



Overcoming Sleep Disorders By Medicinal Plants

¹Fadia Hameed Mohammed

²Eman Fadhel Abbas Awadh

^{1,2} Department Of Biology, College Of Science, Babylon University

Article history

Received: 4 / 6 /2023

Revised: 10 / 8 /2023

Accepted: 12 / 8 /2023

DOI: 10.36320/ajb/v15.i3.13572

*Corresponding Author:

Emails:

Sci.fadyah.hameed@uobabylon.edu.iq

Abstract: Sleep is one of the complex and important processes during which the direction of brain did many functions. Sleep disorders can be the cause of many diseases like hypertension, diabetes, obesity, depression, heart attack, and stroke. Without good and deep sleep, a defect will occur in many mental skills, such as attention, speed of response, focusing , and even a defect in memory. Rejuvenating of tissue , protein production and release of growth hormones It gets done during sleep. The nervous system and hormones control the biological clock which controls many vital processes in the body like sleep time .In this review we will focus on medicinal plants' role in getting rid of sleep disorders.

Keywords: Sleep disorder, Biological Clock, Hormones, Medicinal plants

1. Introduction

Sleep is a natural relaxation for living organisms, during which voluntary movements and a sense of what is happening in the environment are reduced [1]. Sleep cannot be considered a loss of consciousness but rather a change in the state of consciousness [2]. Sleep is one of the complex and important processes during which many complex activities occur at the level of the brain and the body in general, and some functions are more active during sleep and some diseases occur only during sleep and disappear with waking [1,2].

The importance of sleep appears through the negative effects of patients who suffer from sleep disorders, such as physical and psychological problems caused by an imbalance in the sleep process [3], and in fact sleep is affected by the daily body changes that occur within 24 hours. These changes are regulated through the nerves. That respond to light, hormones, and heat, which are also a component of the Biological Clock, which would naturally regulate the stages of sleep and waking [4]. Sleep disorders may be in the quality of sleep, its timing, or the length of time spent in it and all that related to both physical and psychological problems and also may be a symptom of mental illness [3, 4]. When a person sleeps, he passes through his sleep .

cycle in a cycle with different stages called the sleep cycle, and it is repeated during sleep several times to be what is called sleep cycles. It is repeated during sleep for several times to be what is called sleep cycles, and each one cycle in a cycle with different stages called the sleep cycle. It is repeated several times during sleep to be what is called a sleep cycle, and each cycle consists of five different stages [5]. The complete sleep cycle lasts about 90 minutes, and is usually repeated several times each night. The best awakening of a person is after the end of the cycle. But if a person wakes up during the deep sleep stage, he wakes up tired [5-6].

The cumulative effects of sleep loss and sleep disorders have been associated with a wide range of deleterious health consequences including an increased risk of hypertension, diabetes, obesity, depression, heart attack, and stroke [6]. Sleep disorders affect your quality of life by disrupting your thinking, school or work performance, mental and physical health [7]. Common sleep disorders prevent you from getting the restful, deep sleep you need to function at your best. Without sleep, you can't form or maintain the pathways in your brain that let you learn and create new memories, and it's harder to concentrate and respond quickly [7,8]. When we get enough sleep, Tissue regeneration also involves the manufacture of many proteins and the secretion of growth hormone, in addition to processing the information that was exposed to it during the day and storing memories [8].

Biological Clock (Circadian)

Living things have a biological clock, The biological clock is not a watch like we have distinguish hours from minutes, but it has a rhythm, but it is a regulator of many physiological processes in the body depending on the hours of the day and night like sleep time, having meals, changes in hormone levels and temperature in the body [9]. The biological and psychological changes that follow the cycle of the vital clock in 24 hours are known as the circadian rhythm and

rhythmic cycles of behavior, and they are subject to the control of time buffers and external influences. The nervous system and hormones control these rhythmic behavioral patterns [10].

The body's biological clock is controlled by the brain, which sends nerve signals to genes to make proteins, which are produced in waves that rise and fall throughout the day in a cycle that lasts 24 hours [11]. The master clock manages these circadian rhythms using a group of about 20,000 neurons called the nuclei found in the hypothalamus. This part of the brain is located above the optic nerve and produces hormones that govern sleep, body temperature, hunger, sex drive and other body actions [12].

This biological clock announces the beginning of the day between six and seven in the morning, with the rise of the hormone cortisol, which stimulates activity and tension, and this is accompanied by an increase in the secretion of glucose or blood sugar, which leads to charging the body with energy and alerting consciousness [12,13]. Studies have shown that physical and intellectual activity peaks during the early morning hours, and soon decreases between one and four in the afternoon, and rises again to reach the summit again at about six in the evening [13]. Then the pineal gland in the brain begins to secrete the hormone melatonin, which provides us with sleepiness gradually, at about nine o'clock at night, which continues until the morning, when its secretion is inhibited with the rising of the sun [14].

Hormones that influence sleep and wake times are:

Melatonin, serotonin and dopamine

Melatonin, serotonin, and dopamine are called happiness hormones, as well as all other happiness hormones and neurotransmitters [15]. The melatonin is also called the sleep hormone. The pineal gland in the brain produces these hormones; when sunlight is absent at night, the brain converts the amino acid tryptophan into the serotonin hormone,

and then it converts serotonin into melatonin to perform many tasks, the most prominent of which is aiding sleep and relaxation[16]. While in the daytime and in the presence of sunlight, the conversion of serotonin to melatonin stops, and thus serotonin is the dominant hormone during the day and is responsible for many tasks, as it acts as a neurotransmitter between cells and carries messages of the brain and intestine to the digestive and nervous system [15,16]. It controls the regulation of the two most extensive vital processes in the body (eating and thinking), in addition to its role in improving mood and helps to cope [16]. This strange hormone plays a role in regulating the sleep and wakefulness cycle in humans, and its activity is higher in the brain upon waking, while it is almost absent in periods of deep sleep [16,17]. Scientists have linked people with low levels of serotonin to spending less time sleeping than others, and what is known as restless leg syndrome, muscle spasms and insomnia are all related to low levels of this hormone. In the morning, the secretion of dopamine increases, suppressing the formation of melatonin, which leads to the feeling of inability to sleep [17].

Dopamine controls many body functions, transmitting signals between the brain and the body through nerve communication channels, where it is associated with feelings of euphoria, focus, and motivation, and it certainly does not stop there[18]. Dopamine plays a large role in various brain activities, as it affects the body's systems and function, including movement, sleep, learning, mood, memory, and focus(19).

Cortisol

Cortisol is known as a stress hormone, is produced by a complex network known as the pituitary-adrenal axis, and this hormone stimulates the pituitary gland to send out many hormones that have profound effects on the body, mind and sleep[20]. Cortisol levels reach their lowest in the middle of the night and begin to increase after waking up, reaching their highest level at nine in the morning [21]. The body responsible for stress by hormone

cortisol, which increases production in the body in the event of anxiety and psychological stress[20,21]. The increased cortisol concentration leads to a lack of sleep and insomnia, which is why stress and stress increase for people who suffer from lack of sleep more than others [22].

Adrenaline

One of the neurotransmitters in the body is adrenaline which secreted from adrenal gland[23], Also called fighting or fight and flight hormone because it is secreted in the body in emergency and crises in to make the body have a high level of energy. This hormone is secreted in cases of fear, panic, and psychological and nervous stress [22,23].

Adrenaline can last up to an hour after it's released[24].The secretion of the hormone adrenaline in the body for a short period and in response to an emergency and dangerous thing is okay. Still, our bodies sometimes excrete it because of working under some pressure or because of an inaccurate interpretation of a situation we live in[23,24], or specific diseases we may suffer from. The risk lies in the body's prolonged and long-term release of adrenaline with stress, which will result in insomnia, headache, weight gain and many other diseases [24].

Insulin

The hormone insulin works to deliver glucose to cells to burn or stimulates lipogenesis in the liver to store excess sugars in the form of fat [25]. It has been proven that the presence of disturbance in the hours of sleep and waking continuously leads to the occurrence of type II diabetes (insulin resistance) and high fat [26].

Ghrelin and leptin

The hormone ghrelin stimulates eating, and the hormone leptin suppresses this desire [27]. The presence of sleep disturbances reduces the levels of the hormone leptin and increases the levels of the hormone ghrelin, which explains the desire of people who suffer from sleep disorders to eat food[28].

The role of medicinal plants in overcoming sleep problems and disorders

Many medicinal plants, known for their role in getting rid of sleep disorders, help us by working with one or more of the following mechanisms.

1- Being a rich source of tryptophan, tryptophan is an essential amino acid that the body needs to build proteins. It is the main component of serotonin, which increases levels of the sleep hormone (melatonin) at night, which helps produce healthy sleep patterns[29]. The body cannot make tryptophan alone, so eating some medicinal plants rich in this amino acid can regulate sleep [30].

2- It is rich in one of the following elements, which have an important role in regulating sleep:

A- Magnesium: Magnesium helps in muscular and nervous relaxation by stimulating the autonomic nervous system, which helps the body relax and prepare for sleep in addition to the role of this mineral in stimulating the hormone melatonin, which regulates the sleep cycle and thus helps us get a deep and sound sleep [31].

B- Iron: Iron helps transport oxygen to all parts of the body, so a deficiency in the iron level leads to a feeling of fatigue when sleeping [32,33].

C- Calcium: Calcium deficiency, known as REM sleep, can disrupt the dreaming cycle [33].

3- It is rich in one of the following vitamins, which have an important role in regulating sleep:

A- Vitamin D: Vitamin D deficiency leads to a lack of absorption of calcium and phosphate in the body, which causes rickets in children, or osteoporosis in adults[34]. Deficiency of this vitamin is one of the most important factors causing sleep disorders. Mushrooms are the only vegetable source containing vitamin D, and the amount of vitamin D found in mushrooms varies according to type (35).

B- Vitamin B12: Vitamin B12 maintains the health of the body's nerve and blood cells and helps the body generate energy. Vitamin B12 deficiency causes fatigue, sleep disturbances, numbness and tingling in the hands and feet, and other symptoms[35,36].

C- Vitamin C: Vitamin C deficiency leads to sleep problems, such as waking up several times and being unable to sleep well [36].

3.Conclusion

Medicinal plants can get rid of sleep disorders by many mechanisms. It can be a rich source of tryptophan (precursor of serotonin and melatonin), which helps produce deep and healthy sleep, and it can be a source of elements, which have an important role in regulating sleep like magnesium, Iron and Calcium. In addition to that, many medicinal plants provide our body with necessary vitamins like :Vitamin D ,Vitamin B12 and Vitamin C, which its deficiency is one of the causes of sleep disorders.

References

1. Leproult, R.; Van Cauter, E. (2010) Role of sleep and sleep loss in hormonal release and metabolism. *Endocr. Dev.* (2010), 17, 11–21.
2. Chaiard J, Weaver T. (2019) Update on research and practices in major sleep disorders: Part II-insomnia, Willis-Ekbom disease (Restless Leg Syndrome), and narcolepsy. *J Nurs Sch.* 2019;51(6):624-633.
- 3 Rasch B, Pommer J, Diekelmann S et al. (2009) Pharmacological REM sleep suppression paradoxically improves rather than impairs skill memory. *Nat Neurosci.* 2009; 12 : 396 – 397
- 4 Genzel L, Dresler M, Wehrle R. (2009) Slow wave sleep and REM sleep awakenings do not affect sleep dependent memory consolidation. *Sleep.* 2009; 32 : 302 – 310
- 5 Plihal W, Born J. (1997) Effects of early and late nocturnal sleep on declarative and

procedural memory . *J Cogn Neurosci* .1997 ; 9 : 534 – 547

6 Medic G, Wille M, Hemels M. (2017) Short- and long-term health consequences of sleep disruption. *Nat Sci Sleep*. 2017;9:151-161.

7 Kalmbach D, Anderson J, Drake C. (2018)The impact of stress on sleep: pathogenic sleep reactivity as a vulnerability to insomnia and circadian disorders. *J Sleep Res*. 2018;27(6).

8 Koo B. (2015)Restless leg syndrome across the globe: epidemiology of the restless legs syndrome/Willis-Ekbom disease. *Sleep Med Clin*. 2015;10(3):189-205.

9 Kim, T. W. (2015)The Impact of Sleep and Circadian Disturbance on Hormones and Metabolism. *International Journal of Endocrinology*. 2015. 62, 302–310.

10 Steiger A . (2007)Neurochemical regulation of sleep . *J Psychiatr Res*. 2007 ; 41 : 537 – 552

11. Schaedel, Z.; Holloway, D.; Bruce, D.; Rymer, J. (2021) Management of sleep disorders in the menopausal transition. *Post. Reprod. Health* .2021, 27, 209–214.

12 Saper CB , Chou TC , Scammell TE . (2001) The sleep switch: hypothalamic control of sleep and wakefulness . *Trends Neurosci* .2001 ; 24 : 726 – 731

13. Brown, R.E.; Basheer, R.; McKenna, J.T.; Strecker, R.E.; McCarley, R.W. (2012)Control of Sleep and Wakefulness. *Physiol. Rev*. 2012, 92, 1087–1187.

14 Morris, C. J. (2008)Circadian System, Sleep and Endocrinology. *Molecular and Cellular Endocrinology*. 2018, 11, 129–136 .

15. Afonso, P.; Figueira, M.L.; Paiva, T. (2007)Sleep-promoting action of the endogenous melatonin in schizophrenia compared to healthy controls. *Int. J. Psychiatry Clin. Pract*. 2011, 15, 311–315.

16. Bersani, G.; Mameli, M.; Garavini, A.; Pancheri, P.; Nordio, M. (2003) Reduction of night/day difference in melatonin blood levels as a possible disease-related index in schizophrenia. *Neuro Endocrinol. Lett*. 2003, 24, 181–184.

17. Park, H.J.; Park, J.K.; Kim, S.K.; Cho, A.R.; Kim, J.W.; Yim, S.V.; Chung, J.H. (2011)Association of polymorphism in the promoter of the melatonin receptor 1A gene with schizophrenia and with insomnia symptoms in schizophrenia patients. *J. Mol. Neurosci*. 2011, 45, 304–308.

18. Frye, C.A.; Sora, I. (2010)Progesterone reduces hyperactivity of female and male dopamine transporter knockout mice. *Behav. Brain Res*. 2010, 209, 59–65.

19 .Schier T , Guldner J , Colla M *et al*. (2007)Changes in sleep-endocrine activity after growth hormone-releasing hormone depend on time of administration . *J Neuroendocrinol* 2007 ; 9 : 201 – 205.

20. Held K , Antonijevic I , Murck H *et al*. (2006)Neuropeptide Y (NPY) shortens sleep latency but does not suppress ACTH and cortisol in depressed patients and normal controls . *Psychoneuroendocrinology* 2006 ; 31 : 100 – 107

21. Kluge M , Schüssler P , Zuber V *et al*. Ghrelin enhances the nocturnal secretion of (2007)cortisol and growth hormone in young females without influencing sleep . *Psychoneuroendocrinology* .2007 ; 32 : 1079 – 1085

22. Kluge M , Schüssler P , Dresler M *et al*. (2011) Effects of ghrelin on psychopathology, sleep and secretion of cortisol and Adrenaline in patients with major depression . *J Psychiatr Res* .2011 ; 45 : 421 – 426

23. Davidson, J. R. . (2020)Adrenaline and Cortisol Secretion in Relation to Sleep and Wakefulness. *Journal of Psychiatry and Neuroscience*. 2020 ; 22 : 513 – 517

24. Kluge M , Schüssler P , Zuber V *et al*. Ghrelin administered in the early morning increases secretion of cortisol, adrenaline and growth hormone without affecting sleep . *Psychoneuroendocrinology*. 2007 ; 32 : 287 – 292

25. Reynolds, A. C. (2012)Impact of Five Nights of Sleep Restriction on Glucose Metabolism, Leptin and Testosterone in Young Adult Men.*journal of Physiology*,

Endocrinology and Metabolism.2012.32,102-112.

26. Weikel, J. C. (2018)Insulin Promotes Slow-Wave Sleep in Humans. American Journal of Physiology, Endocrinology and Metabolism. 2018. ; 39 : 385 – 292

27. Weikel JC , Wichniak A , Ising M *et al.* (2003)Ghrelin promotes slow-wave sleep in humans . Am J Physiol – Endocrinol Metab .2003 ; 284 : E407 – E415

28. Kluge M , Gazea M , Schüssler P *et al.* (2010)Ghrelin increases slow wave sleep and stage 2 sleep and decreases stage 1 sleep and REM sleep in elderly men but does not affect sleep in elderly women . Psychoneuroendocrinology 2010 ; 35 : 297 – 304

29. Farag N, Mills P. (2003) A randomized-controlled trial of the effects of a traditional herbal supplement on sleep onset insomnia. Complement Ther Med. 2003;11(4):223-225.

30. Welz, A.N.; Emberger-Klein, A.; Menrad, K. (2018)Why people use herbal medicine: Insights from a focus-group study in Germany. BMC Complementary Altern. Med. 2018, (18):520-528.

31. Zhang, H., Liu, P., Wu, X., Zhang, Y., & Cong, D.. (2019)Effectiveness of Chinese herbal medicine for patients with primary insomnia: A PRISMA-compliant meta-analysis. Medicine, 2019.98(24), 159 -167.

32. Taslaman, M. (2014)The efficacy and safety of herbal medicine for insomnia in adults: an overview of recent research. Australian Journal of Herbal Medicine,2014. 26(3), 86-93.

33. Antoniadou, J., Jones, K., Hassed, C., & Piterman, L. (2012) Sleep... Naturally: A Review of the Efficacy of Herbal Remedies for Managing Insomnia. Alternative and Complementary Therapies, 2012. 18(3), 136-140.

34. Donath F, Quispe S, Diefenbach K, Maurer A, Fietze I, Roots I. Critical evaluation of the effect of valerian extract on sleep structure and sleep quality. Pharmacopsychiatry. 2000;33(2):47-53. 37.

35. Frass, M.; Strassl, R.P.; Friehs, H.; Mullner, M.; Kundi, M.; Kaye, A.D. (2012)Use and acceptance of complementary and alternative medicine among the general population and medical personnel: A systematic review. Ochsner J. 2012, 12, 45–56.

36. Dave, P. H., Vishnupriya, V., & Gayathri, R. (2016) Herbal Remedies for Anxiety,sleep disorder and Depression-A Review. Research Journal of Pharmacy and Technology.2016. 9(8), 1253.