

## Effects of Steroid Hormones on Sleep Disorders

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### Abstract

Sleep disorders, like insomnia and other negative changes, are very commonly seen worldwide and management of them remains quite challenging. Sleep disorders can occur because of many factors like health problems, excessive stress and nowadays the statistics show us that there is a considerably increasing rate of sleep disorders among people especially more common in the United States. In fact, more than 75 percent Trusted Source of Americans between ages 20 and 59 report having sleeping difficulties. The lack of sleep can have a negative impact on energy, mood, concentration, and overall health. Sleeping disorders can affect one's quality of life and general well-being. Depending on the type of sleep disorder people may have a difficult time falling asleep and may feel extremely tired throughout the day. Sleeping disorders can have different risk factors like as: allergies and respiratory problems, nocturia, chronic pain, stress, anxiety, or even can be the sign of other body disorders. The aim of this review article is to addresses sleep and the sleep disorders associated with steroid hormones and briefly the role of these hormones in alleviating these disorders. In the search of the sleep substance, many studies show the different hormones which they are responsible for the regulation of the sleep cycle. In this review article, we noticed the participation of steroid hormones, besides its regulation role of sexual behavior, can be effective in the sleep process. As an important example of sexual steroid hormones, estrogen and progesterone alternate the sleep patterns associated with the hormonal cycles of women throughout life, from puberty to menopause and specific times like pregnancy and the menstrual cycle, including being responsible for some sleep disorders like as insomnia. Another hormone is cortisol which is a hormone released in stressful situations, and also known as the hormone of awakening because the maximum release of it occurs in the morning.

**Keywords:** Sleep disorders; Insomnia; Steroid hormones; Sex hormones; Cortisol

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### Introduction

Sleep is a vital function of living species, comprising one-third of human life [1]. From a neurophysiological standpoint, sleep is classified into rapid eye movement sleep (REM) and non-rapid eye movement (NREM) sleep. REM is divided by rapid eye movement and decreased muscle tone during sleep. NREM is categorized into four stages [2]. The first two phases of NREM sleep (phases 1 and 2) are light and often alternate with short waking episodes. Two deeper phases of NREM sleep (phases 3 and 4) together known as slow wave sleep (SWS) tend to manifest mainly in the earlier part of the night and become lighter thereafter [3]. Light sleep usually initiates in stage 1 and meets its deepest in stages 3 and 4 of NREM sleep. This is then proceeded by the first episode of REM sleep after about 90 min. About 75-80% of total sleep is spent in NREM sleep. Normal sleep during the

night typically takes place in four to six cycles, with each cycle lasting about 90–110 min, alternating between REM and NREM sleep. Sleep is managed by two significant mechanisms, the homeostatic process, which relies on the amount of prior sleep and wakefulness, and the circadian process, which fundamentally is driven by an endogenous circadian pacemaker, producing almost 24-h cycles. The primary regulation of the circadian sleep-wake cycle is the suprachiasmatic nucleus which, in turn, is controlled by the hypothalamus [2]. Sleep requirements vary with age. Poor or insufficient sleep has been related to multiple medical issues in most body systems, such as mood disorders, cardiovascular, metabolic, endocrine, neurological diseases and obesity. Furthermore, sleep deprivation has many adverse effects on humans, particularly on the hormonal profile and possibly on sexual life [1]. The International Classification of Sleep Disorders (ICSD-2) classified sleep disorders into eight major categories:

insomnia, hypersomnias of central origin, parasomnias, sleep-related breathing disorders, sleep-related movement disorders, and circadian rhythm disorders [4]. Sleep disorders are highly common in the general population and can result in serious morbidity. Sleep disturbances lasting at least several nights per month have been reported by 30% of the population. Sleep disorders may cause or worsen preexisting medical and psychiatric diseases and are associated with high rates of anxiety, depression, and impaired daytime functioning. They may also result in motor vehicle accidents, heightened pain perception, endocrine and cardiovascular disorders, or poor occupational performance [1]. The main purpose of the present article is to provide a comprehensive summary of the associations between steroid hormones and sleep disorders, depicting how steroid hormones can influence sleep conditions in both sexes.

## Method

A literature search was undertaken of international databases (PubMed, Google Scholar and Web of Science) to provide a comprehensive overview of existing research evidence about the interactions between sleep disorders and steroidal hormones. The search strategy involved the primary keyword "sleep" combined with "hormones", "steroid", "sleep apnea", "sleep deficiency", and/or "sex hormones". Only papers written in English were included; publication date was not restricted. During the study, had some care as, inspect the dates of papers (for they had the most accurate and updated information possible) and ensured to its trustworthiness through the databases referred to. In this research article, it will start with the definition of some sleep disorders and their risk factors.

**Insomnia:** Insomnia is defined as the disorder that causes the person feel difficulty to sleep, even in the case that the person has this chance to sleep. People with insomnia can feel dissatisfied with their sleep rhythm and usually experience some symptoms such as fatigue, difficulty concentrating, low energy level, mood disturbances, and decreased performance in work. Insomnia may be characterized based on its duration. Acute insomnia is often happening because of life circumstances. Many people might have experienced this type of passing sleep disruption, and it tends to resolve without any treatment. Chronic insomnia is disrupted sleep that happens at least three nights per week and lasts at least three months. Chronic insomnia disorders can have many causes. Insomnia results due to an imbalance between sleep-inducing neurotransmitters.

**ASWPD:** Advanced sleep-wake phase disorder (ASWPD) is a circadian rhythm sleep-wake disorder which in this condition the quality and duration of the sleep in a person is normal but sleep-wake times are earlier than desired or earlier than socially acceptable times. Patients often force themselves to stay awake in the evenings but continue to wake up early, thereby accumulating sleep debt and excessive daytime sleepiness [5].

**DSWPD:** Delayed sleep-wake phase disorder (DSWPD) is defined as a sleep disorder that can start during childhood, but it is usually happening in adolescence people. There are a variety of symptoms that is related to this disorder; the symptoms are included changing mood like depression or anxiety, "Secondary

insomnia" that is resulting from a chronic inability to sleep for some hours after getting into the bed. This may be the major sleep complaint in children and adolescents with DSWPD. The scientists conducted many researches about the cause of this disorder but the etiology factors of DSWPD are not completely known. Children who are natural "night owls" are also more at the risk to develop DSWPD. There also may be a genetic contribution that can cause the development of DSWPD (some 40 percent of those affected have a family history of the disorder) many other factors may be potential contributors, including the early morning demands, late evening activities and so on. For the DSWPD and ASWPD, there are some confirmatory evaluations that are included the sleep log, actigraphy; that is known as a non-invasive method that its usage is for monitoring human resting or activity cycles, and the other confirmatory evaluation is checking out the melatonin hormone. Maintaining a consistent circadian rhythm is important for the general health of the body. Inconsistent eating and sleeping patterns can throw off the circadian rhythm and increase the risk of developing some diseases. Likewise, not getting enough sleep can affect the body's physical and mental well-being [6,7].

There is a close link between sleep and hormones. When women become pregnant. Pregnancy is associated with reproductive hormonal changes, estrogen and progesterone, which increase in level throughout pregnancy and peak at term. The hormonal increase can be related to some changes in the sleep cycle of the pregnant woman, often resulting in an increase in the time of sleeping and daytime napping. In this time distribution of sleep stages, deep sleep and REM sleep may also happen. Developing physical changes in the latter stages of pregnancy (third trimester) has also been proposed to disturb sleep in the majority of women. Similarly, during the menopause, sleep disturbance and insomnia symptoms are very common, and have been linked to decreased levels of estrogen and associated hot flashes.

Testosterone hormone is another sex hormone which can have an impact on the sleep cycle in both men and woman. In men the level of the testosterone decrease by increasing the age which can determine many physiological changes such as change is sleep time, change in sexual activity and also change of the amount of the hormone which is released. With aging, significant declines in sleep duration, the bioavailability of testosterone and DHEA concentrations, coital frequency, engagement in masturbation, and frequency of masturbation were noted [8].

Independent of age, sleep duration was positively associated with testosterone levels. In this fashion, some of the age-related changes in muscle mass, bone mineral density, fat mass, and sexual and cognitive functions resemble those observed in young, hypogonadal men [9].

With respect to how these functions affect testosterone, the log-linear increase with sleep suggests that sleep length is crucial for testosterone levels; short sleep reduces testosterone, and long sleep has the opposite effect [10].

Hormones are chemicals released by the gland or cell which can have an effect on other parts of the body. Many hormones are participating in sleep and circadian rhythmicity. There is a

complex relationship between sleep and reproductive hormones. Moreover, phase changes through the menstrual cycle as well as transition into the menopausal status seem to be associated with changes in sleep patterns [11] and/or with disturbed sleep [12] as a result of modifications in sex steroid hormone profiles. Indeed, sleep complaints are very common among menopausal women who do not receive a hormone replacement therapy [11], and estrogen replacement therapy usually improves sleep because of its powerful effects on several biological factors that directly influence sleep [12,13]. Moreover, the soporific effect of P has been documented in various clinical situations, especially during pregnancy [13]. Conversely, the influence of sleep on the central nervous regulation of endocrine secretion has been presumed to exist since several decades ago. Reproductive hormone secretion in teenagers as in women during their fertile years was shown to be influenced by sleep [14]. Indeed, gonadotropin [15] and PRL secretion seemed to be sleep-dependent, and some observations indicated that LH and  $E_2$  concentrations increased during partial sleep deprivation [16]. Moreover, hormone secretion during sleep may be modified according to the cycle phase; it was observed that during the early follicular phase and the early luteal phase of the cycle, the frequency of gonadotropin pulsation is reduced at night in association with sleep [14], where as LH pulse amplitudes are increased [15,17]. Besides, sleep interacts also with a series of factors that intervene in hormone secretion such as obesity [18], age, and lifestyle habits, including smoking, sports practice, and so on [19].

Testosterone and estrogen are reported to play key roles in influencing sexual desire in women, whereas progesterone has been implicated in enhancing receptivity [20]. Testosterone levels increase during sleep and decrease during waking hours. Research has shown that the highest levels of testosterone happen during REM sleep, the deep, restorative sleep that occurs mostly late in the nightly sleep cycle. Women, like men, are also likely to find their sexual lives negatively affected by obstructive sleep apnea. Many researches show that there are strong correlations between obstructive sleep apnea and sexual dysfunction in women. As obstructive sleep apnea grows worse, problems with sexual function—including sensation and desire, become more serious. Women are particularly at risk for un-diagnosed sleep problems, including sleep-disordered breathing. Women who

are experiencing problems with sexual function should have their sleep evaluated. Sleep deprivation poses a greater risk of cardiovascular problems for women than for men. It's just possible that the resulting lower testosterone levels may have something to do with this. Testosterone has a protective effect on the heart, reducing inflammatory proteins that can cause heart damage.

The more we know about how testosterone affects sleep and sexual health in men and women, the better clinicians will be able to help restore healthy functioning to two critical aspects of people's lives.

## Conclusion

Sleep is defined as the vital function of living species and having a good sleep time is very important in the human lifestyle and being healthy, there are many sleep disorders like insomnia, DSWPD, ASWPD, and many other disorders that may have various reasons and risk factors. One of the most reasons that may cause several disorders such as sleep disorders is a hormone or function of the endocrine system and its hormones. There is a paucity of knowledge and information regarding how insufficient sleep and sleep disorders can affect pubertal development and growth as well. Different types of hormones can affect the sleep, for example, one of the most famous hormones is known as melatonin that is made and secreted by pineal gland; that is found in the middle of the brain and this hormone can help the body to understand the time to sleep and the time to wake up, and normally the body secreted more melatonin at the night, the interesting point that is people use melatonin when they have insomnia or other sleep disorders. The other hormones that are very important in sleep disorders are steroid and sex hormones as well; and the main point is that both endogenous and exogenous steroid hormones can have an impact on sleep. As it is understood, the relationship between the gonadal hormones and sleep is very complex and complicated and our understanding of this relationship is limited. In the case of exogenous hormones, there is compelling evidence that the exogenous administration of sex hormones (like estrogen, testosterone, etc.) does affect brain systems that are involved in the regulation of sleep and associated circadian rhythm. Another hormone is progesterone which affects primarily NREM sleep where as the hormone estrogen can affect primarily REM sleep.

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