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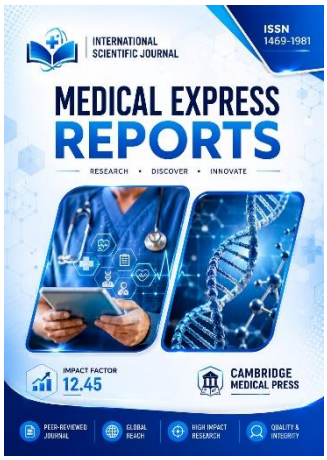

THE IMPACT OF SLEEP DISORDERS ON NEUROENDOCRINE AND AUTONOMIC REGULATORY MECHANISMS

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ABSTRACT

This article provides a comprehensive examination of the effects of sleep disorders on neuroendocrine and autonomic regulatory mechanisms in the human body. Sleep is described as a complex physiological process arising from the coordinated activity of the central nervous, endocrine, and autonomic nervous systems. The article discusses the neurophysiological foundations of the sleep–wake cycle and the roles of the hypothalamus, suprachiasmatic nucleus, pineal gland, pituitary gland, and brainstem structures in its regulation. A major focus is the effect of sleep disorders on neuroendocrine function. The circadian secretion patterns and physiological significance of biologically active substances, including melatonin, cortisol, growth hormone, leptin, and ghrelin, are examined, together with changes that occur during sleep deprivation. The effects of insomnia and chronic sleep restriction on the hypothalamic–pituitary–adrenal axis, stress responses, hormonal balance, and metabolism are explained. The article also considers the effects of sleep disorders on the autonomic nervous system and the importance of functional balance between its sympathetic and parasympathetic divisions. During normal sleep, parasympathetic activity generally predominates, heart rate and blood pressure decrease, and restorative processes become more active. In chronic sleep deprivation, increased sympathetic activity and greater cardiovascular strain may

occur, potentially increasing the risk of hypertension and metabolic disturbances. In addition, the article addresses the effects of sleep disorders on central nervous system function, cognitive abilities, memory, attention, emotional state, and psychological stability. The physiological characteristics of NREM and REM sleep and their importance for information processing and memory consolidation are described. Preventive measures aimed at improving sleep hygiene, normalizing biological rhythms, and supporting neuroendocrine and autonomic function are also considered. The scientific evidence reviewed supports the conclusion that sufficient, high-quality sleep is essential for maintaining homeostasis, hormonal balance, stable autonomic regulation, and overall health.

INTRODUCTION

In modern medicine and biology, the study of human physiological function—and, in particular, the relationship between sleep and the central nervous, endocrine, and autonomic nervous systems—is an important area of scientific research. Sleep is an integral part of human life. It plays a major role in physical and psychological recovery, the maintenance of a stable internal environment, metabolism, and the normal functioning of the nervous system [1].

Sleep is not simply a state of physiological rest; rather, it is a dynamic process produced by complex neurophysiological activity in the central nervous system. Structures such as the hypothalamus, thalamus, brainstem, reticular formation, and cerebral cortex participate in this process. The alternation between sleep and wakefulness is regulated by specialized neuronal networks, neurotransmitters, and biological rhythms [2].

One of the principal physiological functions of sleep is to restore the body's functional reserves and coordinate the activity of different physiological systems. During sleep, synaptic connections between neurons are reorganized, information acquired during the day is processed, memory is consolidated, and important changes occur in metabolic activity. Therefore, the duration and quality of sleep, as well as the normal alternation of its stages, are particularly important for maintaining human health [1, 2].

Physiologically, sleep is divided into non-rapid eye movement (NREM) sleep and rapid eye movement (REM) sleep. NREM sleep comprises three stages: N1, N2, and N3. During these stages, overall physiological activity decreases; heart rate and arterial blood pressure generally fall, while restorative processes become more pronounced during deep sleep. During REM sleep, brain activity becomes relatively active, and processes related to dreaming, emotional information

processing, and memory consolidation take place. The alternation of these stages forms the physiological architecture of sleep [1].

The suprachiasmatic nucleus of the hypothalamus plays a key role in regulating the sleep–wake cycle. It functions as the body's principal biological clock and regulates circadian rhythms in response to the alternation of light and darkness in the external environment. Neural signals from the suprachiasmatic nucleus influence melatonin production by the pineal gland. Melatonin is important for coordinating biological rhythms, facilitating sleep onset, and stabilizing the sleep–wake cycle [3].

In recent years, sleep disorders have become a significant medical and social problem worldwide. The accelerated pace of modern life, chronic stress, night work, irregular daily schedules, reduced physical activity, and prolonged use of electronic devices can all contribute to poorer sleep quality. In particular, prolonged exposure to artificial light in the evening and at night can affect melatonin secretion and disrupt natural biological rhythms [3, 4].

Sleep disorders may present in various clinical forms, including insomnia, sleep apnea, excessive daytime sleepiness, circadian rhythm sleep–wake disorders, and other sleep-related pathological conditions. These disorders may be short-term or chronic. Short-term sleep deprivation may cause fatigue, reduced attention, and impaired work capacity, whereas chronic sleep deprivation can affect several physiological systems simultaneously [5].

One of the most important consequences of sleep disorders is a change in neuroendocrine function. The neuroendocrine system provides functional connections between the central nervous system and the endocrine glands. Through this system, stress responses, energy metabolism, growth, development, and other essential physiological processes are regulated. One of the principal mechanisms of neuroendocrine regulation is the hypothalamic–pituitary–adrenal (HPA) axis. This system regulates cortisol secretion and plays an important role in adaptation to stressors [3, 6].

Under normal physiological conditions, cortisol is secreted according to a distinct circadian rhythm. Its level is usually higher in the morning and decreases during the evening and night. However, reduced sleep duration, chronic stress, and disruption of biological rhythms may affect HPA-axis activity. As a result, the circadian pattern of cortisol secretion may change, sensitivity to stress may increase, and metabolic processes may become disturbed [3, 6].

Melatonin also has a particularly important role in the neuroendocrine regulation of sleep. It is produced by the pineal gland and is secreted more actively in darkness. This hormone synchronizes the body's internal biological clock with the day–night cycle in the external environment. Disruption of melatonin secretion may delay sleep onset, shorten sleep duration, and disturb circadian rhythms [3, 4].

Sleep also affects the secretion of other hormones, including growth hormone, leptin, and ghrelin. Growth hormone is produced by the anterior pituitary gland and is released particularly actively during deep NREM sleep. It is important for protein synthesis, cellular renewal, the

development of muscle and bone tissue, and metabolism. Leptin and ghrelin participate in regulating energy balance and feelings of hunger and satiety. Sleep deprivation may disturb the normal secretion patterns of these hormones, increase appetite, and impair metabolic balance [4].

Another important area affected by sleep disorders is autonomic nervous system function. The autonomic, or involuntary, nervous system regulates the activity of the heart, blood vessels, respiratory system, digestive tract, and other internal organs. It consists of sympathetic and parasympathetic divisions, and the functional balance between them is essential for maintaining homeostasis [5].

The sympathetic nervous system prepares the body for activity and stress, can increase heart rate and arterial blood pressure, and promotes the mobilization of energy. The parasympathetic nervous system supports rest, digestion, and physiological recovery. During normal NREM sleep, sympathetic activity decreases while parasympathetic influence becomes relatively stronger. Consequently, heart rate and blood pressure generally fall. During REM sleep, autonomic activity is more variable, and temporary fluctuations in cardiovascular and respiratory parameters may occur [5].

Chronic insomnia may disrupt the functional balance of the autonomic nervous system. Increased sympathetic activity, relatively reduced parasympathetic regulation, and changes in heart rate variability may be observed. These physiological changes may increase cardiovascular strain and reduce the body's ability to adapt to stress. Scientific studies have reported varying effects of sleep deprivation on autonomic responses and cortisol secretion. Therefore, the duration of sleep disturbance, individual characteristics, and stress factors should be considered when evaluating these mechanisms [6].

Sleep disorders may also adversely affect cardiovascular function. During normal sleep, arterial blood pressure typically decreases at night. This physiological mechanism helps the heart and blood vessels recover after daytime activity. Chronic sleep disruption, however, may be associated with an insufficient nocturnal decrease in blood pressure, increased sympathetic activity, and changes in autonomic regulation of cardiac function [5, 7].

Obstructive sleep apnea is one of the pathological conditions that can significantly affect autonomic regulatory mechanisms. In this disorder, breathing is repeatedly interrupted because the upper airway narrows or becomes temporarily blocked during sleep. This may reduce blood oxygen levels, repeatedly interrupt sleep, and activate the sympathetic nervous system. Over time, these processes are associated with an increased risk of arterial hypertension and cardiovascular disease [5, 7].

Sleep deprivation also affects higher functions of the central nervous system. Attention, memory, thinking, learning, decision-making, and emotional control depend on adequate sleep. During sleep, the brain processes information acquired throughout the day and consolidates memory. Accordingly, sleep disorders may lead to reduced cognitive performance, emotional instability, irritability, and lower resilience to stress [1, 2].

Insufficient sleep also affects metabolic processes and immune defense mechanisms. Chronic sleep disturbances are associated with changes in glucose metabolism, insulin sensitivity, and energy balance. Disruption of sleep and circadian rhythms may also contribute to the activation of certain inflammatory processes. Over time, these changes may be associated with obesity, metabolic syndrome, and cardiovascular disease [4, 8].

According to consensus recommendations developed by the American Academy of Sleep Medicine and the Sleep Research Society, healthy adults should regularly obtain at least seven hours of sleep per night to maintain optimal health. Insufficient sleep duration is associated with obesity, diabetes mellitus, arterial hypertension, cardiovascular disease, and reduced cognitive performance [8].

The scientific information presented above shows that the effects of sleep disorders are not limited to fatigue and sleepiness. Rather, they involve the central nervous system, endocrine glands, autonomic nervous system, cardiovascular system, and metabolic regulatory mechanisms. Therefore, studying sleep disorders from a comprehensive physiological perspective, identifying their underlying mechanisms, and developing preventive measures to reduce their adverse consequences are of considerable scientific and practical importance.

MATERIALS AND METHODS

Modern scientific research methods were used in preparing this article. The principal sources included scientific literature on sleep physiology, neuroendocrine regulation, the autonomic nervous system, endocrinology, neurology, and medical physiology, as well as fundamental textbooks, monographs, and articles published in international scientific journals. Research by local and international scientists concerning the neurophysiological mechanisms of the sleep–wake cycle, biological rhythms, hormonal secretion, and autonomic regulation was also reviewed.

A systematic approach, comparative analysis, descriptive methods, and physiological analysis were used to examine the effects of sleep disorders on the human body. Normal physiological sleep was compared with the functional changes that occur during sleep deprivation. Particular attention was given to the role of the central nervous system in regulating sleep and wakefulness and to the theoretical significance of the hypothalamus and pineal gland in regulating biological rhythms.

One of the main areas of the study was the effect of sleep disorders on neuroendocrine function. For this purpose, scientific sources were analyzed to examine the physiological characteristics and circadian secretion patterns of biologically active substances such as melatonin, cortisol, growth hormone, leptin, and ghrelin, together with changes occurring during sleep deprivation. Special attention was paid to the role of the hypothalamic–pituitary–adrenal axis in stress responses and to the relationship between sleep and cortisol secretion.

The effects of sleep disorders on autonomic nervous system function were also examined. The physiological roles of the sympathetic and parasympathetic divisions, their participation in cardiovascular regulation, and their relationship with sleep stages were considered. Mechanisms

associated with changes in heart rate and arterial blood pressure during normal sleep, the relative increase in parasympathetic activity, and the decrease in sympathetic activity were analyzed. Scientific findings concerning autonomic imbalance and increased sympathetic activity during chronic sleep deprivation were also summarized.

The physiological characteristics of NREM and REM sleep and their relationships with central nervous system activity, hormonal regulation, and autonomic control were investigated. The alternation of sleep stages, increased growth hormone secretion during deep sleep, changes in brain activity during REM sleep, and fluctuations in autonomic parameters were analyzed using available scientific sources.

Scientific information concerning the effects of sleep deprivation on the cardiovascular system, metabolism, immune defense, memory, attention, and emotional stability was also reviewed. The relationships between sleep disorders and arterial hypertension, metabolic changes, insulin sensitivity, and stress responses were examined using comparative analysis.

The research materials were reviewed and synthesized through methods of generalization, analysis, and synthesis. Findings reported in different scientific sources were compared in order to identify the principal physiological pathways through which sleep disorders affect neuroendocrine and autonomic regulatory mechanisms. On the basis of the theoretical findings, the importance of sleep in maintaining homeostasis and ensuring hormonal balance and stable autonomic nervous system function was summarized.

This article is theoretical and analytical in nature. It uses previously published scientific studies and existing physiological data. No independent clinical observations, laboratory experiments, or measurements of hormonal parameters were conducted. The conclusions are based on the analysis and synthesis of scientific literature.

RESULTS

The effects of sleep disorders on neuroendocrine and autonomic regulatory mechanisms in the human body were analyzed theoretically, and several important physiological patterns were identified. The scientific literature reviewed indicates that sleep is essential for normal human functioning and for maintaining functional balance among the central nervous system, endocrine glands, and autonomic nervous system. Insufficient sleep or disruption of its physiological stages may cause a range of neurophysiological, hormonal, and autonomic changes.

The analysis showed that the hypothalamus plays an important role in regulating sleep and wakefulness. In particular, the suprachiasmatic nucleus functions as the body's biological clock and regulates circadian physiological rhythms. Its activity is closely linked to the alternation of light and darkness in the external environment. Disruption of biological rhythms may change the time of sleep onset, shorten nighttime sleep, and increase daytime sleepiness. The ventrolateral preoptic area of the hypothalamus also participates in initiating and maintaining sleep by suppressing wake-promoting centers through inhibitory neurotransmitters such as GABA and galanin.

The analysis of the effects of sleep disorders on the neuroendocrine system demonstrated the physiological importance of circadian hormonal secretion patterns. Melatonin, produced by the pineal gland, is one of the principal biological factors regulating the sleep–wake cycle. Its secretion increases in darkness at night and is suppressed by light. Prolonged exposure to artificial light in the evening may delay melatonin release and make it more difficult to fall asleep. As a result, the body's natural biological rhythms may become disrupted.

The importance of the hypothalamic–pituitary–adrenal axis in responses to sleep disorders was also identified. This system plays a major role in adaptation to stress and in regulating cortisol secretion. Under normal physiological conditions, cortisol levels are higher in the morning and relatively low in the evening and at night. Chronic insomnia and psychological stress may alter the circadian rhythm of this hormone. Such changes may be associated with increased sensitivity to stress, impaired metabolism, and reduced physiological adaptive capacity.

The effects of sleep on endocrine function are also reflected in the activity of growth hormone, leptin, and ghrelin. Growth hormone secretion increases particularly during deep NREM sleep. This hormone participates in cell growth, protein synthesis, the development of muscle and bone tissue, and restorative processes. Insufficient sleep may adversely affect its normal secretion rhythm. Leptin and ghrelin are important in regulating hunger and satiety; sleep deprivation may alter their balance, increase appetite, and disrupt energy metabolism.

Analysis of autonomic nervous system function showed that sleep is important for maintaining the balance between sympathetic and parasympathetic control. During normal NREM sleep, sympathetic activity decreases while parasympathetic influence becomes relatively stronger. Consequently, heart rate, arterial blood pressure, and certain metabolic parameters decrease. These processes support physiological rest of the cardiovascular system and bodily recovery. During REM sleep, autonomic activity is more variable, and temporary fluctuations in heart rate, respiration, and blood pressure may occur.

The findings indicate that chronic sleep deprivation may disrupt the functional balance of the autonomic nervous system. Increased sympathetic activity, relatively reduced parasympathetic regulation, and changes in heart rate variability may occur. This condition increases the functional load on the cardiovascular system. Prolonged sleep disturbances may affect the normal nocturnal decrease in blood pressure and may be associated with an increased risk of arterial hypertension.

The effects of sleep apnea on autonomic and neuroendocrine regulation were also considered. In obstructive sleep apnea, repeated narrowing or closure of the upper airway temporarily interrupts breathing. This may reduce blood oxygen levels, repeatedly fragment sleep, and activate the sympathetic nervous system. Repetition of these events may place additional strain on the cardiovascular system and contribute to increased blood pressure.

The scientific literature reviewed confirms that sleep disorders also have a significant effect on central nervous system function. Insufficient sleep may reduce the efficiency of memory, attention, thinking, and information processing. NREM and REM sleep play important roles in

memory consolidation, learning new information, and processing emotional information. Disruption of sleep architecture may therefore be associated with reduced intellectual performance, rapid fatigue, and a greater likelihood of errors in everyday activities.

The effects of sleep disorders on metabolic and immunological processes were also identified as important findings. Chronic sleep deprivation may be associated with changes in glucose metabolism, insulin sensitivity, and energy balance. Insufficient sleep may also affect certain inflammatory processes and immune responses. Over the long term, these changes may be associated with an increased risk of metabolic syndrome, obesity, and cardiovascular disease.

Overall, the scientific evidence reviewed demonstrates that sleep disorders have complex effects on the human body. Changes in hormonal secretion rhythms within the neuroendocrine system, disruption of the balance between sympathetic and parasympathetic control within the autonomic nervous system, and changes in central nervous system function are closely interconnected. Sleep disorders should therefore be regarded not merely as a reduction in sleep duration, but as an important physiological problem affecting the neurophysiological, hormonal, and autonomic regulation of the entire body.

DISCUSSION

The findings of this study confirm that sleep disorders have complex effects on neuroendocrine and autonomic regulatory mechanisms in the human body. The scientific evidence reviewed indicates that sleep is important not only for functional recovery of the central nervous system but also for coordinating endocrine gland activity, autonomic regulation, cardiovascular function, and metabolism. From this perspective, sleep disorders may be considered complex pathological processes affecting the activity of several physiological systems.

The hypothalamus occupies a central position in regulating the sleep–wake cycle. In particular, the activity of the suprachiasmatic nucleus in regulating biological rhythms is essential for normal sleep formation. Its response to the alternation of light and darkness coordinates melatonin secretion. If a person lives for a prolonged period under conditions that conflict with natural biological rhythms—for example, working at night or being exposed to artificial light for long periods at night—the sleep–wake cycle may become disrupted. This can disturb the balance between the body's internal biological clock and environmental conditions.

Analysis of the effects of sleep disorders on the neuroendocrine system indicates that hormonal regulatory mechanisms are directly related to sleep duration and quality. Melatonin and cortisol are particularly important for maintaining circadian biological rhythms. Melatonin facilitates sleep onset, whereas cortisol regulates daytime activity and the body's adaptive responses to stress. When the normal secretion rhythms of these two hormones are disrupted, falling asleep may become more difficult, nighttime awakenings may become more frequent, and daytime fatigue may increase. Changes in neuroendocrine function are therefore among the important mechanisms involved in the development and persistence of sleep disorders.

The activity of the hypothalamic–pituitary–adrenal axis is also closely associated with sleep disorders. Chronic insomnia may intensify stress responses and alter the circadian rhythm of cortisol secretion. Persistently elevated cortisol levels may adversely affect glucose metabolism, blood pressure, immune responses, and energy balance. There is also a bidirectional relationship between stress and insomnia: psychological stress reduces sleep quality, while insufficient sleep may increase the body's sensitivity to stressors.

The relationship between sleep and the autonomic nervous system is also of particular scientific importance. Under normal physiological conditions, sympathetic activity decreases during NREM sleep, while parasympathetic regulation becomes relatively predominant. As a result, heart rate and arterial blood pressure decrease and the body's overall functional load is reduced. During REM sleep, autonomic activity is more variable, and temporary fluctuations in heart rate and respiratory rhythm may occur. This indicates that different sleep stages have different effects on autonomic nervous system activity.

During chronic sleep deprivation, sympathetic nervous system activity may increase while parasympathetic regulation becomes relatively weaker. These changes increase the load on the cardiovascular system. In particular, reduced heart rate variability is an important physiological indicator for assessing changes in autonomic regulation. Persistently elevated sympathetic activity is associated with an increased risk of arterial hypertension and other cardiovascular diseases. Sleep disorders should therefore be considered an important factor affecting cardiovascular health.

The importance of sleep in hormonal regulation is also reflected in the activity of growth hormone, leptin, and ghrelin. Increased growth hormone secretion during deep NREM sleep supports growth and restorative processes. Insufficient sleep may affect the normal release rhythm of this hormone. An imbalance between leptin and ghrelin may increase appetite, alter eating patterns, and contribute to weight gain. This helps explain the physiological relationship between sleep disorders, obesity, and metabolic syndrome.

Pathological conditions such as sleep apnea have a particular role in disrupting neuroendocrine and autonomic regulation. Repeated interruptions of breathing during sleep reduce blood oxygen levels, trigger arousal responses in the brain, and activate the sympathetic nervous system. Repetition of these processes increases the load on the cardiovascular system. Sleep apnea should therefore be regarded not only as a respiratory problem but also as a pathological condition affecting autonomic and neuroendocrine regulation throughout the body.

The theoretical evidence also demonstrates the importance of the effects of sleep disorders on central nervous system function. During sleep, memory is consolidated, new information is processed, and mechanisms regulating emotional states are coordinated. Insufficient sleep may reduce attention, slow thinking, weaken memory performance, and cause emotional instability. In particular, chronic sleep deprivation may impair everyday functioning, learning ability, and work productivity.

The effects of sleep disorders on immunological and metabolic processes are another important issue. High-quality sleep supports normal immune system function and the body's protective mechanisms. Chronic sleep deprivation may be associated with changes in the activity of certain inflammatory mediators, impaired glucose metabolism, and reduced insulin sensitivity. Over time, these changes may create additional risk factors for the development of metabolic diseases.

Based on the scientific evidence analyzed, adherence to sleep hygiene, maintenance of biological rhythms, regular physical activity, stress reduction, and limiting exposure to artificial light in the evening are important for preventing sleep disorders. Going to bed and waking up at the same time every day helps stabilize circadian rhythms. Ensuring sufficient regular sleep in adults also supports the normal functioning of neuroendocrine and autonomic regulatory mechanisms.

Nevertheless, not all sleep disorders can be explained solely by lifestyle factors. In some cases, they may be associated with neurological, endocrine, cardiovascular, or psychiatric diseases. Therefore, medical evaluation is important when persistent insomnia, severe daytime sleepiness, or breathing disturbances during sleep occur.

Overall, the discussion confirms that sleep disorders affect neuroendocrine and autonomic regulatory systems in an interconnected manner. Changes in hormonal secretion rhythms, disruption of the balance between sympathetic and parasympathetic nervous system activity, metabolic alterations, and reduced functional activity of the central nervous system are among the principal physiological consequences of insufficient sleep. Sleep should therefore be regarded as an essential physiological factor in maintaining human health, and particular attention should be paid to the early identification and prevention of sleep disorders.

CONCLUSION

In conclusion, sleep is one of the essential physiological processes that ensure normal functioning of the human body and plays a particularly important role in coordinating the central nervous, neuroendocrine, and autonomic nervous systems. The scientific evidence reviewed confirms that sleep is not merely a means of physical and psychological rest; it is also an important factor in maintaining hormonal balance, regulating metabolic processes, restoring the cardiovascular system, and ensuring functional stability of the nervous system. Disruption of sleep duration or quality may adversely affect several physiological systems at the same time.

The synthesis of the research findings clarifies the important roles of the hypothalamus, suprachiasmatic nucleus, pineal gland, pituitary gland, and brainstem structures in regulating sleep and wakefulness. In particular, hypothalamic regulation of biological rhythms and melatonin production by the pineal gland are essential for normal sleep formation. Disruption of the natural alternation of light and darkness, prolonged exposure to artificial light at night, and irregular daily schedules may alter biological rhythms. Maintaining the body's natural circadian rhythms is therefore one of the important conditions for improving sleep quality.

Analysis of neuroendocrine regulatory mechanisms demonstrated that sleep is closely linked to the secretion of melatonin, cortisol, growth hormone, leptin, and ghrelin. Melatonin regulates the sleep–wake cycle; cortisol participates in the body's responses to stress; and growth hormone is important for tissue growth and repair. Leptin and ghrelin participate in regulating energy metabolism and appetite. Chronic insomnia may affect the normal secretion rhythms of these hormones, leading to changes in hormonal balance, impaired metabolic processes, and reduced adaptive capacity.

The study also established the importance of the effects of sleep disorders on the autonomic nervous system. During normal sleep, sympathetic activity decreases and the influence of the parasympathetic nervous system becomes relatively stronger. As a result, heart rate and arterial blood pressure decrease, the body's overall physiological load is reduced, and restorative processes become more active. In chronic sleep deprivation, sympathetic activity may increase while parasympathetic regulation becomes relatively weaker. This may increase cardiovascular strain and contribute to the risk of arterial hypertension and other cardiovascular diseases.

The effects of sleep disorders on central nervous system function, memory, attention, thinking, and emotional stability are also of considerable scientific and practical importance. NREM and REM sleep participate in information processing in the brain, memory consolidation, and the regulation of emotional processes. Sleep deprivation may reduce cognitive performance, make it difficult to maintain attention, and increase irritability, anxiety, and psychological stress. These effects may negatively influence everyday activities, learning, and work performance.

The findings also indicate that sleep disorders may affect metabolism and immune defense mechanisms. Prolonged sleep deprivation is associated with changes in glucose metabolism, insulin sensitivity, energy balance, and inflammatory processes. Ensuring high-quality sleep is therefore important not only for the functioning of the nervous and endocrine systems but also for maintaining overall metabolic and immunological health.

Based on the information reviewed in this article, adherence to a healthy lifestyle, development of good sleep hygiene, proper organization of the daily schedule, and preservation of biological rhythms are important for preventing sleep disorders. Going to bed and waking up at the same time every day, ensuring sufficient sleep duration for adults, limiting the use of electronic devices in the evening, engaging in regular physical activity, and reducing psychological stress can help improve sleep quality. When sleep disturbances persist, it is necessary to identify their causes and consult an appropriate specialist.

Overall, the effects of sleep disorders on neuroendocrine and autonomic regulatory mechanisms represent a complex, multidimensional physiological process. Changes in hormonal secretion rhythms, disruption of the balance between sympathetic and parasympathetic nervous system activity, metabolic alterations, and reduced central nervous system function are closely interconnected. Thus, ensuring normal sleep duration and quality is one of the essential conditions for maintaining homeostasis, supporting stable neuroendocrine and autonomic regulation, and

improving overall health. Further study of this area is important for better understanding the physiological mechanisms of sleep disorders, their early detection, and the development of effective preventive approaches.

REFERENCES

1. Hall J. E. Guyton and Hall Textbook of Medical Physiology. — 14th ed. Philadelphia: Elsevier, 2021.
2. Kryger M. H., Roth T., Goldstein C. A., Dement W. C. Principles and Practice of Sleep Medicine. — 7th ed.Philadelphia: Elsevier, 2022.
3. Smith P. C., Mong J. A. Neuroendocrine Control of Sleep. — Current Topics in Behavioral Neurosciences,2019. Vol. 43. P. 353–378.
4. Kim T. W., Jeong J. H., Hong S. C. The Impact of Sleep and Circadian Disturbance on Hormones andMetabolism. — International Journal of Endocrinology, 2015. DOI: 10.1155/2015/591729.
5. Leproult R., Van Cauter E. Role of Sleep and Sleep Loss in Hormonal Release and Metabolism. —Endocrine Development, 2010. Vol. 17. P. 11–21.
6. Watson N. F., Badr M. S., Belenky G. et al. Recommended Amount of Sleep for a Healthy Adult: A JointConsensus Statement of the American Academy of Sleep Medicine and Sleep Research Society. — Journal of Clinical Sleep Medicine, 2015. Vol. 11, No. 6. P. 591–592.
7. Benarroch E. E. Control of the Cardiovascular and Respiratory Systems During Sleep. — AutonomicNeuroscience, 2019.
8. Trinder J., Kleiman J., Carrington M. et al. Autonomic Activity During Human Sleep as a Function of Timeand Sleep Stage. — Journal of Sleep Research, 2001. Vol. 10. P. 253–264.
9. Somers V. K., Dyken M. E., Mark A. L., Abboud F. M. Sympathetic-Nerve Activity During Sleep in NormalSubjects. — New England Journal of Medicine, 1993. Vol. 328. P. 303–307.
10. Tobaldini E., Costantino G., Solbiati M. et al. Sleep, Sleep Deprivation, Autonomic Nervous System andCardiovascular Diseases. — Neuroscience and Biobehavioral Reviews, 2017. Vol. 74. P. 321–329.
11. Buysse D. J. Sleep Health: Can We Define It? Does It Matter? — Sleep, 2014. Vol. 37, No. 1. P. 9–17.
12. Carskadon M. A., Dement W. C. Normal Human Sleep: An Overview. — In: Principles and Practice of SleepMedicine. Philadelphia: Elsevier.
13. Boron W. F., Boulpaep E. L. Medical Physiology. — 3rd ed. Philadelphia: Elsevier, 2017.
14. American Academy of Sleep Medicine. International Classification of Sleep Disorders. — 3rd ed., TextRevision. Darien: AASM, 2023.
15. Morris C. J., Aeschbach D., Scheer F. A. J. L. Circadian System, Sleep and Endocrinology. — Molecular andCellular Endocrinology, 2012. Vol. 349, No. 1. P. 91–104.