UPSHOTS OF SLEEP DEFICIENCY IN HEALTHY ADULTS

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Abstract

One of the very basic and common biological activity in human beings is sleep. Sleep is essential for recovery for recovering or replenishments of energy loss during daily functional activities. Total sleep deprivation (TSD) may induce fatigue, neurocognitive slowing and mood changes, which are partly compensated by stress regulating brain systems, resulting in altered dopamine and cortisol levels in order to stay awake if needed. These systems, however, have never been studied in concert. At baseline, after a regular night of sleep, and the next morning after TSD, 12 healthy subjects performed a semantic affective classification functional magnetic resonance imaging task, followed by a Craclopride positron emission tomography (PET) scan. Saliva cortisol levels were acquired at 7 time points during both days. Affective symptoms were measured using Beck Depression Inventory (BDI), and visual analogue scales. After TSD, perceived energy levels, concentration, and speed of thought decreased significantly, whereas mood did not. During, response speed decreased for neutral words and positive targets, and accuracy decreased trend wise for neutral words and for positive targets with a negative distracter. Sleep extension has benefits in sports performance despite the variety of sports.

Key Words: *Sleep extension, Sleep deprivation, Micro-sleep, Performance, Physiology*

1) INTRODUCTION

Sleep is one of the most indispensable biological activities of human beings. It is a method during which the bodily tissues recover from metabolic processes operative throughout the day and set up the body for effective physiological performance the following day [1]. Lack of sleep is a common condition in everyday life, either related to psychosocial demands or related to working shift hours. In healthy individuals, this may induce decreased alertness and vigilance, together with a general decline in mood. Total sleep deprivation (TSD) has been associated with general psychomotor slowing and diminished cognitive performance [1,2]. In affective disorders, only one night of sleep deprivation may improve mood in 40–60% of subjects with major depressive disorder [3-6], whereas bipolar patients may even turn into (hypo)mania [7,8]. Thus, in humans, sleep deprivation is clearly related to alter emotional and affective functioning. Sleep deprivation makes us moody and irritable, and impairs brain functions such as memory and decision-making. It also negatively impacts the rest of the body – it impairs the functioning of the immune system, for example, making us more susceptible to infection. In a nutshell, sleep deprivation is caused by consistent lack of sleep or reduced quality of sleep [9-11].

2) OUTCOMES OF SLEEP DEFICIENCY

Getting less than 7 hours of sleep on a regular basis can eventually lead to health consequences that affect your entire body. This may also be caused by an underlying sleep disorder. Your body needs sleep, just as it needs air and food to function at its best [12-15]. During sleep, your body heals itself and restores its chemical balance. Your brain forges new thought connections and helps memory retention. Without enough sleep, your brain and body systems won't function normally [16]. It can also dramatically lower your quality of life. Noticeable signs of sleep deprivation include: excessive sleepiness, frequent yawning, irritability, daytime fatigue Stimulants, such as caffeine, aren't enough to override your body's profound need for sleep[17-18]. In fact, these can make sleep deprivation worse by making it harder to fall asleep at night. This, in turn, may lead to a cycle of night time insomnia followed by daytime caffeine consumption to combat the tiredness caused by the lost hours of shut-eye.

Behind the scenes, chronic sleep deprivation can interfere with your body's internal systems and cause more than just the initial signs and symptoms listed above. While you sleep, your immune system produces protective, infection-fighting substances like antibodies and cytokines[19,20]. It uses these substances to combat foreign invaders such as bacteria and viruses. Certain cytokines also help you to sleep, giving your immune system more efficiency to defend your body against illness. Sleep deprivation prevents your immune system from building up its forces. If you don't get enough sleep, your body may not be able to fend off invaders, and it may also take you longer to recover from illness [21]. Long-term sleep deprivation also increases your risk for chronic conditions, such as diabetes mellitus and heart disease. Our central nervous system is the main information highway of your body[22]. Sleep is necessary to keep it functioning properly, but chronic insomnia can disrupt how your body usually sends and processes information.

During sleep, pathways form between nerve cells (neurons) in your brain that help you remember new information you've learned. Sleep deprivation leaves your brain exhausted, so it can't perform its duties as well. You may also find it more difficult to concentrate or learn new things. The signals your body sends may also be delayed, decreasing your coordination and increasing your risk for accident. Sleep deprivation also negatively affects your mental abilities and emotional state. You may feel more impatient or prone to mood swings. It can also compromise decision-making processes and creativity[23]. If sleep deprivation continues long enough, you could start having hallucinations — seeing or hearing things that aren't really there. A lack of sleep can also trigger mania in people who have bipolar mood disorder. Other psychological risks includes, impulsive behavior, anxiety, depression, paranoia, suicidal thoughts. You may also end up experiencing micro sleep during the day. During these episodes, you'll fall asleep for a few to several seconds without realizing it.

Micro sleep is out of your control and can be extremely dangerous if you're driving. It can also make you more prone to injury if you operate heavy machinery at work and have a micro sleep episode. The relationship between sleep and the respiratory system goes both ways. A night time breathing disorder called obstructive sleep apnea (OSA) can interrupt your sleep and lower sleep quality [24]. As you wake up throughout the night, this can cause sleep deprivation, which leaves you more vulnerable to respiratory infections like the common cold and flu. Sleep deprivation can also make existing respiratory diseases worse, such as chronic lung illness. Along with eating too much and not exercising, sleep

deprivation is another risk factor for becoming overweight and obese. Sleep affects the levels of two hormones, leptin and ghrelin, which control feelings of hunger and fullness.

Leptin tells your brain that you've had enough to eat. Without enough sleep, your brain reduces leptin and raises ghrelin, which is an appetite stimulant. The flux of these hormones could explain night time snacking or why someone may overeat later in the night. A lack of sleep can also make you feel too tired to exercise. Over time, reduced physical activity can make you gain weight because you're not burning enough calories and not building muscle mass. Sleep deprivation also causes your body to release less insulin after you eat. Insulin helps to reduce your blood sugar (glucose) level[25]. Sleep deprivation also lowers the body's tolerance for glucose and is associated with insulin resistance. These disruptions can lead to diabetes mellitus and obesity.

CONCLUSION

Sleep deprivation in healthy adults induces widespread neurophysiologic and endocrine changes, characterized by impaired cognitive functioning, despite increased regional brain activity. Our pilot findings indicate that activation of the dopaminergic system occurs together with a blunted cortical response, suggesting augmented motivational top down control and requiring increased involvement of prefrontal and limbic cortical areas. Sustained wakefulness requires the involvement of compensatory brain systems, and may help to understand the therapeutic effects of sleep deprivation in affective disorders.

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