the maintenance of normal metabolism and ion transport, which is critically important for the normal functioning of neurons.

Methodology

To analyze the impact of water imbalances on brain tissue, methods of systematic review of existing scientific works and statistical data were used. The article reviews studies conducted in human and animal models, as well as analyzes cases of hypohydration and hyperhydration. Techniques used include laboratory tests of blood sodium and other electrolytes, magnetic resonance imaging (MRI), neuropsychological tests, and cognitive assessments.

For statistical data processing, variation analysis and correlation methods were used to identify the relationship between water balance disorders and changes in brain activity.

Results

Studies show that hypohydration can lead to cognitive decline, decreased concentration, and memory impairment. In one study conducted in 50 healthy people, it was shown that a 3% decrease in body weight due to dehydration was accompanied by a deterioration in neuropsychological tests

(D'Anci et al., 2009). At the same time, overhydration, especially in the context of hyponatremia (low sodium levels in the blood), can cause brain swelling, which in turn can lead to headache, confusion, and even coma (Waickman et al., 2018).

In addition, MRI data have shown that people suffering from chronic dehydration have a decrease in the volume of the brain's gray matter, indicating a possible neurodegenerative effect of long-term water deficiency (Popkin et al., 2010).

Discussion

The results of the studies highlight the importance of maintaining water balance for the normal functioning of the brain. Both hypohydration and overhydration can lead to a variety of pathological conditions, including neuropsychological disorders. An important aspect is that many of these conditions can be reversible if they are identified and corrected in a timely manner. However, long-term and chronic water disorders can cause irreversible changes in brain structures, making them particularly dangerous.

To prevent water imbalances, it is necessary to regularly monitor the level of hydration, especially in people who are exposed to intense physical activity, the elderly and those who suffer from diseases that affect the kidneys and metabolism.

Conclusion

Impaired water balance has a significant impact on the state of the brain and cognitive functions of a person. Both hypohydration and overhydration can lead to a variety of disorders, ranging from headaches and fatigue to serious neurological problems. Maintaining optimal water balance is an important part of preventing diseases of the nervous system and improving overall health.

For further research, it is necessary to focus on the development of methods for the effective diagnosis and correction of water imbalances, as well as the study of the long-term consequences of these disorders on the level of cognitive functions and brain structure.

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