Mini Review

Journal of
Obstetrics and Gynecological Surgery

Gupta PD, J Obst Gynecol Surg 2022, 3:1

Sexual Dimorphism in Sleep: A Mini-Review

P D Gupta*

Former Director Grade Scientist, Centre for Cellular and Molecular Biology, Hyderabad, India

Correspondence to: Former Director Grade Scientist, Centre for Cellular and Molecular Biology, Hyderabad, India
Received date: June 09, 2022; **Accepted date:** June 20, 2022; **Published date:** June 28, 2022
Citation: Gupta PD (2022) Sexual Dimorphism in Sleep: A Mini-Review. J Obst Gynecol Surg 3(1): pp. 13-15. doi: 10.52916/jogs224025

ABSTRACT

Morphologically sexual dimorphism is well characterised in *Homo sapiens.* This also reflects in many of their physiological activities too; among those, sleep is one. Sleep differences between human male and female is a comparatively new area and drawn attention of the scientists recently. In this short review, we have taken two aspects namely, endocrinological, which is well established factor and the other one which is less defined, the microbial content. Recent researches have shown the michrobial contents are also regulated by hormonal milieu and therefore, directly or indirectly hormones play the role in sleep sexual dimorphism.

Keywords:

Hormonal milieu, Microbiota, Menstrual cycle, Low estrogen, Sleep apnea, Immune system, Epigenetics.

Introduction

Sexual dimorphism in the two sexes of the same species is widespread in nature. Evolutionary-developmental biologists have shown how sexually dimorphic traits arise, and ecologists have shown the importance of such traits in nature. An important future goal is to bridge the findings of these two disciplines. Sexually dimorphic phenotypes are a universal phenomenon and it also exists in human species [1,2]. Sleep takes up around one third of the lifespan in many humans. Sleep differences between male and female (sexually dimorphic sleep) is a comparatively new area and drawn attention of the scientists recently. However, the internal regulation mechanism of sleep difference is still unclear. In general, many factors regulate sleep cycle include medical conditions, medications [3], stress, sleep environment, and diet and drink. In addition to these exposure to light perhaps has the greatest influence on sleep. Sleep hormone-melatonin and its regulators and microbiota are also sleep regulators. Endocrinology of sleep is a open chapter in sleep research numerous endocrine factors can affect sleep quantity and quality, while studies have shown a profound effect of sleep behaviour on overall endocrine function and stability [4,5].

Frequently, women are more likely than men to report difficulty maintaining sleep, feeling unrefreshed in the morning, and excessive daytime sleepiness [6]. Obstructive sleep apnea, however, is more prevalent in men [7]. Other sleep regulatory factors being similar in both sexes in humans however there is a sea difference in the hormonal and micro organism milieu are different in males and females. Therefore our stress will be more on hormonal and microbiological factors.

Endocrinological Sexual Dimorphism in Sleep

Various hormones such as peptides and steroids participate in sleep regulation. It looks like that change in the ratio between Growth Hormone-Releasing Hormone (GHRH): Corticotropin-Releasing Hormone (CRH) results in changes of sleep-endocrine activity may be the same in both the sexes. However, gonadal hormones which participate in sleep regulation are responsible for sexual dimorphism [8]. In sleep research to combat with low estrogen levels, estrogen replacement therapy and to deal with elevated secretion of hypothalamic Corticotropin-Releasing Hormone (CRH). CRH-1 receptor antagonism is used. Melatonin is commonly known as the sleep hormone and plays an important role in regulating human sleep It's produced by the pineal gland. It is produced only in dark. We have shown earlier that estrogen-the hormone synthesised in the ovaries is inversely proportional to melatonin [9].

Because of painful menstrual cramps (dysmenorrheal) sleep quality is significantly poor [11,12]. Further, sleep quality differs in different phases of the cycle, more disrupted in the luteal phase better in the follicular phase in menstruating female. The luteal phase changes also include reduced rapid eye movement sleep and blunted temperature rhythm amplitude. Reduced sleep time is associated with irregular menstrual cycles, in turn that impacts reproductive health. For female insomniac patients, the menstrual cycle phase and menstrual-related disorders should be also be considered [13,14]. During pregnancy and postpartum conditions, Sleep disruption is nearly universal; however, effective and practical countermeasures are available.

The hormone levels of a woman fluctuate dramatically, causing night sweats and hot flashes, which can wake the brain during sleep, as she nears menopause. In addition, lower levels of progesterone make some women irritable and less able to relax [15]. The low estrogen condition in menopause contributes to disrupted sleep by causing menopausal symptoms from hot flushes and vasomotor symptoms to anxiety and depressed mood. Anxiety is another leading condition for getting to sleep, and depression leading to non-restorative sleep and early morning wakening [16]. But there is no such phenomenon exists in males.

Sleep deprivation has been associated with multiple physiological changes, including increased cortisol and ghrelin levels, decreased leptin levels and impaired glucose metabolism. Insomnia is considerably more common in women than men Higher rates of insomnia in women have been found in numerous studies and some estimates place the lifetime risk of insomnia as 40% higher in women. Insomnia experienced by women may differ from men. Women suffer from insomnia

at nearly twice the rate of men due to the physiology female hormones play. Low estrogen levels typically cause insomnia, because estrogen helps move magnesium into tissues, which is crucial for catalyzing the synthesis of important sleep neurotransmitters, including melatonin [17].

Microbiota and Sleep

The gut microbiota of each individual is unique. It participates in various physiological, immunological, psychological and neurological processes taking place in the body. The gut microbiota contains over 3 million genes, which make it 150 times more genetically varied than the human body. There is a close connection between intestinal health and healthy brain function. New research from the University of Tsukuba in Japan suggests that gut bacteria may also influence normal sleep patterns by helping create important chemical messengers in the brain, such as serotonin and dopamine

The gut microbiota can also very much influence sleep quality. Previous studies have yielded conflicting results on sleep deprivation and the human gut microbiota. For example, Brittany A Matenchuk et al. advocated that, Both sleep fragmentation and short sleep duration are associated with gut dysbiosis which may be due to activation of the HPA-axis. In a recent study it has been shown that sleep deprivation leads to changes in composition of gut microbiota while in an another study found that sleep deprivation does not lead to changes in gut microbiota. Therefore, the relationship between physiology of sleep and the gut microbiota remains unclear [18]. Recently, it has been reported that melatonin can modulate specific gut microbiota activity and abundances [19]. It has been shown that melatonin can influence the swarming and motility of human intestinal bacteria, especially *Enterobacter aerogenes* [19,20].

In general, Sleep quality and duration is associated with several aspects of cognitive and neurobehavioral performance [21-23] and several diseases including cancer [25], type II diabetes [26] and Alzheimer's disease [27]. Notably, cytokines represent a potential critical interface between sleep physiology and gut microbiome composition.. Notably, cytokines represent a potential critical interface between physiology of sleep and composition of gut microbiota. The microbiota plays important role in [1] developing immune system [28] which in turn linked to sleep . In humans, sexual dimorphism in the immune response [2] has been well demonstrated. Females exhibit lower infection rates than males for a variety of bacterial, viral, and other parasitic pathogens. There is also a substantially increased incidence of autoimmune disease in females compared to males [2]. This is due to the role of sex hormones and epigenetic factors [29].

Funding

No.

References

1. Williams T, Carroll S (2009) Genetic and molecular insights into the development and evolution of sexual dimorphism. Nat Rev Genet 10(11): pp. 797-804.

2. Mallampalli MP, Carter CL (2014) Exploring sex and gender differences in sleep health: A Society for Women's Health Research Report. J Womens Health (Larchmt) 23(7): pp. 553-562.

3. Phillips BA, Collop NA, Drake C, et al. (2008) Sleep disorders and medical conditions in women. Proceedings of the Women and Sleep Workshop, National Sleep Foundation, Washington, DC, March 5-6, 2007. J Womens Health (Larchmt) 17(7): pp. 1191-1199.

4. Morgan D, Tsai SC (2015) Sleep and the endocrine system. Crit Care Clin 31(3): pp. 403-418.

5. Leproult R, E Van Cauter EV (1999) Impact of sleep debt on metabolic and endocrine function Lancet. 354(9188): pp. 1435-1439.

6. Lindberg E, Janson C, Gislason T, et al. (1997) Sleep disturbances in a young adult population: can gender differences be explained by differences in psychological status? Sleep 20(6): pp. 381-387.

7. Paul KN, Turek FW, Kryger MH (2008) Influence of Sex on Sleep Regulatory Mechanisms. J Womens Health (Larchmt) 17(7): pp. 1201-1208.

8. Mong JA, Baker FC, Mahoney MM, et al. (2011) Sleep, rhythms, and the endocrine brain: Influence of sex and gonadal hormones. J Neurosci 31(45): pp. 16107-16116.

9. Jagota A, Olcese J, Rao SH, et al. (1999) Pineal rhythms are synchronized to light–dark cycles in congenitally anophthalmic mutant rats. Brain Res 825(1-2): pp. 95-103.

10. Gupta PD (2022) Menstrual cycle effects on sleep. Clin J Obstet Gynecol 5(2): pp. 42-43.

11. Hachul H, Andersen ML, Bittencourt LRA, et al. (2010) Does the reproductive cycle infl uence sleep patterns in women with sleep complaints? Climacteric 13(6): pp. 594-603.

12. de Zambotti M, Willoughby AR, Sassoon SA , et al. (2015) Menstrual Cycle-Related Variation in Physiological Sleep in Women in the Early Menopausal Transition. J Clin Endocrinol Metab 100(8): pp. 2918-2926.

13. Baker FC, Lee KA (2018) Menstrual Cycle Effects on Sleep. Sleep Med Clin 13(3): pp. 283-294.

14. Moline ML, Broch L, Zak R, et al. (2003) Sleep in women across the life cycle from adulthood through menopause. Sleep Med Rev 7(2): pp. 155-177.

15. Lee KA and Kryger MH. Women and sleep. J Womens Health (Larchmt) 17: pp. 1189–1190.

16. Cusmano DM, Hadjimarkou MM, Mong JA (2014) Gonadal steroid modulation of sleep and wakefulness in male and female rats is sexually differentiated and neonatally organized by steroid exposure. Endocrinology 155(1): pp. 204–214.

17. Krishnan V, Collop NA (2006) Gender differences in sleep disorders. Curr Opin Pulm Med 12(6): pp. 383-389.

18. Zhang B, Wing YK (2006) Sex differences in insomnia: A meta-analysis. Sleep 29(1): pp. 85-93.

19. Smith RP, Easson C, Lyle SM, et al. (2019) Gut microbiome diversity is associated with sleep physiology in humans. PloS one 14(10): p. e0222394.

20. Paulose JK, Wright JM, Patel AG, et al. (2016) Human gut bacteria are sensitive to melatonin and express endogenous circadian rhythmicity. PLoS One 11(1): p. e0146643.

21. Park YS, Kim SH, Park JW, et al. (2020) Melatonin in the colon modulates intestinal microbiota in response to stress and sleep deprivation. Intest Res 18(3): pp. 325-336.

22. Gobin CM, Banks JB,Fins AI, et al. (2015) Poor sleep quality is associated with a negative cognitive bias and decreased sustained attention. J Sleep Res 24(5): pp. 535-542.

23. Lo JC, Groeger JA, Cheng GH, et al. (2016) Self-reported sleep duration and cognitive performance in older adults: a systematic review and meta-analysis. Sleep Med 17(1): pp. 87-98.

24. Ferrie JE, Shipley MJ, Akbaraly TN, et al. (2011) Change in sleep duration and cognitive function: findings from the Whitehall II Study. Sleep 34(5): pp. 565-573.

25. Kakizaki M, Kuriyama S, Sone T, et al. (2008) Sleep duration and the risk of breast cancer: the Ohsaki Cohort Study. Br J Cancer 99(9): pp. 1502-1505.

26. Yaggi HK, Araujo AB, McKinlay JB (2006) Sleep duration as a risk factor for the development of type 2 diabetes. Diabetes Care 29(3): pp. 657-661.

27. Ju Y-ES, Lucey BP, Holtzman DM, et al. (2014) Sleep and Alzheimer disease pathology-A bidirectional relationship. Nat Rev Neurol 10(2): pp. 115-119.

28. Gupta PD, Tyagi S (2020) Development of Immune system from New born to Adult: A New Insight. J Cell Tissue Res 20(1): pp. 6853-6860.

29. Shepherd R, Cheung AS, Pang K, et al. (2021) Sexual Dimorphism in Innate Immunity: The Role of Sex Hormones and Epigenetics Front Immunol 21(1): p. 604000.