

THE IMPACT OF SLEEP DEPRIVATION AND POOR LIFESTYLE ON THE CARDIOVASCULAR SYSTEM

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Abstract: This article explores the correlation between sleep patterns, stress, hormonal imbalances, disruptions in nervous systems and their contribution to the development of cardiovascular diseases (CVDs). Poor sleep hygiene, elevated stress levels, and hormonal fluctuations can significantly negatively impact cardiovascular function, promoting various pathologies. The combined effect of these factors may increase the risk of heart disease and reduce quality of life. This highlights the importance of studying and managing these factors.

Keywords: Cardiovascular system, nervous system, endocrine system, sleep patterns, pathologies, sleep disruption, quality of life, circadian rhythm disruption

Cardiovascular System and its Regulation

The human cardiovascular system comprises numerous blood vessels and the heart, functioning in close interplay with the hormonal and nervous systems. Critically, these systems cannot operate efficiently without a normal sleep pattern. Research demonstrates that sleep is essential for bodily restoration, allowing the brain to process information, identify damage, and prepare the body for the upcoming day.

The Role of the Nervous and Humoral Systems in the Pathogenesis of Cardiovascular Diseases

The cardiovascular system is controlled by the central nervous system (CNS), with cardiac centers located in the medulla oblongata and pons. Innervation of the heart is achieved via the parasympathetic and sympathetic nervous systems. The vagus nerve (n. vagus) contains preganglionic fibers innervating the heart, including the right atrium, forming a plexus in the sinoatrial node and extending to the atrioventricular (AV) node. Studies reveal that patients with sleep disturbances exhibit increased anxiety and tachycardia. Specifically, in 87% of adolescents with delayed sleep schedules, tachycardia is linked to autonomic nervous system dysfunction. Activity of the 10th cranial nerve (n. vagus), responsible for parasympathetic innervation, remains elevated both day and night. Normally, sympathetic nervous system (n. truncus sympathicus) activity is expected during the day, and parasympathetic activity at night. This is because melatonin, the sleep hormone, begins to be produced with the onset of darkness. The pineal gland, an endocrine gland attached to the brain, plays this role. Melatonin production shifts bodily functions according to the time of day. However, research indicates that individuals who sleep late or work night shifts under artificial light risk developing various heart conditions. This is attributed to the inability to produce sufficient melatonin during daylight hours. The biochemistry of melatonin production involves tryptophan, a proteinogenic amino acid found in

both animal and plant proteins. The pineal gland requires a signal from the visual organs and the suprachiasmatic nucleus. The CNS signals the autonomic nervous system to decrease sympathetic fiber activity and increase parasympathetic activity, relaxing muscles and slowing the heart rate by vasodilation. Therefore, poor or disrupted sleep patterns can lead to arrhythmia, dyspnea, apnea, etc. According to the US National Center for Biotechnology Information, industrialization, a shift to sedentary lifestyles, modern consumption habits, and long working days have contributed to the rise in cardiovascular diseases (CVDs) in recent decades. People have become less active and more likely to consume high-calorie foods with high fat and sugar content. This leads to cardiovascular problems, including atherosclerosis, metabolic syndrome, diabetes, and hypertension.

The INTERHEART study identified nine risk factors accounting for 90% of the likelihood of a first myocardial infarction. These include smoking, dyslipidemia (lipid abnormalities), hypertension, diabetes, obesity, psychosocial factors, low fruit and vegetable intake, moderate alcohol consumption, and physical inactivity. Of these, smoking presents the most significant risk. Other studies have confirmed the link between elevated cholesterol and blood pressure with cardiovascular disease. The American Heart Association has issued recommendations to mitigate these risks: quitting smoking, engaging in physical activity, adopting a healthy diet, and monitoring blood pressure, weight, and blood sugar levels.

It's also crucial to consider non-modifiable risk factors—family history, age, and sex. For instance, a family history of premature cardiovascular disease increases individual risk. Moreover, certain risk factors may differentially affect men and women. For example, diabetes and smoking more than 20 cigarettes daily elevate the risk of heart disease more significantly in women.

Additional risks include HIV infection, radiation exposure to the chest or mediastinum, microalbuminuria, and elevated inflammatory markers, all of which can increase the probability of cardiovascular disease. Cardiovascular diseases (CVDs) consistently rank among the top two leading causes of death in the US since 1975, surpassing cancer in mortality rates by 2015. According to the WHO, CVDs are the leading cause of death globally (17.7 million deaths in 2015). Furthermore, CVDs represent the most expensive disease burden, exceeding Alzheimer's disease and diabetes (USD 237 billion annually, projected to rise to USD 368 billion by 2035). Despite reduced myocardial infarction mortality due to advancements in diagnosis and treatment, the risk of CVD remains high (50% by age 45). Incidence increases with age, with higher rates in younger men, although this difference narrows post-menopaus

Conclusion

In summary, insufficient quality sleep and irregular sleep patterns may contribute to the development of cardiovascular diseases through alterations in nervous system function and hormonal balance. Future research in this area could help elucidate the mechanisms linking sleep quality to cardiovascular health and develop strategies for the prevention and treatment of CVD in patients with sleep disturbances. Sleeping later than usual keeps your resting heart rate (RHR) higher than normal, both overnight and into the following day. This effect only occurs with later,

not earlier, bedtimes. Although factors like medication, weight, and exercise influence RHR, researchers suggest inconsistent bedtimes also play a role, even when total sleep time remains consistent. Surprisingly, even those with regular bedtimes experienced slightly higher heart rates during the final hour of sleep compared to those who retired a bit earlier. While RHR is a valuable marker of cardiovascular health, practical clinical application requires further study. Current medical advice focuses on promoting healthy habits like sufficient sleep and exercise to lower RHR, but defining an optimal RHR target remains an area for future research. Cardiovascular disease (CVD) is a major global health crisis, representing the leading cause of death worldwide and a significant economic burden. While progress in treatment has reduced mortality from some CVD events, the overall risk remains high, impacting a substantial portion of the population by mid-life. This risk is influenced by a complex interplay of factors, including non-modifiable risks like genetics, age, and sex, along with additional factors such as radiation exposure, and elevated inflammation. Understanding these multifaceted risk factors is crucial for effective prevention and management strategies.

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