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THE IMPACT OF SLEEP ON COGNITIVE BRAIN FUNCTIONS

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Abstract

Sleep is not a passive state but an active physiological process that plays a decisive role in maintaining cognitive health. This article examines sleep phases, neurophysiological mechanisms, and the influence of sleep on attention, memory, learning, and decision-making. Special attention is given to the consequences of chronic sleep deprivation and sleep disorders. Neuroscientific data are presented, emphasizing the need for quality sleep to ensure effective mental performance. Keywords: sleep, cognitive functions, memory, attention, brain, sleep stages, sleep deprivation, neuroplasticity.

Introduction: *Modern society lives in a state of constant rush and information overload. In many cultures, sleep is viewed as a luxury rather than a necessity. However, neuroscience has long proven that sleep is a key component of brain health and cognitive processes. Sleep disorders are directly linked to reduced concentration,*

memory deterioration, decreased learning ability, and even an increased risk of neurodegenerative diseases. This article explores how sleep affects the brain's cognitive functions.

Neurophysiology of Sleep

Sleep is divided into two main phases: REM sleep (Rapid Eye Movement) - characterized by brain activity similar to wakefulness. This is the phase in which dreams occur, emotional processing takes place, and memory consolidation happens. NREM sleep (Non-Rapid Eye Movement) - includes stages from light to deep sleep. During this phase, the body recovers, toxins are cleared from the brain, and neural connections are strengthened. A full sleep cycle lasts about 90 minutes and is repeated 4–6 times per night. Each sleep phase performs a unique function in maintaining cognitive balance.

Sleep and Memory

Sleep plays a critical role in: Memory consolidation - transferring information from short-term to long-term memory (hippocampus → neocortex). Emotional filtering - the brain “sorts” emotionally significant information during sleep. Knowledge retrieval - sleep promotes restructuring of knowledge and enhancement of associative connections. Sleep deprivation disrupts this process: a person may learn something but cannot retain or recall it over time. This is a common problem for students, although they may struggle to manage it. Insomnia is a condition that reduces quality of life and work capacity. It can lead to a range of diseases, including arthritis. Patients with sleep disorders often report problems with concentration and memory.

Effects of Sleep on Attention and Concentration

Even slight sleep reduction leads to: slower reaction times, distractibility, impaired decision-making, errors in tasks requiring precision and focus.

Chronic sleep deprivation reduces activity in the prefrontal cortex - the brain area responsible for logical thinking, planning, and self-control. Chronic insomnia, lasting more than three months, affects 15 to 30 percent of the global population, according to various sources. The causes of sleep disorders are numerous. Among the diseases that provoke these disorders are Parkinsonism, hyperthyroidism, depressive disorders, neuroses, kidney disease, and arthritis.

Creativity and Problem-Solving

REM sleep plays an important role in insights and creative thinking. Studies show that after sleep, people perform better on tasks requiring out-of-the-box thinking. Sleep helps integrate scattered data, allowing for unexpected solutions.

Consequences of Chronic Sleep Deprivation

Reduced neuroplasticity - impaired ability of the brain to adapt and learn. Accumulation of beta-amyloid - a protein associated with Alzheimer's disease. Increased cortisol levels - a stress hormone that suppresses hippocampal function. Higher risk of depression, anxiety, obesity, diabetes, and stroke. Even one night of sleeplessness can impair cognitive functions to a degree comparable to alcohol intoxication.

Sleep in Adolescents and Students

Lack of sleep is particularly dangerous for the developing brain. Studies show that schoolchildren and students who sleep less than 7 hours a night: score lower on tests,

experience more emotional breakdowns, show lower motivation and creativity. It is important to consider biological rhythms: adolescents have a shifted biological "time zone," so early school start times contradict their physiology.

Ways to Restore Healthy Sleep

Sleep hygiene - avoid gadgets 1-2 hours before bed, sleep in a dark and cool room, maintain a regular schedule. Physical activity - improves sleep quality if done no later than 4 hours before bedtime. Meditation and breathing techniques - help reduce anxiety and prepare for sleep. Limit caffeine and heavy meals in the evening.

Conclusion

Sleep is not merely “disconnection” from the external world, but an active and vital process during which key cognitive transformations occur. The quality and duration of sleep affect productivity, learning ability, and overall mental health. Ignoring sleep is a direct path to reduced efficiency and increased risk of disease. Good and regular sleep impacts not only our health but also our daily mood and energy. Everyone should establish their own sleep routine and ensure quality rest, as it is a fundamental human need. Therefore, treating sleep with care is an investment in our intellectual and physical future.

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